Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science)
Applicable for Batch: 2019-23

DIT UNIVERSITY
Dehradun

Detailed Course Structure& Syllabus of B.Tech – CSE (with AI & Data Science)

Approved by the Academic Council at its 11th Meeting held on 29.04.2019

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Course Structure

Year: 1st Semester: I

Course Category	Course Code	Course Title	L	T	P	Credit
UC	HS 103	Professional Communication	2	0	2	3
UC	MA 101	Engineering Mathematics-I	3	1	0	4
UC	EE 103	Basic Electrical Engineering	3	1	2	5
UC	PY102 / PY103 / PY104	Introduction to Mechanics / Waves and Optics and Introduction to Quantum Mechanics / Introduction to Electromagnetic Theory	3	1	2	5
UC	ME 103	Engineering Graphics	0	0	3	1.5
		Total				**18.5**

Year: 1st Semester: II

Course Category	Course Code	Course Title	L	T	P	Credit
UC	MA 102	Engineering Mathematics - II	3	1	0	4
UC	CH 101	Engineering Chemistry	3	1	2	5
UC	ME 105	Engineering Mechanics	2	1	2	4
UC	ME 104	Workshop Practice	0	0	2	1
UC	CS 105	Programming for Problem Solving	3	0	4	5
		Total				**19**

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Year: 2nd Semester: III

Course Category	Course Code	Course Title	L	T	P	Credit
AC	CH201/HS244	Environmental Science / Indian Constitution	2	0	0	0
SC	MA202	Probability & Statistics	3	1	0	4
DC	CS211	Discrete Mathematics	3	1	0	4
	CS212	Computer Organization	3	1	0	4
	CS201	Data Structures	3	0	2	4
	IB241	**Python for Data Science**	3	0	2	4
EC	EC 202	Digital System Design	3	0	2	4
Total						**24**

Year: 2nd Semester: IV

Course Category	Course Code	Course Title	L	T	P	Credit
HE	HS24*	Humanities Elective-1	2	0	0	2
AC	CH201/HS244	Environmental Science / Indian Constitution	2	0	0	0
DC	CS 213	Theory of Computation	3	1	0	4
	CS 214	Operating Systems	3	1	0	4
	CS 203	Computer Networks	3	0	2	4
	CS202	Java Programming Concepts	3	0	2	4
	IB202	Information Management Basics(T3 Mode)	3	0	2	4
	IB242	**AI & ML Foundations**	2	0	2	3
AC		*VALUE ADDED TRAINING(Dot Net programming)*	0	0	2	0
Total						**25**

Humanities Elective-1

HS241-Education and Social Change
HS242-Introduction to Psychology
HS243-Science, Technology and Society
HS245-Ethics and Self-Awareness

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Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Year: 3rd **Semester: V**

Course Category	Course Code	Course Title	L	T	P	Credit
DC	CS301	Algorithms: Analysis & Design	3	0	2	4
DC	CS303	Computer Graphics	3	0	2	4
DC	IB304	Essentials of Software Engineering(OOAD & SW life cycle) T3 Mode	2	0	2	3
DC	IB341	**Predictive Analyst Modeler**	3	0	2	4
DE		Department Elective1	3	0	2	4
DE		Department Elective2	3	0	2	4
HE		Humanities Elective-2	2	0	0	2
PRJT	IB342	study project	0	0	4	2
ST	CS322	Summer training Evaluation *AUDIT COURSE*	0	0	2	0
Total						**27**

Department Elective 1 & 2

Course Code	Course Title
CS341	Computer Based Numerical and Statistical Techniques
CS342	Linux Administration & Shell Programming
CS343	Advanced Concepts in OOPs
CS344	Introduction to Cloud Technologies
EC361/EE207(10/7/19 mail)	Microprocessor

Humanities Elective 2

Course Code	Course Title
HS384	Principles of Management
HS385	Engineering Economics
HS391	Positive Psychology & Living
HS382	Literature, Language & Society

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Year: 3rd **Semester: VI**

Course Category	Course Code	Course Title	L	T	P	Credit
DC	CS304	Compiler Design	3	0	2	4
DC	IB343	**Artificial Intelligence Analyst**	3	0	2	4
DC	IB344	**Accelerating Deep Learning(T3 Mode)**	3	0	2	4
DE		Department Elective3	3	0	2	4
DE		Department Elective4	3	0	2	4
DE		Department Elective5	3	0	0	3
PRJT	IB345	**Project-GRM**	0	0	10	5
		Startup & Entrepreneurship	2	0	2	3
AC	CS324	Industrial Tour	0	0	2	0
AC	CS325	*Aptitude Building*	3	0	0	0
Total						**31**

Department Elective 3 & 4

Course Code	Course Title
CS345	Web Technology
CS368	Machine Learning using R
CS346	Introduction to Big Data Analytics
CS361	Pattern Recognition in AI
CS347	Digital Image Processing
CS348	Advanced Computer Network

Department Elective 5

Course Code	Course Title
CS352	Data Mining and data Warehousing
CS353	Grid Computing
CS355	Natural Language processing

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Year: 4th **Semester: VII**

Course Category	Course Code	Course Title	L	T	P	Credit
DC	IB401	**Advanced RDBMS**	3	0	2	4
DC	IB404	**Block Chain**	3	0	2	4
DC	IB413	**Data Science**	3	0	2	4
DE		Department Elective6	3	0	0	3
OE		Open Elective	3	0	0	3
HE		Humanities Elective-3	2	0	0	2
PRJT	IB441	**Project-GRM**	0	0	16	8
AC	CS410	Employment Enhancement Program				0
Total						**28**

Department Elective 6

Course Code	Course Title
CS451	Advanced computer architecture
CS452	Information storage and Management
CS453	Parallel Computing
CS454	Introduction to Genetic Algorithms and Fuzzy Logic
CS477	Data Analysis & Modelling

Humanities Elective 3

Course Code	Course Title
HS481	Application of Psychology
HS484	Intellectual Property Rights
HS482	Human Values
HS492	Indian English Literature

Open Elective- 1

Course code	Course Title	L	T	P
IT353	Basics of Data Science	3	0	0
IT356	Multimedia	3	0	0
EC383	Consumer Electronics	3	0	0
EC385	Analog Electronics	3	0	0
EE481	New and Renewable Energy Sources	3	0	0
ME342	Composites Materials	3	0	0
ME445	Total Quality Management	3	0	0
PE481	Fuel Technology	3	0	0
PE482	Health Safety and Environment in Industry	3	0	0
MA451	Statistical Techniques & their application	3	0	0
AR481	Graphics & Product Design	3	0	0

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Year: 4th **Semester: VIII**

Course Category	Course Code	Course Title	L	T	P	Credit
IP/THESIS	CS422	Industrial Project/Thesis				16
		or				
DE		Department Elective7	3	0	2	4
DE		Department Elective8	2	0	2	3
DE		Department Elective9	2	0	2	3
DE		Department Elective10	2	0	0	2
OE		open elective	3	0	0	3
HE		Humanities Electives 4	2	0	0	2
Total						**16-17**

Department Elective 7

Course Code	Course Title
CS442	Cryptography and Network Security
CS461	Fundamentals of Machine Learning
CS478	Advanced Concepts in AI & its Applications

Department Elective 8 & 9

Course Code	Course Title
CS457	Soft Computing
CS443	LAMP Technology
CS475	Software Testing
CS471	Data Base Administration
CS472	Information Security
CS473	Computer Vision

Department Elective 10

Course Code	Course Title
CS456	Business Intelligence
CS458	Mobile computing
CS459	IOT Concepts

Humanities Elective 4

Course Code	Course Title
HS493	Indian Culture & Tradition
HS483	Indian Philosophy
HS491	Industrial Sociology
HS485	Sustainable Development

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Open Elective- 2

Course code	Course Title	L	T	P
IT357	Internet of Things	3	0	0
IT359	Mobile Computing and Services	3	0	0
EC386	Fundamental of communication & Networks	3	0	0
EC382	Biomedical Instrumentation	3	0	0
EE485	Basic Instrumentation & Process Control	3	0	0
ME382	Ergonomics and Value Engineering	3	0	0
ME366	Product Design and Development	3	0	0
ME452	Renewable Energy Sources	3	0	0
CE483	GIS	3	0	0
PE491	Carbon Capture and Sequestration Technology	3	0	0
MA452	Optimization Techniques	3	0	0
AR485	Art Appreciation	3	0	0
PY481	Nano scale science and technology	3	0	0

Summary of the Credit

Year	Semester	Credit
1	1	18.5
	2	19
2	3	24
	4	25
3	5	27
	6	31
4	7	28
	8	16-17
Total Credits		188.5-189.5

Category wise classification of the Credit

Category	Credit
UC	40.5
AC	0
SC	4
DC	78
HE	8
DE	34
OE	6
EC	4
PRJT/THESIS/ST/IND	15
VAT/EEP/APT	0

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	HS103	Subject Title	Professional Communication						
LTP	2-0-2	Credit	3	Subject Category	UC	Year	1st	Semester	I / II

Course Outline:

Course Objective:

To develop the LSRW skills of students for effective communication, to equip the students for business environment, to prepare the students understand and present themselves effectively

Course Pre/Co- requisite (if any):

UNIT 1: Communication

Communication: Meaning, Types of Communication: General and Technical Communication. Knowledge and adoption of Non Verbal cues of communication: Kinesics, Proxemics, Chronemics, Oculesics, Haptics, Paralinguistics. Barriers to Communication, Overcoming strategies.

UNIT 2: Listening & Speaking Skills

Listening Comprehension: identifying General and Specific information, Note taking and drawing inferences. Introduction to Phonetics: Articulation of consonants and vowel sounds.

UNIT 3: Reading Skills & Technical Writing Skills

Reading Strategies and Vocabulary Building Reading Comprehension.Paragraph development. Intra office Correspondence: Notice, Agenda, Minutes and Memorandum. Technical Proposal & Report.

UNIT 4: Business Letter Writing

Business Letter Writing, Job Application Letter & Resume, Interview Skills, Impression Management, Swot Analysis (Identifying Strength & Weakness), EQ and Its Dimensions

Learning Outcome

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

CO1. Communicate smoothly

CO2. Write formal documents

CO3. Present themselves effectively

Text book [TB]:

1. Rizvi, Ashraf. Effective Technical Communication, McGraw Hill, New Delhi. 2005.
2. Raman, Meenakshi and Sangeeta Sharma,. Technical Communication: Principles and Practice, 2nd Edition. New Delhi: Oxford University Press. 2011.

Reference Books [RB]:

1. Aslam, Mohammad. Introduction to English Phonetics and Phonology Cambridge.2003.
2. Ford A, Ruther. Basic Communication Skills; Pearson Education, New Delhi.2013.
3. Gupta, Ruby. Basic Technical Communication, Cambridge University Press, New Delhi.2012.
1. Kameswari, Y. Successful Career Soft Skills and Business English, BS Publications, Hyderabad.2010.
2. Tyagi, Kavita& Padma Misra. Basic Technical Communication, PHI, New Delhi. 2011.

List of Experiments:

1. Neutralization of Mother Tongue Influence through manner of articulation, Introduction to Speech Sounds – Practicing Vowel and Consonant sounds
2. Listening (Biographies through software) & Presentation of Biographies
3. Listening & Role Play on Situational/ Telephonic Conversation (through software)
4. Picture presentation
5. Public Speaking
6. Group Discussion
7. Case Studies
8. SWOT analysis
9. Interview
10. Final evaluation

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	MA101	Subject Title	Engineering Mathematics-I						
LTP	3-1-0	Credit	4	Subject Category	UC	Year	1st	Semester	I / II

Course Outline:

Course Objective:

To introduce the fundamentals in Differential, Integral and Vector Calculus, use of tools for solving engineering problems.

Course Pre/Co- requisite (if any):

UNIT 1: Limit, Continuity and Differentiability
Review of Limit, Continuity and Differentiability; Indeterminate forms, L' Hospital's rule, Rolle's Theorem, Mean Value theorem and its applications, Successive Differentiation, Leibnitz's Theorem, Taylor's and Maclaurin's Series, Maxima and Minima, Asymptotes, Curvature, Evolutes, Involutes, Sketching of curves.

UNIT 2: Multivariable calculus (Differentiation)
Limit, Continuity, Partial Derivatives, Euler's Theorem, Total Derivatives, Taylor's series, Maxima and Minima, Method of Lagrange's multipliers.

UNIT 3: Multiple Integral
Review of indefinite and definite integrals and its application to evaluate surface area and volume of revolutions, Beta and Gamma functions and their properties, Double integral, Change of order of integration, Change of variables, triple integral, Dirichlet's integral and their applications.

UNIT 4: Vector Calculus
Scalar and Vector functions, fields, Gradient and its applications, Directional derivative, Divergence and Curl and their applications. Line integral, Surface integral, Statement of Green's Theorem, Volume integral, Statements of Stokes and Divergence Theorems and their applications.

Learning Outcome

At the end of the course, the student will be able to:
CO1. Learn techniques in calculus, multivariate analysis and linear algebra.
CO2. Equip the students with standard concepts and tools for tackling advanced level of mathematics and applications.
CO3. Familiarity with fundamental tools of Differential, Integral and Vector Calculus.

Text book [TB]:

1. G. B. Thomas Jr. and R. L. Finney, Calculus and Analytic Geometry, 9th Edition, Pearson Education, 2017.
2. R. K. Jain and S. R. K. Iyenger, Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House, New Delhi, India, 2014.

Reference Books [RB]:

1. B. S. Grewal, Higher Engineering Mathematics, 42nd Edition, Khanna Publication, New Delhi, India, 2012
2. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, U.K., 2006.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	EE103	Subject Title	Basic Electrical Engineering						
LTP	3-1-2	Credit	5	Subject Category	UC	Year	1st	Semester	I / II

Course Outline:

Course Objective:

- To apprise students about electric charge, current, voltage and various circuit laws involved in analysis.
- To get acquainted with the basic idea of Generation, Transmission and Distribution of Electrical energy.
- To provide the basic knowledge of operation and working of different types of electrical equipment and their applications.

Course Pre/Co- requisite (if any):

UNIT 1: D.C. Network Theory

Review of basic circuit theory concepts, Mesh and Nodal analysis, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Star – delta transformation, Magnetic Circuits.

UNIT 2: A.C. Circuits & Measuring Instruments

Single Phase A.C.: Phasor representation of voltage and current, A.C. circuit behavior of resistance, inductance, capacitance & their combination in series and parallel, Power triangle, Power factor, Concept of series & parallel resonance.

Three Phase A.C.: Star – delta connections, Relation between line and phase quantities, three phase power and its measurement, What is 3 phase 4 wire and 3 phase 3 wire system.

Measuring Instruments: Construction and principle of voltage and current measuring instruments.

UNIT 3: Power System & Transformers

Single line diagram of simple power system.

Single phase Transformer: Principle of operation, Types of construction, Phasor diagram, Equivalent circuit, Efficiency and voltage regulation, O.C. and S.C. tests.

UNIT 4: D.C. & Synchronous Machines

D.C. Machines: Construction and working principle of d.c. generator and d.c. motor, Types of d.c. machines, E.M.F. equation, Torque equation, characteristics, Losses and efficiency, Need of starter in d.c. motors.

Synchronous Machines: Construction and Principle of operation of Alternator and Synchronous Motor.

UNIT 5: Induction Motors

Three Phase Induction Motors: Principle of operation of 3-Ø induction motor, Types of 3-Ø induction motor, Need of starters in 3-Ø induction motors, Slip – torque characteristics

Single Phase Induction Motor: Principle of operation of single phase induction motor by double revolving field theory, Methods of starting of single phase induction motor.

Learning Outcome

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

CO1. Students will be familiar about electrical charge, current, voltage and various basic electric circuit laws.

CO2. Acquaint students about DC circuit analysis and methods

CO3. Advanced approach for solving series parallel network of resistors by star delta transformation.

CO4. Acknowledge students with the use of transformers and its working.

CO5. To build an ability amongst students regarding the functioning of DC machines and its characteristics.

CO6. Students will recognize the need for synchronous machine in our electrical systems, its basic functioning and various advantages over other types of machines.

Text book [TB]:

1. V. Del Toro. "Principles of electrical Engineering", Prentice hall International.
2. J. Nagrath, "Basic Electrical Engineering", Tata Mc Graw Hill.

Reference Books [RB]:

1. W.H. Hayt& J.E. Kemmerly, “Engineering circuit Analysis”, Mc Graw Hill.
2. H. Cotton, “Advanced Electrical Technology” Wheeler Publishing.

List of Experiments:

1. Verification of Network Theorems.
2. Study of diode characteristics. Study of phenomenon of resonance in RLC series circuit.
3. Measurement of power in a three phase circuit by two wattmeter method.
4. Measurement of efficiency of a single phase transformer by load test.
5. Determination of parameters and losses in a single phase transformer by OC and SC test.
6. Study of characteristic of DC Motor.
7. Study of characteristic of AC Motor.
8. DC generator characteristics.
9. Speed control of dc shunt motor.
10. Study running and reversing of a three phase induction motor.
11. Study of a single phase energy meter.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	PY102	Subject Title	Introduction to Mechanics						
LTP	3-1-2	Credit	5	Subject Category	UC	Year	1st	Semester	I / II

Course Outline:

This course starts with the basic concepts of work, energy and collisions between particles. The course then covers the angular motion of bodies and moment of inertia, elasticity, fluid motion, laws of gravitation.

Course Objective:

Mechanics lies at the foundation of physics and along with an appreciation of the molecular structure of matter exposes the student to the phenomenology of physics.

Course Pre/Co- requisite (if any) :

Detailed Syllabus

UNIT 1 **8 L**

Transformation of scalars and vectors under Rotation transformation; Newton's laws and its completeness in describing particle motion, Cylindrical and spherical coordinates

Mechanics of a system of particles, conservation of laws of linear momentum, angular momentum and mechanical energy, centre of mass and equation of motion, Constraints and degrees of freedom.

UNIT 2 **8 L**

Potential energy function; F = - Grad V, Equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, curl of a force field; Central forces; Conservation of Angular Momentum and areal velocity; Elliptical, parabolic and hyperbolic orbits

UNIT 3 **6 L**

Non-inertial frames of reference; Rotating frames of reference, Coriolis force; Applications: Weather systems, projectile motion

UNIT 4 **8 L**

Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and lightly-damped oscillators; Forced oscillations and resonance, Kater's Pendulum and bar pendulum

UNIT 5 **8 L**

Rotation of rigid body, Moment of Inertia, Torque, angular momentum, kinetic energy of rotation, Theorems of perpendicular and parallel axis, Moment of Inertia of rectangular rod, spherical and cylindrical bodies. Acceleration of a body moving on horizontal and inclined plane.Moment of inertia of Fly Wheel.

UNIT 6 **6 L**

Elastic constants- Introduction and relationship between elastic constants, Cantilever, Beam, Bending of beam, Twisting of a cylindrical body.

Learning Outcome

At the end of the course, the student can :

CO1. To know Newton's laws of motion, potentials, conservation of energy, momentum and angular momentum, and be able to apply them to projectiles, circular motion, and gravity

CO2. Demonstrate an understanding of intermediate mechanics topics such as co-ordinate transformations, oscillatory motion, gravitation etc.

CO3. Demonstrate rigid body and rotational dynamics using the concept of angular velocity and momentum.

CO4. Understand the concept of non-inertial frames of reference, coriolis and centripetal accelerations and their applications.

Text book [TB]:

1. Mechanics – D.S. Mathur, S. Chand & Co., 2012.
2. Introduction to Mechanics – D.Kleppner&R.Kolenkow, Cambridge University Press, 2017

Reference books [RB]:

1. Analytical Mechanics, G.R. Fowles and G.L. Cassiday., Cengage Learning India Pvt. Ltd., 2006
2. Introduction to Special Relativity, R. Resnick, John Wiley and Sons, 2007
3. Principles of Mechanics — J.L. Synge & B.A. Griffiths, Andesite Press, 2015

SR.NO.	LIST OF EXPERIMENTS
1	To measure internal diameter, external diameter and depth of a vessel using vernier calipers
2	To measure density of a wire using screw gauge.
3	To determine the Moment of Inertia of a Flywheel
4	To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method)
5	To determine the Modulus of Rigidity of a Wire by Maxwell's needle
6	To determine the elastic Constants of a wire by Searle's method
7	To determine the value of g using Bar Pendulum
8	To measure the Young's Modulus using Bending of Beam
9	To determine the value of g using Kater's Pendulum
10	To determine the moment of inertia of a body using Torsion pendulum

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	PY103	Subject Title	Waves and Optics and Introduction to Quantum Mechanics						
LTP	3-1-2	Credit	5	Subject Category	UC	Year	1st	Semester	I / II

Course Outline:

This course develops a strong background of simple harmonic motion, their superposition, wave motion, interference and diffraction, lasers, semiconductors, and introduction to quantum mechanics.

Course Objective:

The objective of this course is to develop a fundamental basis of waves, optical phenomenon, concepts of quantum mechanics and semiconductor physics which the engineering students can apply to their respective area of specialization.

Course Pre/Co- requisite (if any) :no pre-requisite

Detailed Syllabus

Unit 1: Waves **6 L**

Mechanical and electrical simple harmonic oscillators (characteristics and energy), damped harmonic oscillator, forced mechanical and electrical oscillators, impedance.

Unit 2: Non-dispersive transverse and longitudinal waves **8 L**

Transverse wave on a string, the wave equation on a string, harmonic waves, reflection and transmission of waves at a boundary, standing waves and their eigen frequencies, longitudinal waves and the wave equation for them, acoustics waves (Newton formula and Laplace correction).

Unit-3: Wave Optics **10 L**

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, fringes with white light, interference in parallel thin films, Newton's rings, Fraunhofer diffraction from a single slit & N- slits, Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

Unit- 4: Lasers **6 L**

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, components of LASER and pumping methods (in brief), different types of lasers: gas lasers (He-Ne), solid-state laser (ruby)

Unit- 5: Introduction to Quantum Mechanics **10 L**

Wave nature of particles, Phase velocity, wave-packet and group velocity, Uncertainty principle and its applications, time-dependent and time-independent Schrodinger equation, physical significance of wave function., Solution of stationary-state Schrodinger equation for one dimensional problem–particle in a box,potential barrier.

Learning Outcome

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

CO1. To acquire skills allowing the student to identify and apply formulas of optics and wave physics using course literature.

CO2.To be able to identify and illustrate physical concepts and terminology used in optics and to be able to explain them in appropriate detail.

CO3. To be able to make approximate judgments about optical and other wave phenomena when necessary.

CO4. To acquire skills allowing the student to organize and plan simpler laboratory course experiments and to prepare an associated oral and written report.
CO5. To have basic knowledge of Quantum Mechanics and Semiconductors.

Text book [TB]:

1. The physics of vibrations and waves, H. J. Pain, Wiley, 2008
2. Optics ,AjoyGhatak, , McGraw Hill Education, 2017.
3. Solid State Electronic Devices, B.G. Streetman, Prentice Hall of India, 2015.
4. Quantum mechanics, D. J. Griffiths, Pearson Education, 2015.

Reference books [RB]:

4. Optics, E. Hecht, Pearson Education, 2008.
5. Principles of Lasers, O. Svelto, Springer Science & Business Media, 2010.
6. Semiconductor Physics and Devices, D. A. Neamen, Times Mirror High Education Group, Chicago, 2017.

SR.NO.	LIST OF EXPERIMENTS
1	(a) To determine wavelength of sodium light using Newton's Rings. (b) To determine the refractive index of a liquid using Newton's Rings.
2	To determine wavelength of sodium light using Fresnel's Biprism.
3	(a) To determine wavelength of prominent lines of mercury using plane diffraction grating. (b) To determine the dispersive power of a plane transmission diffraction grating.
4	To determine the specific rotation of cane sugar solution using bi-quartz polarimeter
5	To study the diffraction pattern of Single slit and hence determine the slit width.
6	(a) To verify cosine square law (Malus Law) for plane polarized light. (b) To study the nature of polarization using a quarter wave plate.
7	To study the variation of refractive index of the material of the prism with wavelength and to verify Cauchy's dispersion formula
8	(a) To study photoelectric effect and determine the value of Planck's constant. (b) To verify inverse square law using photocell.
9	To determine the frequency of AC mains using sonometer.
10	To determine the frequency of AC mains or of an electric vibrator by Melde's experiment
11	To measure the numerical aperture (NA) of an optical fiber.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	PY104	Subject Title	Introduction to Electromagnetic Theory						
LTP	3-1-2	Credit	5	Subject Category	UC	Year	1st	Semester	I / II

Course Outline:

The course develops a strong base on electrostatics and magnetostatics, Faraday's Laws, Displacement current, Electromagnetic waves

Course Objective:
To teach students the effects of electric charges at rest and in motion. Both positive and negative charges produce force field which is called "electric field". Moving charges produce current, which gives rise to another force field called "magnetic field". The electromagnetic theory studies the behavior of the electric and magnetic fields.

Course Pre/Co- requisite (if any) : no pre-requisite

Detailed Syllabus

Unit 1: Electrostatics in vacuum **9 L**

Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Gauss law and its applications, Laplace's and Poisson's equations; Practical examples like Faraday's cage and coffee-ring effect; energy of a charge distribution and its expression in terms of electric field.

Unit 2: Electrostatics in a linear dielectric medium **7 L**

Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; gauss law in dielectrics; Polarization vector, solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field. Energy in dielectrics system

Unit 3: Magnetostatics **9 L**

Electric current and current density, magnetic force, continuity equation, Bio-Savart law and its applications(straight wire and solenoid), Divergence and curl of static magnetic field; Ampere circuital law and its applications(wire, solenoid & toroid), current loop as magnetic dipole and dipole moment, Para, dia and ferro magnetic materials (properties only)

Unit- 4: Faraday's law **6 L**

Faraday's law in terms of EMF produced by changing magnetic flux; equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic breaking and its applications; Differential form of Faraday's law expressing curl of electric field in terms of time-derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi-static approximation; energy stored in a magnetic field.

Unit- 5: Displacement current, Magnetic field due to time-dependent electric field and Maxwell's equations **9 L**

Concept of displace current, Modifying equation for the curl of magnetic field to satisfy continuity equation; and magnetic field arising from time-dependent electric field; Maxwell's equation in integral and differential form in vacuum and non-conducting medium; transverse nature of EM wave, Wave equation in free space, Wave propagation in conducting medium and non-conducting medium & skin depth, Flow of energy and Poynting vector.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Learning Outcome

Having successfully completed this course, the student will be able to demonstrate knowledge and understanding of:

CO1. The use of Coulomb's law and Gauss' law for the electrostatic force
CO2. The relationship between electrostatic field and electrostatic potential
CO3. The use of the Lorentz force law for the magnetic force
CO4. The use of Ampere's law to calculate magnetic fields
CO5. The use of Faraday's law in induction problems
CO6. The basic laws that underlie the properties of electric circuit elements

Text book [TB]:

1. Introduction to Electrodynamics, David Griffiths, PHI Learning, 2012.

Reference books [RB]:

1. Physics, Halliday and Resnick, Wiley, 2013.
2. Electricity, Magnetism and Light, W. Saslow, Academic Press, 2002.

SR.NO.	LIST OF EXPERIMENTS (ANY TEN)
1	Identification of various electronic components.
2	Use of multimeter for testing diodes, LEDs, transistors and measurements of resistance, capacitance, inductance, dc voltage, dc current, ac voltage, ac current and frequency of ac mains.
3	Charging and discharging of capacitor through resistance and determination of time constant.
4	To determine the specific resistance of a given wire using Carey Foster's bridge.
5	To verify Stefan's law by electrical method.
6	To study the variation of magnetic field with distance along the axis of a current carrying coil and determination of radius of the coil.
7	To calibrate the given voltmeter using potentiometer.
8	To calibrate the given ammeter using potentiometer.
9	To determine the band gap of a semiconductor p-n junction.
10	To determine the resistance of a sample using four probe method.
11	To determine the band gap of semiconductor using four probe method.
12	To determine a unknown resistance using Wheatstone bridge.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	ME103	Subject Title	Engineering Graphics						
LTP	0-0-3	Credit	1.5	Subject Category	UC	Year	1st	Semester	I / II

Course Outline:

Course Objective:
The objectives of this course are to enable students to acquire and use engineering graphics skills as a means of accurately and clearly communicating ideas, information and instructions for technical communication.

Course Pre/Co- requisite (if any):

Detailed Syllabus

UNIT 1: Introduction to Engineering Graphics
Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Involutes; Scales Plain, Diagonal

UNIT 2: Projection of Points and Planes
Orthographic Projections covering, Principles of Orthographic Projections, Projections of Points and lines inclined to both planes; Projections of planes inclined Planes

UNIT 3: Projection of Solids
Projections of solids in simple position, projections of solids with axes inclined to one reference plane and parallel to other. Projections of solids with axes inclined to both of the reference plane

UNIT 4: Section of Solids and Development of Surfaces
Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone, Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone

UNIT 5: Isometric Projection and Auto CAD
Isometric Projections, Freehand Sketching, Simple and compound Solids, Conversion of Isometric Views to Orthographic Views (simple machine components according to first angle projection method), Basic AutoCAD commands & its applications

Learning Outcome

At the end of the course, the student will be able to:
CO1: Be able to use Engineering Drawing Skills as a means of accurately and clearly communicating ideas, information and instructions.
CO2: Acquire requisite knowledge, techniques and attitude for advanced study of engineering drawing.
CO3: Comprehend and draw a simple engineering drawing primarily in first angle Orthographic projections.
CO4: To create section views of simple engineering objects
CO5: To understand basic AutoCAD commands and appreciate the need of AutoCAD over Manual Drafting.

Text book [TB]:

1. N. D. Bhatt and V.M. Panchal, "Engineering Drawing", Charotar Publishing House Pvt. Ltd., 53rd edition, 2016 reprint.
2. P.S. Gill, "Engineering graphics", S. K. Kataria& Sons, 13th edition, 2016

Reference Books [RB]:

1. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.
3. Narayana, K.L. & P Kannaiah (2012), Text book on Engineering Drawing, Scitech Publishers
4. D.M. Kulkarni, A.P. Rastogi, A.K. Sarkar, "Engineering Graphics with AutoCAD" , PHI Learning Pvt. Ltd., Ist edition, 2009.
5. (Corresponding set of) CAD Software Theory and User Manuals

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	MA102	Subject Title	Engineering Mathematics-II						
LTP	3-1-0	Credit	4	Subject Category	UC	Year	1st	Semester	I / II

Course Outline:

Course Objective:
The objective of the course is to introduce the fundamentals in Matrices and Linear Algebra, Solving Ordinary Differential Equations, Convergence of an Infinite Series, Laplace Transform and Fourier Series relevant to engineering applications.

Course Pre/Co- requisite (if any):

UNIT 1: Linear Algebra
Matrices, Elementary row and column operations, row reduced echelon form, rank of a matrix, invertible matrices. Consistency and solution of a system of linear equations. Linear dependence and independence of vectors, Vector space and its basis, Matrix transformation, Rank-Nullity theorem, Eigen-values and eigen-vectors, Similar matrices, Cayley–Hamilton theorem and its applications. Diagonalization of matrices.

UNIT 2: Differential Equations
Methods of solving differential equations of first order and first degree, Bernoulli equation, Wronskian, Solutions of linear differential equations of higher order with constant coefficients, Cauchy-Euler linear differential equation, Solution of second order linear differential equation with variable coefficients, Method of variation of parameters. Solution of simultaneous linear differential equations of first order.

UNIT 3: Infinite Series
Introduction to sequences and series, Convergence and divergence, Series of positive terms, Comparison test, Cauchy's integral test, D'Alembert's ratio test, Cauchy's root test, Raabe's test, Logarithmic test, Alternating series, Leibnitz test.

UNIT 4: Fourier Series
Periodic functions, Fourier series of Periodic functions, Euler's formulae, Functions having arbitrary period, Change of intervals, Even and odd functions, Half range sine and cosine series

UNIT 5: Laplace Transform
Laplace Transform, Existence theorem, Properties of Laplace transform, Laplace transform of derivatives and integrals, Laplace Transform of Periodic functions, Unit Step function and Error Function, Dirac- Delta function. Inverse Laplace transform and their properties, Convolution theorem, Applications of Laplace Transform to solve linear differential equations pertaining to engineering problems.

Learning Outcome

At the end of the course, the student will be able to:
CO1. Equip the students to deal with advanced level of mathematics and applications.
CO2. Familiarity with fundamental tools of Matrices and Linear Algebra, Ordinary Differential Equations, Infinite Series, Laplace Transforms and Fourier Series.
CO3. Use of tools to solve engineering applications.

Text book [TB]:

1. R. K. Jain and S. R. K. Iyenger, Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House, New Delhi, India, 2014.
2. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, U.K., 2006.

Reference Books [RB]:

1. B. S. Grewal, Higher Engineering Mathematics, 42nd Edition, Khanna Publications, New Delhi, India, 2012.
2. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CH101	Subject Title	Engineering Chemistry						
LTP	3-1-2	Credit	5	Subject Category	UC	Year	1st	Semester	I/II

Course Outline:

Course Objective:

The objectives of this course are to provide a summary on water chemistry, water treatment, green chemistry and synthetic chemistry. The course intends to provide an overview of the working principles, mechanism of reactions and application of the building blocks like batteries, fuel cells, polymers and an overview of surface coatings in order to protect the metal

Course Pre/Co- requisite (if any):

UNIT 1: Water Treatment and Analysis

Standards for drinking water, Water Quality parameters, Determination of alkalinity of water, Hardness of water: Units and determination. Demineralization of water.

Softening of water: Lime soda Process, Ion exchange process, Zeolite process and RO process. Internal conditioning methods: Carbonate conditioning, Phosphate conditioning, Colloidal conditioning, Calgon conditioning. Desalination of brackish water. Numerical Problems based on all these parameters.

UNIT 2: Electrochemistry & Corrosion

Electrochemical cell, Electrode potential & EMF of a Galvanic cell, Nernst Equation, Migration of ions, Transport number, Determination of Transport number by Hittorf`s method, Conductometric titrations, Types of electrode: Calomel and glass electrode, Liquid junction potential.

Corrosion and its economic aspects, Types of corrosion: Galvanic, Erosion, Crevice, Pitting, Waterline, Soil, Microbiological. Theories of corrosion: Acid, Direct Chemical attack, Electrochemical. Corrosion prevention by metallic, organic/inorganic coatings and corrosion inibitors

UNIT 3: Polymers & Biomolecules

Introduction; Classification of Polymers; Functionality; Mechanism of Polymerization; Plastics; Individual Polymers; LDPE, HDPE, PVC, Polystyrene, Bakelite, Teflon, PMMA, PET, Nylon-6, Rubbers (BUNA-S and BUNA-N); Specialty Polymers (Conducting Polymers, Silicones and Polycarbonates), Structural and functional attributes of cell and cell organelles; Biomolecules (Proteins, Carbohydrates, Lipids, Enzymes, Nucleic acids)

UNIT 4: Fuels, Battery& Lubrication

Classification of fuels, Calorific value, Cetane number, Octane number, Comparison of solid, liquid and gaseous fuel, properties of fuel, Biofuels, Power alcohol and synthetic petrol, Battery, Metal-air battery, Lithium and nickel battery. Introduction of Lubricants, Functions of Lubricants, Classification of lubricants, Mechanisms of Lubrication, Properties of Lubricants.

UNIT 5: Green Chemistry & Nano Chemistry

Emergence of green chemistry, Twelve principle of green chemistry, use of alternative feedstock (biofuels), Use of innocuous reagents, use of alternative solvents, design of safer chemicals, designing alternative reaction methodology, minimizing energy consumption. Introduction to Nano chemistry, properties of Nano materials, preparation of nanomaterial, self-assembly, Different Nano materials, Applications of Nano materials

Learning Outcome

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

CO1: To understand about the treatment of water, sewage water and hardness related calculation

CO2: An overview of surface coatings in order to protect the metal.

CO3: An ability to identify and formulate polymers and have a knowledge of various polymers like polythene, PVC, PS, Teflon, Bakelite, Nylon which have engineering applications. To gain acquaintance regarding biomolecules and their application in Engineering.To gain acquaintance regarding biomolecules and their application in engineering.
CO4: An overview of the working principles, mechanism of reactions and application of the building blocks like batteries, fuel cells,
CO5: An ability to handle various instruments like spectroscope, flame photometer etc. Have a knowledge of synthesizing Nano materials and their applications in industry. Know the properties of Fuels and Lubricants. Have a scope in the area of Material Chemistry.

Text book [TB]:

5. Engineering Chemistry by Shikha Agarwal. Cambridge University Press Edition 2015.
6. Engineering Chemistry by S. Vairam& Suba Ramesh. Wiley India Pvt. Ltd. 2014.

Reference books [RB]:

7. Environmental Chemistry by Stanley E. Manahan. CRC Press Taylor and Francis.
8. Organic Chemistry by Morrison and Boyd. Pearson.
9. Physical Chemistry by Atkins. Oxford University Press.
10. Concise Inorganic Chemistry by J.D. Lee. Oxford University Press.
11. Basic Biotechnology by S Ignacimuthu. Tata Mcgraw-Hills
12. Spectroscopy by Silver Stein. Pearson.
13. Nano: The essentials by T. Pradeep. McGraw Hill Education.
14. Biochemistry by StryerLubert. Mcmillan learning. 2015.

List of Experiments:

1. Determination of alkalinity in the given water sample.
2. Estimation of temporary and permanent hardness in water sample using EDTA as standard solution.
3. To determine the percentage of available chlorine in bleaching powder.
4. To determine the chloride content in the given water sample by Mohr's method
5. Determination of iron content in the given ore by using External indicator
6. To determine the Dissolved Oxygen in a given water sample.
7. To determine the strength of unknown acid pH-metrically
8. To analyze the coal sample by proximate analysis.
9. To determine the Flash and Fire point of a fuel sample.
10. To determine the Viscosity of a lubricant by redwood viscometer.
11. To determine the rate constant and order of reaction
12. To determine the strength of a given solution conductometrically

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	ME105	Subject Title	Engineering Mechanics						
LTP	2-1-2	Credit	4	Subject Category	UC	Year	1st	Semester	I / II

Course Outline:

Course Objective:

The objectives of this course is to learn basics concepts of engineering mechanics and increase the ability to solve problems involving forces, loads and moments and to know their applications in allied subjects

Course Pre/Co- requisite (if any):

Detailed Syllabus

UNIT 1: Introduction to Engineering Mechanics

Basic idealizations - Particle, Continuum and Rigid body; Newton's laws of Force and its characteristics, types of forces-Gravity, Lateral and its distribution on surfaces, Classification of force systems, Principle of physical independence, superposition, transmissibility of forces, Introduction to SI units.

Couple, Moment of a couple Characteristics of couple, Moment of a force, Equivalent force - couple system; Numerical problems on moment of forces and couples, on equivalent force - couple system.

UNIT 2: Equilibrium of forces

Equilibrium of forces - Definition of Equilibrant; Conditions of static equilibrium for different force systems, Lami's theorem; Numerical problems on equilibrium of coplanar – concurrent and non-concurrent force systems

Application- Static Friction in rigid bodies in contact, Types of friction, Laws of static friction, Limiting friction, Angle of friction, angle of repose; Impending motion on horizontal and inclined planes; Numerical Problems on single and two blocks on inclined planes, ladder and wedge friction.

UNIT 3: Analysis of Plane truss and Beam

Support Reaction in beams: Types of beams, Types of Loads and Supports, statically determinate beams, Numerical problems on support reactions for statically determinate beams with Point load (Normal and inclined) and uniformly distributed and uniformly varying loads and Moments.

Plane Truss: Perfect and imperfect truss Assumptions and Analysis of Plane Truss by Method of joints and Method of section.

UNIT 4: Center of Gravity and Centroids

Introduction to the concept, Centroids of line and area, Centroids of basic geometrical figures, computing Centroids for– T, L, I, and full/quadrant circular sections.

UNIT 5: Kinetics of Particle

Newton’s law of motion; Motion of bodies in Rectangular coordinates; D’Alembert’s Principle.

Learning Outcome

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

CO1. Identify principles of mechanics to be used for solving real life engineering problems.

CO2. Apply basic Engineering concepts based on force, shape and dimension for selection of material

CO3. Comprehend the action of Forces, Moments and other loads on systems of rigid bodies.

CO4. Compute the reactive forces and the effects that develop as a result of the external loads.

CO5. Express the relationship between the motions of bodies.

Text book [TB]:

3. Engineering Mechanics by S.S. Bhavikatti, New Age International Publisher, New Delhi, 3rd edition 2009.
4. Engineering Mechanics-Statics and Dynamics by A Nielson, Tata McGraw Hill Education Private Ltd, New Delhi, 2009.

Reference Books [RB]:

1. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education
2. Beer FP and Johnson ER, "Mechanics for Engineers- Dynamics and Statics"- 3rd SI Metric edition, Tata McGraw Hill. - 2008
5. Shames IH, "Engineering Mechanics – Statics & Dynamics"- PHI

List of Experiments:

1. Study of different types of beam.
2. Calculation and Verification of forces in truss elements.
3. Calculation and verification of equilibrium condition on beam model.
4. Calculation to find the redundant force in a truss.
5. Mechanical advantage over pulley arrangement.
6. Determining the coefficient of friction.
7. Optional Tensile Strength
8. Optional Hardness Measurement

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	ME104	Subject Title	Workshop Practice						
LTP	0-0-2	Credit	1	Subject Category	UC	Year	1st	Semester	I / II

Course Objective:

Ability to prepare simple objects using machines and machine tools to make students aware of fundamental operations of manufacturing an engineering component, enhance visualization and motivate them to innovate

Course Pre/Co- requisite (if any):

UNIT 1: Machine Shop

To make a machined-component using lathe with mild steel round bar or hexagonal bar
Comprising of common turning operations with reference to drawing given in the manual.
Any one of the following jobs
Jobs: Hex Bolt, Axle for cycle wheel, Jig Bush, a typical turning specimen.

UNIT 2: Sheet metal Shop

To make a sheet metal component with galvanized iron sheet as per the drawing provided in the manual having spot welding joint.
Any one of the following jobs
Jobs: Square tray, Scoop, Funnel

Fitting Shop

To make a joint using fitting tools with mild steel flats, round bars or square bars as per the drawing provided in the manual.

UNIT 3: Welding Shop- Arc Welding

To prepare a welding joint with mild steel flat using Manual Metal Arc welding machine according to the drawing provided in the manual.
Any one of the following jobs
Jobs: Lap joint, Butt joint, Fillet/Corner joint

Gas & Spot Welding

To observe the demonstration of making a Lap joint/Butt joint with mild steel sheet using oxyacetylene flame as per the drawing provided in the manual. To perform the spot welding operation on G.I. sheet

UNIT 4: Carpentry Shop

To make a wooden joint with soft wood as per the drawing provided in the manual.
Any one of the following jobs
Jobs: T-Lap joint, Dove tail joint, Mortise & Tendon joint, Bridle joint.

UNIT 5: Foundry Shop

Introduction to foundry process like melting of metals, mould making, casting process and use of patterns to prepare of a component and significance of foundry.
Demo of mould preparation

Minor Project:

To make a minor project by the students in batches comprising the operations performed in different shops

Learning Outcome

At the end of the course, the student will be able to:
CO1: Have Capability to identify hand tools and instruments for machining and other workshop practices.
CO2: Obtain basic skills in the trades of fitting, carpentry, welding and machining
CO3: Acquire measuring skills, using standard workshop instruments & tools.
CO4: Gain eye hand co-ordination, enhance psycho motor skills and attitude.

Text book [TB]:

1. A course in Workshop Technology Vol I and Vol II by Prof. B.S. RaghuwanshDhanpat Rai & Co.(P) Ltd.
2. Elements of Workshop Technology Vol I and Vol II by S.K. Hajara Choudhury ,A.K. Hajara Choudhury &Nirjhar Roy ;Media Promoters & Publishers Pvt. Ltd, Mumbai

Reference Books [RB]:

1. WorkshopTechnology Part 1 , Part2 & Part3 by W.A.J. Chapman;CBS Publishers & Distributors, New Delhi

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS105	Subject Title	Programming for Problem solving						
LTP	3-0-4	Credit	5	Subject Category	UC	Year	1st	Semester	I / II

Course Outline:

Course Objective:

The objective of the course is to make the students to understand the key hardware components in a modern computer system and as to how the software is mapped to the hardware. The student shall also be able to learn make the computer programs using C language by exploring the various features of C.

Course Pre/Co- requisite (if any):

Detailed Syllabus

UNIT 1: Introduction to Computer, Programming & algorithms
Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)
Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples, From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

UNIT 2: Arithmetic Expression, and Conditional statements, Loops
Expression:
Arithmetic, Logical , Relational expressions and precedence.
Loops & Branching: Writing and evaluation of conditionals and consequent branching, Iteration and loops.

UNIT 3: Arrays & Functions
Arrays: Arrays (1-D, 2-D), Character arrays and Strings.
Functions: functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference.
Searching & Sorting: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT 4: Fuels, Battery& Lubrication
Recursion:
Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc.
Structure:
Structures, Defining structures and Array of Structures.

UNIT 5: Pointers & File handling
Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list.
File handling: different modes of opening a file in C, reading, writing from files.

Learning Outcome

At the end of the course, the student will be able to:
CO1. To formulate simple algorithms for arithmetic and logical problems.
CO2. To implement conditional branching, iteration and recursion.
CO3. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
CO4. To use arrays, pointers and structures to formulate algorithms and programs.

CO5. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems

Text book [TB]:

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd edition 1988, Prentice Hall of India.

List of Experiments:

1. Familiarization with programming environment.
2. Programming for Simple computational problems using arithmetic expressions.
3. Programming for Problems involving if-then-else structures.
4. Programming for Iterative problems e.g., sum of series.
5. Programming for 1-D Array manipulation.
6. Programming for Matrix problems, String operations.
7. Programming for Simple functions
8. Programming for Recursive functions.
9. Programming for Pointers and structures.
10. Programming for File operations
11. Programming for solving Numerical methods problems

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS211	Subject Title	Discrete Mathematics						
LTP	3 1 0	Credit	4	Subject Category	DC	Year	2nd	Semester	III

Objective:
The objectives of this course is to learn concepts of Discrete Mathematics and by applying the algorithms to solve the problems related to Recursion , combinatorial mathematics and problems on basic graph theory.

UNIT I: Unit 1: Introduction to Sets, Relations & Functions (7)

Set Theory: Introduction, Combination of sets, Multisets, Ordered pairs, Set Identities.
Relations: Definition, Operations on relations, Properties of relations, Composite Relations, Equality of relations, Order of relations.
Functions: Definition, Classification of functions, Operations on functions, Recursively defined functions.
Natural Numbers: Introduction, Mathematical Induction.

UNIT II: Unit 2: Posets& Introduction to Boolean algebra (6)

Partial order sets: Definition, Partial order sets, Combination of partial order sets, Hasse diagram.
Lattices: Definition, Properties of lattices – Bounded, Complemented and Complete Lattice
Boolean algebra: Introduction, Axioms and Theorems of Boolean algebra, Algebraic manipulation of Boolean expressions.

UNIT III: Groups & Rings (8)

Algebraic Structures: Definition, Groups, Subgroups and order, Cyclic Groups, Cosets, Lagrange's theorem, Normal Subgroups Permutation and Symmetric groups, Group Homeomorphisms, Definition and elementary properties of Rings and Fields, Integers modulo n.

UNIT IV: Propositional logic, Predicate Logic & Introduction to Probability (8)

Propositional Logic: Proposition, well-formed formula, Truth tables, Tautology, Contradiction, Algebra of proposition, Theory of Inference ,Natural Deduction.
Predicate Logic: First order predicate, well-formed formula of predicate, quantifiers, Inference theory of predicate logic.
Combinatorics: Introduction, Counting Techniques, Pigeonhole Principle
Probability: Introduction, Conditional Probability & Independence

UNIT V:Introduction to Graphs & Recurrence Relations (7)

Graphs: Definition and terminology, Representation of graphs, multigraphs, bipartite graphs, Planar graphs, Isomorphism and Homeomorphism of graphs, Euler and Hamiltonian paths, Graph coloring.
Trees: Definition, Binary tree, Binary tree traversal, binary search tree.
Recurrence Relation & Generating function: Recursive definition of functions, Recursive algorithms, Method of solving recurrences

Course Outcomes:

- An ability to perform operations on discrete structures such as sets, functions, relations, and sequences..

- An ability to construct proofs using direct proof, proof by contradiction, proof by cases, and mathematical induction.
- An ability to demonstrate the ability to solve problems using counting techniques and combinatorics in the context of discrete probability.
- An ability to solve problems involving recurrence relations and generating functions.
- An ability to prove computational theorem

Text Books:

1. Liu C.L., Elements of Discrete Mathematics, McGraw Hill Int. 4th edition2012.
2. Kolman B & Busby C.R., Discrete Mathematical Structure for Computer Science, Prentice Hall of India Ltd. 6th Edition 2008.
3. Deo N., Graph Theory, Prentice Hall of India.4th edition 2014.

Reference Books:

1. Trembley J.P. &Manohar R., Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill.1st Indian Edition 2001.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS212	Subject Title	Computer Organization						
LTP	3 1 0	Credit	4	Subject Category	DC	Year	2nd	Semester	III

OBJECTIVE:

This course will facilitate the students to learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design.

Unit 1: Introduction to Register Transfer and Micro operation& Computer Arithmetic (8)

Register Transfer and Micro operation: Register Transfer Language, Bus and Memory Transfers, Bus Architecture, Arithmetic, Logic, Shift Micro-operation, Design of ALU, Design of Fast adder.
Computer Arithmetic: Introduction, addition and subtraction algorithms, Booth Multiplication Algorithms, floating point arithmetic operation, IEEE format for floating point numbers.

Unit 2: Processor Organization & Control Design. (8)

Processor Organization: General register organization, Stack organization, Addressing modes, Instruction format, Data transfer & manipulations, Program Control.

Control Design: Single and multiple bus architecture, Execution of a Complete Instruction, sequencing of control signals, Hardwired control, Micro programmed Control, microinstruction format.

Unit 3 Input-Output Organization (6)

Input-Output Organization: I/O Interface, Modes of transfer, Interrupts & Interrupt handling, Direct Memory Access, Input-Output processor, Serial Communication.

Unit-4 Memory Organization (6)

Memory Organization: Memory Hierarchy, Main Memory (RAM and ROM Chips), organization of Cache Memory, Virtual Memory, Memory management hardware.
Unit- 5: Parallel Processing & Multiprocessor (8)

Parallel Processing: Flynn's classification, Pipelining- Arithmetic Pipelining, Vector Processing, and Array Processor.
Multiprocessor: Characteristic of Multiprocessor, Interconnection Structure, Interprocessor Arbitration.

COURSE OUTCOME:

At the end of the course, the student can:

CO1. This will help the students to be familiarized with the hardware components and concepts related to the control design.

CO2. This also will help the students to be familiarized withaddressing modes, different types of instruction formats, input-output organization.

CO3. The student will be able to learn the hardware components and concepts related to the memory organization.

CO4. An ability to will be able to get the theoretical concept of parallel processing and different types of multiprocessor's interconnection structures

TEXT BOOKS

1. Computer System Architecture, M. Mano, Pearson, 3rd Edition 2017.
2. Computer Organization, John P.Hayes, McGraw Hill, 6thEdition.2003.

REFERENCES

1. Computer Organization, Vravice, Zaky&Hamacher (TMH Publication),3rd Edition 2017.
2. Structured Computer Organization, Tannenbaum,6th Edition 2012.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS201	Subject Title	Data Structures						
LTP	3 0 2	Credit	4	Subject Category	DC	Year	2nd	Semester	III

OBJECTIVE:

The objective of this course is familiarizing the students with the different kinds of data structure used for information storage and data retrieval in different applications of computer science.

Unit 1: Introduction to Algorithms & Data Structure (8)

Introduction: Concept of data structure, Types of data structures, Character String in C, Recursion, Structure, Pointer, Dynamic Allocation, Algorithms, Algorithm analysis, Complexity of algorithms and Time space trade-off.

Arrays: Introduction, Single and multi-Dimensional Arrays, address calculation, application of arrays, Operations defined: traversal, insertion and deletion.

Stacks: Stacks, Array representation of stack, Applications of stacks, Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack

Unit 2: Queues & Link List (7)

Queue: Queue, Array representation and implementation of queues, Circular queues, Operations on Queue: Create Add, Delete, and Full and Empty, De-Queue, Priority queues, Applications of Queues.

Linked Lists: Concept of linked list, Representation and implementation of singly linked list, Circular linked list, doubly linked list, Operations on Linked lists, Concepts of header linked lists, applications of linked lists.

Unit 3 Trees (8)

Trees: Basic terminologies of trees, Binary tree, Complete Binary tree, Extended Binary tree, Representation of Binary tree, Binary tree traversal, Operations on Binary tree.

Binary Search Tree: Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, Path Length, AVL Trees, B-trees.

Unit-4 Graphs (7)

Graphs: Terminology & Representations, Graphs & Multi-graphs, Directed Graphs, Representations of Graphs, Traversal, Connected Component and Spanning Trees, Minimum Cost Spanning Trees.

Unit- 5: Searching, Sorting & File Handling: (9)

Searching &**hashing:** linear search, binary search, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation

Sorting: Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort, Heap Sort.

File Handling: Introduction to file handling, Data and Information, File concepts, File organization, files and streams, working with files.

COURSE OUTCOME:

At the end of the course, the student can :

CO1. Students develop knowledge of basic data structures for storage and retrieval of ordered or unordered data. Data structures include: arrays, linked lists, binary trees, heaps, and hash tables.

CO2. Students develop knowledge of applications of data structures including the ability to implement algorithms for the creation, insertion, deletion, searching, and sorting of each data structure.

CO3. Students learn to analyze and compare algorithms for efficiency using Big-O notation.

CO4. Students implement projects requiring the implementation of the above data structures.

TEXT BOOKS

1. Schaum'souline series "Data structures" TMH. 1st Edition Indian Reprint 2014.
2. A. M. Tenenbaum, Langsam, Moshe J. Augentem, Data Structures using C PHI Pub.1st Edition.1998

REFERENCES

1. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication,2nd Edition. 2008.
2. Robert Kruse, Data Structures and Program Design in C PHI.2nd Edition.2006.
3. Willam J. Collins, Data Structure and the Standard Template library –2003, T.M.H.1st Edition.

SR.NO.	EXPERIMENT NAME
1	Program in C for the implementation of Array for various operations.
2	Program in C for the creation of Stack for its various operation implementation.
3	Program in C for the creation of Queue for its various operation implementation.
4	Program in C for the creation of Link list for its various operation implementation.
5	Program in C for the creation of Circular Link list for its various operation implementation.
6	Program in C for the creation of Doubly Link list for its various operation implementation.
7	Program in C for the creation of Binary Search Tree for its various operation implementation.
8	Program in C for the Implementation of sorting Algorithms.
9	Program in C for the Implementation of basic Graph Algorithms.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	IB241	Subject Title	Python for Data Science						
LTP	3 0 2	Credit	4	Subject Category	DC	Year	2nd	Semester	III

OBJECTIVE:

Course Outline

The python for Data Science Course leads the students from the basics of writing and running Python scripts to more advanced features such as file operations, regular expressions, working with binary data, and using the extensive functionality of Python modules. Extra emphasis is placed on features unique to Python, such as tuples, array slices, and output formatting. The course includes data handling, use cases and visualization using the powerful python language.

Objective: The objective of this course to provide the knowledge of Python and its uses in Data Science & Machine Learning applications.

Unit 1 INTRODUCTION TO PYTHON8 L

- What is Python?
- Advantages and disadvantages
- Downloading and installing
- Which version of Python
- Running Python Scripts
- Using the interpreter interactively
- Using variables
- String types: normal, raw and Unicode
- String operators and expressions
- Math operators and expressions
- Writing to the screen
- Reading from the keyboard
- Indenting is significant
- The if and else statements
- While Loops
- Using List
- Dictionaries
- Using the for statement
- Opening, reading and writing a text file
- Using Pandas, the python data analysis library and data frames
- Grouping, aggregating and applying, merging and joining.
- Dealing with syntax errors
- Exceptions, Handling exceptions with try/excep

Unit 2: DATA HANDLING AND USE CASES 8 L

- RE Pattern Matching
- Parsing Data
- Introduction to Regression
- Types of Regression
- Use Cases
- Exploratory data analysis
- Correlation Matrix

- Implementing linear regression

Unit 3: Introduction to Visualization Tools7 L

- Introduction to Data Visualization
- Introduction to Matplotlib
- Basic Plotting with Matplotlib
- Dataset on Immigration to Canada
- Line Plots

Basic Visualization Tools

- Area Plots
- Histograms
- Bar Charts

- Specialized Visualization Tools

- Pie Charts
- Box Plots
- Scatter Plots
- Bubble Plots

UNIT 4 Advanced Visualization8 L
Advanced Visualization Tools

- Waffle Charts
- Word Clouds
- Seaborn and Regression Plots

Creating Maps and Visualizing Geospatial Data

- Introduction to Folium
- Maps with Markers
- Choropleth Maps

UNIT 5: Advanced Concepts8 L

- Machine Learning - Algorithm
- Algorithms – Random forest
- Super vector Machine
- Random Forest
- Build your own model in python

- Comparison between random forest and decision tree

Learning Outcome:

- To understand why Python is a useful scripting language for developers.
- To learn how to design and program Python applications.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to identify Python object types.
- To learn how to use indexing and slicing to access data in Python programs.
- To define the structure and components of a Python program.
- To learn how to write loops and decision statements in Python.
- To learn how to write functions and pass arguments in Python.
- To learn how to build and package Python modules for reusability.
- To learn how to read and write files in Python.
- To learn how to design object-oriented programs with Python classes.
- To learn data handling and use cases diagrams
- To learn how to use class inheritance in Python for reusability.
- To learn how to use exception handling in Python applications for error handling
- To learn visualization libraries in Python, namely Matplotlib, Seaborn, and Folium

Text Book:IBM Course ware

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	EC202	Subject Title	Digital System Design						
LTP	3 0 2	Credit	4	Subject Category	EC	Year	2nd	Semester	III

OBJECTIVE:

To acquire the basic knowledge of digital logics and application of knowledge to understand digital electronics circuits.
To prepare students to perform the analysis and design of various digital electronic circuits.

COURSE OUTCOME:
At the end of the course, the student can:
CO1. To understand and examine the structure of various number systems and its application in digital design
CO2. Have a thorough understanding of the fundamental concepts and techniques used in digital electronics.
CO3. The ability to understand, analyze and design various combinational and sequential circuits.
CO4. To develop skill to build digital circuits.

UNIT I – INTRODUCTION: 10 HRS

Number Systems, Basic & Universal Logic gates, Boolean algebra, Direct Conversion of various base, Negative number representations, Floating point number representation, BCD & EXCESS-3 arithmetic, Error detecting and correcting codes: Hamming code, parity code, Review and Limitation of K-Map, Quine-Mcclusky Method (Tabular Method).

UNIT II – COMBINATIONAL LOGIC CIRCUITS: 10 HRS

Characterization of digital circuits: Combinational & Sequential Logic circuit.
Design Procedure-Arithmetic Circuits: Adders, Subtractors, Parallel Adder, BCD Adder, and Multiplier.
Design Procedure-Switching Circuits: Decoder, Encoder, Priority Encoder, Multiplexers, Demultiplexers and their applications, Magnitude Comparators.
Design Procedure-Other Circuits: Parity checker and generator,
Code Conversion: Binary to BCD, BCD to Binary, BCD to Excess-3, Excess-3 to BCD.

UNIT III – SEQUENTIAL LOGIC CIRCUITS: 06 HRS

Latches: SR, S $\overline{R}$ ($\overline{S}$ Bar and R bar), D latch. Race around condition, Propagation Delay.
Flip-Flops: SR, D, JK & T Flip Flops and their conversions, Master-Slave Flip Flop, Edge Triggered Flip-Flop, Characteristic Table, Characteristic Equation, State Table, State Diagram, Excitation Table & Diagram, Analysis with JK Flip-Flop, Design Procedure of Sequential Circuits, Designing with unused states.
Finite State Machine: Mealy and Moore Models.

Unit IV- APPLICATION OF SEQUENTIAL LOGIC CIRCUITS: 08 HRS
Registers: Registers with Parallel Load, Serial Transfer, Shift Registers with Parallel Load, Bidirectional Shift Register, Universal Register.
Counters: Asynchronous Counters-Ripple Up and Down Counters using JK Flip-Flop, impact of Propagation delay.
Counters: Synchronous Counters - Binary Counter, Counter with D Flip-Flop, Up & Down Counters, BCD/Decade Counters.

Unit V- LOGIC FAMILIES & PROGRAMMABLE LOGIC DEVICES:
Logic Families: Diode, BJT & MOS as a switching element, concept of transfer characteristics, ECL, TTL, I2L, Tri-state, PMOS, NMOS and CMOS logic families- Power Consumption, Gate delay and Figure of merit (SPP), Package

density, Comparison of standard logic families, pass transistor Logic, Open Collector and Totem pole output stage for TTL.

TEXT BOOKS

1. Digital Design, M. Morris Mano and M. D. Ciletti, 4th Edition, Pearson.

REFERENCES

1. Digital Systems: Principles and Design, Raj Kamal, Pearson
2. Maini, Digital Electronics: Principles and Integrated Circuits, Wiley India.
3. Switching Theory and Finite Automata, Kohavi, TMH Publications.

SR.NO.	EXPERIMENT NAME
1	Implementation of All Logic Gates using Universal gates (NAND & NOR both).
2	Bread-board implementation (Parallel adder, One bit Multiplier, One bit Magnitude comparator, parity checker)
3	Bread-board implementation of any one code converter (i.e. Gray Code, BCD Code, Excess-3, Hex. etc.).
4	Design of shift registers (SISO, SIPO, PIPO, and PISO), up and down counters.
5	Design of Mod-6 types of Asynchronous Counters.
6	Transfer characteristics of TTL and CMOS inverters.
7	Realization of Decoder, Multiplexer, encoder and De-multiplexers using IC 74138.
8	To design & Implement PAL.
9	To design & implement PLA.
10	Clock circuit realization using 555, CMOS inverter.

Subject Code	CS213	Subject Title	Theory of Computation

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

LTP	3 1 0	Credit	4	Subject Category	DC	Year	2nd	Semester	IV

OBJECTIVE:

This course will facilitate the students to learn the mathematical foundations of computation including automata theory; the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability.

Unit 1: Introduction to Finite Automata. (8)

Introduction to Mathematical foundation for automata: Mathematical preliminaries, alphabets, strings, languages, states, transition, transition graph, generalized transition graph.

Finite Automata: Deterministic Finite Automata, Non-Deterministic Finite Automata, Non-Deterministic Finite Automata with ϵ transitions, minimization of DFA.

Unit 2: NFA & FA with output (7)

Conversions and Equivalence: Equivalence between NFA with and without ϵ transitions. NFA to DFA conversion.

Application of FA: Equivalence between two DFA's, Limitations of FSM; Application of finite automata, Finite Automata with output- Moore &Melay machine and its conversion.

Unit 3 Grammars & context Free Language (8)

Regular Languages: Regular sets; Regular expressions, Arden's theorem, Construction of finite Automata for a given regular expression, Pumping lemma for regular sets. Closure properties of regular sets. Grammar Formalism: right linear and left linear grammars; Equivalence between regular linear grammar and FA.

Context free grammar: Grammar for CFL, Derivation trees, sentential forms. Ambiguity in context free grammars; Normal forms: Chomsky normal form and Greibach normal form; Pumping Lemma for Context Free Languages, Closure property of CFL.

Unit-4 Pushdown Automata (8)

Push Down Automata: Push down automata, definition; Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence; Equivalence of CFL and PDA; Introduction to DCFL and DPDA

Unit- 5: Turing Machine & Computational Decidability (8)

Turing Machine: Turing Machine, definition, model, Design of TM, Computable functions Church's hypothesis, Types of Turing machines, Universal Turing Machine, Halting problem.

Properties and Decision problems: Properties of recursive and recursively enumerable languages, unsolvable decision problem, undecidability of Post correspondence problem, Church Turing Thesis.

COURSE OUTCOME:

At the end of the course, the student will able to :

CO1. Analyze and design finite automata, pushdown automata, Turing machines, formal languages, and grammars.

CO2. Demonstrate their understanding of key notions, such as algorithm, computability, decidability, and complexity through problem solving.

CO3. Prove the basic results of the Theory of Computation.

CO4. State and explain the relevance of the Church-Turing thesis.

TEXT BOOKS

1. Hopcroft H.E. and Ullman J. D ,"Introduction to Automata Theory Language and Computation",., Pearson Education.3rd Edition.2008.
2. J. C. Martin, "Introduction to Languages and the Theory of Computation", 3rd edition, Tata McGraw-Hill.2009.
3. K.L.P. Mishra, "Theory of Computer Science", PHI.3rd Edition 2014.

REFERENCES

1. Lewis H.P. &Papadimitrou "Elements of Theory of Computation", C.H. Pearson, PHI.2nd Edition 2011.
2. Michael Sipser " Introduction to the Theory of Computation", Thomson India 2nd Edition(international)2004

Subject Code	CS214	Subject Title	Operating Systems					
LTP	3 1 0	Credit	4	Subject Category	DC	Year	2nd	Semester	IV

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

OBJECTIVE:

This course will facilitate the students to learn the different components and various functioning of an operating system.

Unit 1: Introduction to Operating System. (8)

Introduction: Components of a computer System, Operating system: User view & System view, Evolution of operating system, Single Processor & Multiprocessor systems, Real Time System, Distributed Systems, Multimedia Systems, Handheld Systems.

Operating System Structure: Operating System Services, User Operating System Interfaces: Command-Line and GUI, System Calls.

Unit 2: Management & Scheduling (6)

Process Management: Process Concept, Process States, Process Transition Diagram, Process Control Block (PCB).

CPU Scheduling: Scheduling Concepts, Performance Criteria, Scheduling Queues, Schedulers, Scheduling Algorithms: Preemptive & Non Preemptive: FCFS, SJF, Priority, Round-Robin

Unit 3 Concurrent Processes & Deadlocks (8)

Concurrent Processes: Principle of Concurrency, Producer / Consumer Problem, Co-operating Processes, Race Condition, Critical Section Problem, Peterson's solution, Semaphores, Classical Problem in Concurrency- Dining Philosopher Problem; Inter Process Communication models and Schemes.

Deadlock: System Model, Deadlock Characterization, Prevention, Avoidance and Detection, Recovery from deadlock.

Unit-4 Memory Management (7)

Memory Management: Bare machine, Resident monitor, Multiprogramming with fixed partition, Multiprogramming with variable partition, Multiple base register, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replaced algorithm, Allocation of frames, Cache memory.

Unit- 5: File Systems & I/O Management (7)

File System: Different types of files and their access methods, various allocation methods.

I/O Management and Disk Scheduling: I/O Devices, Organization of I/O functions, Disk Structure, Disk Scheduling (FCFS, SSTF, SCAN, C-SCAN, LOOK).

COURSE OUTCOME:

At the end of the course, the student will able to :

CO1. Learn the general architecture& functioning of computers with operating system.

CO2. Describe, contrast and compare differing structures for operating systems.

CO3. Understand and analyze theory and implementation of: processes, resource control (concurrency etc.).

CO4. Understands physical and virtual memory, scheduling, I/O and files

TEXT BOOKS

1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts", Wiley,6th Edition 2006.
2. D M Dhamdhere, "Operating Systems: A Concept based Approach", PHI. 3rd Edition.2017..

REFERENCES

1. Harvey M. Dietel, " An Introduction to Operating System", Pearson Education ,1st Edition 2009

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS203	Subject Title	Computer Networks					
LTP	3 0 2	Credit	4	Subject Category	DC	Year	2nd	Semester	IV

OBJECTIVE:

The objective of this course is familiarizing the students with the concepts of networking in computers, routing of data packets on the network and protocols followed in the networked computers.

Unit 1: Introduction to Computer Network (8)

Introduction: Motivation, OSI model, Signals and media, Bits over signals, Synchronous communication, Modulation and modems, Bandwidth, Throughput, and noise, Time division and Frequency division multiplexing, Standards, Switching methods, ISDN.

Unit 2: Data Link Protocol (8)

Packet Transmission: Multiplexing, Frames, Error correction techniques, LAN/WAN/MAN, Topology, CSMA/CD,LAN protocol, Elementary Data link protocol- Sliding window protocols, Token passing rings, FDDI, IEEE 802.3, 802.5.

Unit 3 Routing algorithms of Data Packets in networked computers (8)

Routing Algorithms: Distance-Vector, Link-State, Shortest path computation, Dijkstra's algorithm, Congestion control, WAN technologies including frame relay, X.25, ATM.

Unit-4 Interworking & IP addressing (8)

Internetworking: Motivation, Concept, Goals, TCP/IP model, IP addressing with sub netting, Address binding with ARP, IP Datagram, Encapsulation IP fragmentation and reassembly, ICMP,IGMP,TCP.

Unit- 5: Introduction to Network Services (8)

Network Services: Electronic mail, File transfer, Access and management, Virtual terminals, Remote procedure call.

COURSE OUTCOME:

At the end of the course, the student can:

CO1. An ability to perform Design and simulation of protocol using simulation tool.

CO2. Ability to create reliable communication using communication model with high quality of service.

CO3. Able to understand the data Packet Routing in networked computers.

CO4. Able to understand the protocols followed used in computer networks.

TEXT BOOKS

1. Hopcroft H.E. and Ullman J. D ,"Introduction to Automata Theory Language and Computation",., Pearson Education.3rd Edition.2008.
2. J. C. Martin, "Introduction to Languages and the Theory of Computation", 3rd edition, Tata McGraw-Hill.2009.
3. K.L.P. Mishra, "Theory of Computer Science", PHI.3rd Edition 2014.

REFERENCES

1. Lewis H.P. &Papadimitrou "Elements of Theory of Computation", C.H. Pearson, PHI.2nd Edition 2011.
2. Michael Sipser " Introduction to the Theory of Computation", Thomson India 2nd Edition(international)2004

SR.NO.	EXPERIMENT NAME
1	Simulate a network having two communication node using Cisco packet Tracer.
2	Simulate a network having 4 communication nodes with one switch.
3	Simulate a network having Two subnet using 2 switch, one Router and 6 nodes using Cisco packet tracer
4	Simulate a network having Two subnets and two Routers using DTE/ DCE Cable with user defined clock rate.
5	Simulate a network using Star Topology Using Cisco packet Tracer.
6	Simulate a network using Bus Topology Using Cisco packet Tracer.
7	Simulate a network using Ring Topology Using Cisco packet Tracer.
8	Simulate a network using Mesh Topology Using Cisco packet Trace.
9	Create a DHCP server using Cisco packet tracer
10	Implement Intra domain and Inter domain routing Protocol using Cisco Packet Tracer.
11	Implement Bit Stuffing using Turbo C++ Editor.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS202	Subject Title	Java Programming Concepts						
LTP	3 0 2	Credit	4	Subject Category	DC	Year	2nd	Semester	IV

OBJECTIVE:

The objective of this course is familiarizing the students with the concepts of object oriented programming and its implementation in Java programming language.

Unit 1: Object Oriented Programming, Static & Dynamic models (9)

Object Oriented Programming: Objects and classes, generalization and inheritance, aggregation, abstract class.
Static and dynamic models: UML diagrams: Class diagram, interaction diagram: collaboration diagram, sequence diagram, state diagram, activity diagram.

Unit 2: Introduction to Java, Class, Objects (8)

Introduction to Java: Importance and features of Java, Keywords, constants, variables and Data Types, Operators and Expressions.
Branching and looping: if-else, switch, while, do, for statements, jump statements: break, continue, and return.
Introducing classes, objects and methods: defining a class, adding variables and methods, creating objects, constructors, inheritance, overriding, final class, and use of super keyword.

Unit 3 Arrays & Interface in Java (7)

Arrays and Interfaces: Creating an array, string array, dynamic array, abstract classes, interfaces, extending interfaces, IO stream handling, and packages.

Unit-4 Multithreading, Exception handling, Applet and AWT (8)
Multithreading: Thread, thread life cycle, extending thread class, implementing runnable interface, thread synchronization.
Exception handling: inbuilt and user defined exceptions.
Applet and AWT: Introduction to applet, event handling, event classes and listeners, handling images.

Unit- 5: Introduction to Swings (7)

Introduction to Swings: Features of swings, swing UI elements, sample cases developing user interfaces using Swing UI classes, design animation, sound and video application using swings.

COURSE OUTCOME:

At the end of the course, the student can :

CO1. Able to learn Identify classes, objects, members of a class and relationships among them needed for a specific problem.

CO2. Able to learn Java application programs using OOPS principles and proper program structuring.

CO3. Able to Java programs to implement error handling techniques using exception handling.

CO4. Able to GUI programs in java and embed with web pages.

TEXT BOOKS

1. Herbert Schieldt, "The Complete Reference: Java", TMH.9th Edition.2014.
2. E. Balagurusamy, "Programming in JAVA", TMH.5th Edition 2014.

REFERENCES

1. Booch Grady, "Object Oriented Analysis & Design with application 3/e", 3rd Edition Pearson Education, New Delhi,2009.

SR.NO.	EXPERIMENT NAME
1	Program in Java to design simple calculator for (+, -, *, and /) using switch case
2	Program in Java to design accounts class and two functions withdraw() and deposit().
3	Program in Java to show the inheritance in java and use of super keyword..
4	Program in Java to the concept of polymorphism by designing functions to sum different type of numbers
5	Program to show the concept of method overriding in Java.
6	Program in Java that import the user define package and access the Member variable of classes that Contained by Package.
7	Program in C for the creation of Binary Search Tree for its various operation implementation.
8	Program in Java to handle the Exception using try and multiple catch block.
9	Program in Java to create a thread that Implement the Runable interface
10	Program in Java to create Frame that display the student information using awt components
11	Program in Java to create frame for course enquiry using Swings components.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	IB202	Subject Title	Information Management basics						
LTP	3 0 2	Credit	4	Subject Category	DC	Year	2nd	Semester	IV

OBJECTIVE:

This course aims to educate students on the role of a well-structured relational database management system (RDBMS) to the efficient functioning of an organization. This course covers theory and practice in designing a relational database management system with example of a current database product of MYSQL. Students also learn about the important concepts of database integrity, security and availability with techniques like normalization, concurrency control and recoverability control.

Unit 1: Introduction to Database System (8)

Introduction: Data base System Applications, data base System VS file System, Data Abstraction, Instances and Schemas, data Models: the ER Model, Relational Model & Other Models , Database Languages, data base Users and Administrator, data base System Structure, Storage Manager, the Query Processor, Two/Three tier architecture.

Unit 2: E-R modeling Data Base Design (7)

E-R model: Basic concepts, Design Issues, Mapping Constraints, Attributes and Entity sets, Relationships and Relationship sets, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

Unit 3 Relational Model & SQL (8)

Relational Model: Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra

SQL: Form of Basic SQL Query, Nested Queries, Aggregative Operators, NULL values, Logical operators, Outer Joins, Complex Integrity Constraints in SQL.

Unit-4 Database Design Concepts (8)

Database Design: Schema refinement, Different anomalies in designing a Database, Decompositions , Problem related to decomposition, Functional Dependency, Normalization using functional dependencies, 1NF, 2NF, 3NF & BCNF , Lossless join decomposition, Dependency preserving Decomposition , Schema refinement in Data base Design, Multi valued Dependencies, 4NF, 5NF.

Unit- 5: Transaction & Concurrency (8)

Transaction Management: Transaction-concepts, states, ACID property, schedule, serializability of schedules, concurrency control techniques - locking, timestamp, deadlock handling, recovery-log based recovery, shadow paging.

COURSE OUTCOME:

At the end of the course, the student will able to learn:

CO1. To work on MySQL database management system.

CO2. To create database and query the database for information retrieval.

CO3. To design a database so that data redundancy, data inconsistency and data loss problems may be resolved.

CO4. Exposure to DB2 data base.

TEXT BOOKS

1. Raghurama Krishnan, Johannes Gehrke, Data base Management Systems, TATA McGrawHill 3rdEdition,2003
2. Silberschatz, Korth, Data base System Concepts, McGraw hill, 5th edition,2005

REFERENCES

1. Peter Rob & Carlos Coronel, Data base Systems design, Implementation, and Management, 7thEdition,2006.
2. ElmasriNavate, Fundamentals of Database Systems, Pearson Education,7th edition 2016
3. C.J.Date ,Introduction to Database Systems, Pearson Education,8th edition,2012
4. IBM Redbooks – Essentials of DB2

SR.NO.	EXPERIMENT NAME
1	Implementation of Data Definition language in Query Language.
2	Implementation of Data Manipulation in Query Language.
3	Insertion &Updation of records in Database table
4	Implementation of GROUP functions (avg, count, max, min, Sum).
5	Execution of the various type of SET OPERATORS (Union, Intersect, Minus).
6	Apply the various types of Integrity Constraints on table.
7	Creation of various types of JOINS.
8	Implementation of Views and Indices in database.
9	Implementation of foreign key on database.
10	Modify the database structure and drop the record with structure.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	IB242	Subject Title	AI & ML Foundations (IBM)					
LTP	2 0 2	Credit	3	Subject Category	DC	Year	2nd	Semester	IV

Course Outline: The course will introduce to IBM Watson Machine Learning and IBM Cloud service that enables users to perform two fundamental operations of machine learning: training and scoring,.

- **Training** is the process of refining an algorithm so that it can learn from a data set. The output of this operation is called a model. A model encompasses the learned coefficients of mathematical expressions.
- **Scoring** is the operation of predicting an outcome by using a trained model. The output of the scoring operation is another data set containing predicted values.

Also, to understand the invention of Artificial Intelligence, trends, acceptance and advancement. Types of Artificial Intelligence, its form and application. Creating a chatbot using Watson services.

COURSE OBJECTIVE:

- Describe R syntax, including assigning variables
- Describe simple operations with one of R's most important data structures – vectors
- Describe lists, matrix, arrays and data frames.
- Describe conditional statements, functions, classes and debugging.
- Describe important functions for character strings and dates in R.
- Describe popular algorithms Classification, Regression, Clustering, and Dimensional Reduction.
- Describe proper model - Train/Test Split, Root Mean Squared Error, and Random Forests.
- Describe how statistical modelling relates to Machine Learning
- Describe R to unlock the value of data in relational databases
- Describe DataScience and SystemML
- Describe Cloudant and Analytics Engine
- Describe Artificial Intelligence, its form and advancements
- Describe methods of creating chatbot

Unit 1 FUNDAMENTAL OF MACHINE LEARNING 10L

Machine Learning vs Statistical Modeling & Supervised vs Unsupervised Learning

- Machine Learning Languages, Types, and Examples
- Machine Learning vs Statistical Modelling
- Supervised vs Unsupervised Learning
- Supervised Learning Classification
- Unsupervised Learning

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

IBM WATSON MACHINE LEARNING

- Getting started with IBM Watson
- Foundation Concept
- Creating a catalog and finding a data fast
- Adding Data set to catalog
- Using Data set in a project
- Tracking Asset Lineage
- Working with Connected data
- Protecting data column using anonymization
- Discovering Assets from data collection
-

Supervised Learning
Supervised Learning I

- K-Nearest Neighbors
- Decision Trees
- Random Forests
- Reliability of Random Forests
- Advantages & Disadvantages of Decision Trees

Supervised Learning II

- Regression Algorithms
- Model Evaluation
- Model Evaluation: Overfitting &Underfitting
- Understanding Different Evaluation Models

UNIT 2: Unsupervised Learning8 L
Unsupervised Learning

- K-Means Clustering plus Advantages & Disadvantages
- Hierarchical Clustering plus Advantages & Disadvantages
- Measuring the Distances Between Clusters - Single Linkage Clustering
- Measuring the Distances Between Clusters - Algorithms for Hierarchy Clustering
- Density-Based Clustering

Dimensionality Reduction & Collaborative Filtering

- Dimensionality Reduction: Feature Extraction & Selection

Collaborative Filtering & Its Challenges

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Building Models:
BUILD MODELS

- Building Logistic regression Model
- Building a Naïve Bayes Model
- Building a continuous learning Model
- Scoring a Predictive Model with SPSS
- Building Deep Learning Architecture with Neural Network Modeler

Working on Analytics Engine

- Getting started with Openscale
- Streaming Analytics
- Using IBM Lift for migrating the data
- Cloudant : Loading Data, HTTP, Replication, Indexes, queries, Cloudant Queries, view and Search
- Working on Cloudant Geospatial
- Working with Databases for Postgress SQL
- Compose for ScyllaDB
- Storing Data for Analytics exchange in compose for MySQL
- Using MongoDB and Elasticsearch together with compose transporter

UNIT III: Apache SystemML and Chatbot10 L

- **Data Series**
  Introduction to Dimension Reduction
  Dimension Reduction Goals
- **Data Refinement**
  Principal Component Analysis, Labs

- **Exploring Data**
  Exploratory Analysis, Labs
- **What is SystemML?**
  Explain the purpose and the origin of SystemML
  List the alternatives to SystemML
  Compare performances of SystemML with the alternatives

- **SystemML and the Spark MLContext**
- Use MLContext to interact with SystemML (in Scala)
- AI overview, trends, advancements
- Types of AI, and its applications
- AI research focus
- Business analytics

- Introduction to chatbots and chatbots components

Learning Outcome

- Able to work on R syntax, including assigning variables
- Able to create simple operations with one of R's most important data structures – vectors
- Able to list, matrix, arrays and data frames.
- Able to use conditional statements, functions, classes and debugging.
- Able to apply important functions for character strings and dates in R.
- Able to use popular algorithms Classification, Regression, Clustering, and Dimensional Reduction.
- Able to use proper model - Train/Test Split, Root Mean Squared Error, and Random Forests.
- Able to use statistical modelling r to Machine Learning
- Able to apply R to unlock the value of data in relational databases
- Able to understand DataScience and SystemML
- Able to work on Cloudant and Analytics Engine
- Able to understand Artificial Intelligence, its form and advancements
- Able to create chatbot

Text Book: IBM Courseware

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS222	Subject Title	*Dot Net programming* (VAT)						
LTP	0 0 2	Credit	0	Subject Category	AC	Year	2nd	Semester	IV

OBJECTIVE:

This course aims to provide the knowledge to understand the concepts and elementary use of .NET library such as development of windows application and website creation through ASP.NET. Students are also able to learn about the different validation and use of controls available in Visual Studio.

SR.NO.	EXPERIMENT NAME
1	Program in C# to demonstrate System.Array class members like Clone(), Copy(), Clear() ,Sort() and Reverse().
2	Program in C# to demonstrate System. String members like Contains(),Insert(),Remove(),Replace() and ToUpper().
3	Program in C# Create a Simple Calculator using Text Boxes and Button Tools of Visual Studio which also calculates %, modulus, Root, Clear, Sign Change, and Result
4	Design Login form and create windows form using basic form controls application.
5	Design a form in C# that takes the details of a person (Name, Address and DOB) and enables Radio Button to vote if the age of the person is above 18 and then shows a thanks message.
6	Create a form using Menu Strip Tool and add the following options:-File, Edit,Help. Also add submenu ,for File add :- Open,Close and Exit. For Edit add:- Cut, Copy and Paste.For Help add:-Help and About.
7	Create a windows application which stores an Item (Item_Id, Name,Price,Weight,Type,quantity) in a database. After that there will be a button to view the Detail of Items added. After that create another form from which Item can be removed and Updated.
8	Create a Registration Form with all validations to store the information of a Student in a database. Create Another windows form to assign Elective Subjects to all the students.
9	Create a website for a book store, which sold and give books on rent to customers. Also Store the information of customers
10	Write a Program to demonstrate System.Array class members like Clone(), Copy(), Clear() ,Sort() and Reverse().

COURSE OUTCOME:

On successful completion of this course, student should be able to:

CO1. To have knowledge of the structure and model of the programming language C #.

CO2. To Use the programming language C # for various programming technologies.

CO3. To develop software in C #.

CO4. To design web applications using ASP.NET..

TEXT BOOKS

1. E. Balagurusamy, "Programming in C#", Tata McGraw-Hill, 2nd edition 2004.
2. J. Liberty, "Programming C#", O'Reilly,2nd edition 2002.

REFERENCES

1. Herbert Schildt, "The Complete Reference: C#", Tata McGraw-Hill,2nd edition 2004.
2. Robinson et al, "Professional C#", 2nd ed., Wrox Press, 2002.

Andrew Troelsen, "C# and the .NET Platform", A! Press, 1st edition 2003

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS301	Subject Title	ALGORITHMS: ANALYSIS & DESIGN						
LTP	3 0 2	Credit	4	Subject Category	DC	Year	3rd	Semester	V

OBJECTIVE:

This course aims to provide the knowledge and understanding the complexity issues of algorithms
1. To introduce algorithms analysis and design techniques
2. To understand and design of algorithms used for searching, sorting, indexing operation

Unit-I **(6 L)**

Introduction: Algorithms, Performance Analysis: Space and Time Complexity, Asymptotic Notations- Big Oh, Omega, theta notations, finding complexity of the algorithm, Linear Sorting: Insertion sort, Bubble sort, selection sort.

Unit –II **(8 L)**

Advanced Data structures: B-Tree, Binomial Heaps, Fibonacci Heaps, Red& Black Tree.
Divide and Conquer: General method, binary search, quick sort, merge sort, heap sort,

Unit –III **(8 L)**

Greedy Method: General method, Activity Selection, job scheduling with deadlines, fractional knapsack problem, Minimum cost spanning tree: Kruskal's and Prim's, single source shortest path, Huffman tree.
Amortized analysis

Unit – IV **(8 L)**

Dynamic Programming: General Method, 0-1 Knapsack, Matrix chain multiplication, longest subsequence, all pair shortest paths,
Backtracking- Travelling Salesman Problem, Graph Coloring, n-Queen Problem, Hamiltonian Cycles and Sum of subsets.

Unit –V **(6 L)**

Branch and Bound: Travelling Salesman Problem, Graph Coloring, n-Queen Problem, Hamiltonian Cycles and Sum of subsets.
NP-Hard and NP-Complete problems: Basic Concepts, non-deterministic algorithms, NP-Hard and NP-Complete classes, Cooks Theorem.

LEARNING OUTCOMES

CO1. Analyzing complexity issues of algorithms
CO2. Ability in using the appropriate algorithm for searching, sorting, indexing operations
CO3. Designing of new algorithms
CO4. Student will be able to learn NP Class problems.

Text Books:

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, "Introduction to Algorithms", PHI Pvt. Ltd., 2012.
2. Anany Levitin, "Introduction to the Design and Analysis of Algorithm", Pearson Education Asia, 2003.
3. M.T.Goodrich and R.Tomassia, Algorithm Design: Foundations, Analysis and Internet examples, Johnwiley and sons.

Reference Books:

1. R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai, Introduction to Design and Analysis of Algorithms A strategic approach, McGraw-Hill Education (Asia) ,2005
2. Aho, Ullman and Hopcroft ,Design and Analysis of algorithms,Pearson Education India; 1st edition 2002
3. Ellis Horowitz, SatrajSahniand Rajasekharam, Fundamentals of Computer Algorithms, Galgotia publications pvt. Ltd.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS303	Subject Title	COMPUTER GRAPHICS						
LTP	3 0 2	Credit	4	Subject Category	DC	Year	3rd	Semester	V

OBJECTIVES:

This course is designed to provide a comprehensive introduction to computer graphics leading to the ability to understand contemporary terminology, progress, issues, and trends.

1. A thorough introduction to computer graphics techniques, focusing on 3D modelling, image synthesis, and rendering. We will look at raster scan graphics including line and circle drawing, polygon filling, anti-aliasing algorithms, clipping, hidden-line and hidden surface.
2. The interdisciplinary nature of computer graphics is emphasized in the wide variety of examples and applications.

Unit I : (7 L)

Introduction to computer graphics and primitives algorithms: Points, planes, pixels and frames buffers, lines, circles and ellipse drawing algorithms, display devices, primitive devices, applications of computer graphics.

Unit II : (7 L)

Two-Dimensional Transformation: Introduction to transformation matrix, **Types of transformations in 2-D:** Identity Transformation, Scaling, Reflection, Shear Transformation, Rotation, Translation, Rotation about an arbitrary point, Combined Transformation, Homogeneous coordinates, 2-D transformation using homogeneous coordinates.

Unit III : (8 L)

Three-Dimensional Transformation: Objects in homogeneous coordinates, **3-D Transformation:** Scaling, Translation, Rotation, Shear Transformations, Reflection, world coordinates and viewing coordinates, Projection, parallel Projection, Perspective projection. **Hidden Lines and Surfaces:** Back face removal algorithms, Hidden lines methods.

Unit IV : (8 L)

Viewing and Solid Area Scan-Conversion: Introduction to viewing and clipping, viewing transformation in 2-D, Point Clipping, Line Clipping, Introduction to polygon Clipping, Viewing and clipping in 3-D, Three Dimensional Viewing Transformations, Text Clipping, generalize Clipping, Multiple windowing.

Introduction to Solid Area Scan: Conversion, Inside-Outside Test, Winding Number Method and Coherence Property, Polygon Filling, Seed Fill Algorithms, Scan Line Algorithm, priority Algorithm, Scan Conversion of Characters, Aliasing, Anti-aliasing, Halfoning, Threshold and Dithering

Unit V : (6 L)

Introduction to curves: Curves Continuity, Conic Curves, Piecewise Curve Design, Spline curve representation, Bezier Curves, Fractals and its Applications.

Object rendering: Introduction to Object Rendering, Shading, Ray Tracing, Illuminational model, Colour Models.

LEARNING OUTCOMES

After completion of the course the students will able to learn:

CO1. To understand a comprehensive introduction to computer graphics leading to the ability to understand contemporary terminology, progress, issues, and trends.

CO2. Explain the through introduction to computer graphics techniques, focusing on 2D and 3D modeling, image synthesis, and rendering.
CO3. Expose to the interdisciplinary nature of computer graphics is emphasized in the wide variety of examples and applications
CO4. Students will be able to develop the projects based on Computer Graphics.

Text Book:

1. R.K. Maurya, Computer Graphics, John Willey.2011
2. David F. Rogers, Procedural Elements of Computer Graphics, Tata McGraw Hill.1985

Reference Book:

1. Donald Hearn and M.Pauline Beaker, Computer Graphics, Prentice Hall of India, 2010.
2. Steven Harrington, Computer Graphics, McGraw Hill.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	IB304	Subject Title	Essentials of Software Engineering(OOAD & SW life cycle)						
LTP	2 0 2	Credit	3	Subject Category	DC	Year	3rd	Semester	VI

OBJECTIVES:

The objective of this Course is to provide the knowledge & necessary skills to develop a software and also aware agile methods and prototyping.

Unit I (7 L)

Introduction to Software Engineering, Software Characteristics, Software Crisis, Software Engineering Processes, Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models

Unit II (7 L)

Software Requirement Analysis and Specifications: Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Data Flow Diagrams, Data Dictionaries, Entity-Relationship diagrams, Software Requirement and Specifications, Functional and non-Functional requirements, Software Prototyping, Feasibility Study, Information Modeling, Decision Tables, SRS Document, IEEE Standards for SRS, Software Quality Assurance (SQA),SEI-CMM Model.

Unit III : (8 L)

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.

Unit IV : (8 L)

Software Reliability: Failure and Faults, Reliability Models: Basic Model, Logarithmic Poisson Model, Calender time Component, Reliability Allocation. **Coding:** Top-Down and Bottom –Up programming, structured programming, Compliance with Design and Coding Standards.

Unit V : (6 L)

Testing: Objectives, Testing Tools & Standards. Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Top-Down and Bottom-Up Testing Strategies: Test Drivers and Test Stubs, Path Testing, Structural Testing (White Box Testing), Functional Testing (Black Box Testing),

Maintenance: Corrective and Perfective Maintenance, Maintenance Process, Maintenance Models, Maintenance Cost, Software Re-Engineering, Reverse Engineering. Constructive Cost Models (COCOMO).

Software Quality Management: Software Quality Factors, Quality Assurance, Quality Standards, Software Maintenance.

LEARNING OUTCOMES

At the end of the course the students will able to learn

1. Ability to analyze and specify software requirements
2. Ability to apply software engineering principles and techniques to develop large-scale software systems.
3. Ability to plan and work effectively in a team.
4. Ability to design configuration of software

Text Book:

1.R. S. Pressman, "Software Engineering – A practitioner's approach", 3rd ed., McGraw Hill Int. Ed., 1992.

2. K.K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International, 2001

3. Pankaj Jalote, Software Engineering, Wiley India,2010

Reference Book:

1. Rajib Mall, Fundamentals of Software Engineering, PHI Publication, 3rd Edition, 2009.

2. Ian Sommerville, Software Engineering, Addison Wesley, 8th Edition,2011

3. James Peter, W Pedrycz, "Software Engineering", John Wiley & Sons,2000

Subject Code	IB341	Subject Title	Predictive Analyst Modeler

LTP	3 0 2	Credit	4	Subject Category	DC	Year	3rd	Semester	V

COURSE OUTLINE:

In this program students will learn data mining, data collection and integration, nodes, and statistical analysis.

Students will use tools for market research and data mining in order to predict problems and improve outcomes.

- To illustrate the interaction of multi-faceted fields like data mining, statistics and mathematics in the development of Predictive Analytics
- To acquaint the student with the concepts of Ordinary Least Squares & Generalized Least Squares
- To make the student familiar with various data clustering and dimension reduction techniques

COURSE OBJECTIVE

- to understand the importance of analytics and how its transforming the world today
- to Understand how analytics provided a solution to industries using real case studies
- to explains analytics, the various types of analytics, and how to apply it
  Improve efficiency, sample records, and work with sequence data
- to explain data transformations, and functions
- to do modelling, relationships, derive and reclassify fields
- to Integrate and collect data
- to understand the principal of data mining
- to Use the user interface of modeler to create basic program streams
- to read a statistics data file into modeler and define data characteristics
- to review and explore data to look at data distributions and to identify data problems, including missing values
- to use the automated data prep node to further prepare data for modelling
- to use a partition node to create training and testing data subsets
- topredictand analyse business growth, short come and essential measures through Realtime data and reports.

UNIT 1 8 L

Introduction to Data Mining:
Data-Mining Application, A strategy for Data Mining: CRISP-DM, Stages and Tasks in CRISP-DM, Life Cycle of a Data-Mining Project, Skills Needed for Data Mining.

Working with Modeler:
Introducing Nodes and Streams, Explore the user Interface, Creating Streams-General Rules, Placing Nodes, Managing Nodes, Managing Connections, Encapsulating Nodes in a super Node, Generating Nodes from Output, Running Streams.

A Data-Mining Tour:
The Basic framework of a Data-Mining Projects, Business Case, A Predictive Model, Deploying the Model, A Data-Mining project in Modeler, Building the Model-Setting roles in Type Node, Score Records, Filter and Sort.

Collecting Initial Data:
Rectangular Data Structure, The Unit Analysis, Field Storages, Field Measurement Levels, Storage and Measurement level, Fields Instantiation, Importing Data, The Sources Dialog Boxes- Data Tab, Importing Text Files, Exporting data.

Understanding Your Data:
Data Audit, Using Statistics Node and Graphs Nodes for Reporting, Describe Types of Invalid Values, Action for Invalid Values, Dealing with Missing Data, Reporting Blanks in a Data Audit.

Setting The Unit Of Analysis :
The Required Unit of Analysis, Methods to create datasets with the required unit of analysis, Distincting Records, Aggregating Records, Setting To Flag Fields.

UNIT II7 L
Integrating Data:
Methods to Integrate Data, Appending Records, Merging Fields, Sampling Records, Caching Data

Deriving and Reclassifying Fields :
Methods To Create Fields, Introducing The Control Language For Expression Manipulation (Clem), Deriving fields And Blanks, Reclassifying Fields, Checking Your Results.

Looking For Relationships:
Methods To Examine The Relationship Between Two Fields, Explore Matrix Output, Distribution Output, Means Output, Histogram Output, Statistics Output, Plot Output.

Introduction To Modeling:
Modeling Objectives, Objectives And Roles In The Type Node, Types Of Classification Models, Rule Induction Models, Traditional Statistical Models, Machine Learning Models, Running Classification

Models, Modeling Results: The Model Nugget, Evaluating Classification Models, Applying Classification Models, Segmentation Models, Running Segmentation Models, Examining The Results: Cluster Profiles.

LAB:
Working With Modeler, Data Mining Tour, Collecting Initial Data, Understanding Your Data, Integrating Data, Deriving And Reclassifying Fields, Looking For Relationships, Modeling

UNIT III8 L

Using Functions:
Using Date And Time Functions, Using Conversion Functions, Using String Functions, Using Statistical Functions, Using Missing Value Functions

DataTransformations:
Selecting A Method To Transform Data, Filling Fields, Binning Fields, Data Transformations.

Working WithSequenceData
Sequence Data, Using Cross-Record Functions, Deriving A Counter Field, Deriving A Counter Field, Restructuring Data, Using Geospatial And Time Data.

SamplingRecords:
Selecting A Sampling Method, Selecting A Simple Sampling Method, Selecting A Complex Sampling Method, Using Partitioning, Balancing Record.

ImprovingEfficiency:
Using Sql Pushback, Previewing Sql, Identifying A-Typical Values, Processing Missing Values, Imputing Missing Values, Using Globals, Using Parameters, Using Conditional Execution And Looping

LAB:
Using Functions, Data Transformation, Working With Sequence Data, Sampling Records, Improving Efficiency.

UNIT IV9 L

Automated Data Mining:
The basics of using a modeler, Adding nodes and creating streams in the modeler, Reading data files, Data exploration, Automated data preparation, Data partitioning, Predictor selection for modeling, Automated models for categorical targets, Model evaluation, Automated models for continuous targets, Deploying models.

LAB:
Develop a model to predict the total spending, Use a scoring stream to make predictions
Introduction to Statistical Analysis; Understanding Data Distribution Theory; Data Distribution for

Categorical Variables& Scale Variables; Making Inference about population from sample; Relationship between Categorical variables; The; Independent Sample T Test; The Paired Sample T Test; One Way ANOVA;

UNIT V7 L

Bivariate Plots and Correlation for Scale Variables
Regression Analysis
Concepts of Logistic Regression.
USER CASE STUDY and Working on data set
Predicting business growth using all the available information
Analyzing the customer choices and trends.
Suggesting measures
Best Practices

Course Outcome

- Be able to understand the importance of analytics and how its transforming the world today
- Be able to Understand how analytics provided a solution to industries using real case studies
- Be able to explains analytics, the various types of analytics, and how to apply it Improve efficiency, sample records, and work with sequence data
- Be able to explain data transformations, and functions
- Be able to do modeling, relationships, derive and reclassify fields
- Be able to Integrate and collect data
- Be able to understand the principal of data mining
- Be able to Use the user interface of modeler to create basic program streams
- Be able to read a statistics data file into modeler and define data characteristics
- Be able to review and explore data to look at data distributions and to identify data problems, including missing values
- Be able to use the automated data prep node to further prepare data for modelling
- Be able to use a partition node to create training and testing data subsets
- Be able to work on case studies
- Be able to predict business growth, short come and essential measures through realtime data and reports.

ReferenceBook:

1. IBM COURSEWARE.

Subject Code	CS341	Subject Title	COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES *(Department Elective)*

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

LTP	3 0 2	**Credit**	4	**Subject Category**	DE	**Year**	3rd	**Semester**	V

OBJECTIVES: This course is designed to provide solutions of nonlinear equations in one variable, interpolation and approximation, numerical differentiation and integration, direct methods for solving linear systems, numerical solution of ordinary differential equations.

Unit I : (8 L)

Introduction: Numbers and their accuracy, Computer Arithmetic, Errors and their Computation, General error formula, Error in a series approximation.

Solution of Algebraic and Transcendental Equation: Bisection Method, Iteration method, Method of false position, Secant method, Newton-Raphson method, Rate of convergence of Iterative, Newton Raphsion methods.

Unit II : (8 L)

Interpolation: Finite Differences, Difference tables Polynomial Interpolation**:** Newton's forward and backward formula Central Difference Formulae: Gauss forward and backward formula, Stirling's, Bessel's, Everett's formula. Interpolation with unequal intervals: Langrange's Interpolation, Newton Divided difference Formula.

Unit III : (6 L)

Statistical Computation: Frequency chart, Curve fitting by method of least squares, fitting of straight lines, polynomials, exponential curves, Regression Analysis, Linear and Non linear Regression, Multiple regression.

Unit IV : (8 L)

Numerical Integration and Differentiation: Introduction, Numerical differentiation Numerical Integration: Trapezoidal rule, Simpson's 1/3 and 3/8 rule, Boole's rule.

Unit V: **(6 L)**

Solution of differential Equations: Picards Method, Eulers Method, Taylors Method, Runge-Kutta Methods, Automatic Error Monitoring and Stability of solution.

LEARNING OUTCOMES

CO1.Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.

CO2. Apply numerical methods to obtain approximate solutions to mathematical problems.

CO3. Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration.

CO4. The student will learn the solution of linear and nonlinear equations, and the solution of differential equations.

Text Book:

1. PradipNiyogi, "Numerical Analysis and Algorithms", TMH, 1st Edition.
2. Gerald &Whealey, "Applied Numerical Analysis", AW

Reference Book:

1. Grewal B S, "Numerical methods in Engineering and Science", Khanna Publishers, Delhi.
2. Srimamta Pal Numerical Method Principles, analysis and algorithms, (Oxford Higher ed)
3. Rajaraman V, "Computer Oriented Numerical Methods", PHI, 3rd edition.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS342	Subject Title	LINUX ADMINISTRATION AND SHELL PROGRAMMING *(Department Elective)*						
LTP	3 0 2	**Credit**	4	**Subject**	DE	**Year**	3rd	**Semester**	V

Approved by the Academic Council at its 11th Meeting held on 29.04.2019

				Category					

OBJECTIVES: This course is designed to get the exposure to the students about the functioning and shell programming in Linux operating system.

UNIT I 8L

Introduction to Linux and UNIX, What is an operating system?, A brief history of UNIX, Architecture of the Linux operating system, Logging into (and out of) UNIX systems, Changing your password, General format of UNIX commands. The UNIX filesystem, Typical UNIX directory structure ,Directory and file handling commands,Making hard and soft (symbolic) links, Specifying multiple filenames, Quotes.

UNIT II 8L

File and directory permissions ,Inspecting file content ,Finding files, Finding text in files, Sortingfiles, File compression and backup, Handling removable media, Processes, Pipes, Redirecting input and output, Controlling processes associated with the current shell ,Controlling other processes

UNIT III 7L

Connecting to remote machines, Network routing utilities, Remote file transfer, Other Internet related utilities, User Information and Communication, Printer control, Email utilities. Server Configuration in Linux environment: Telnet, FTP.

UNIT IV 7L

Introduction to vi, Basic text input and navigation in vi ,Moving and copying text in vi,Searching for and replacing text in vi,Other useful vi commands, Quick reference for vi ,Introduction to emacs, Basic text input and navigation in emacs, Moving and copying text in emacs, Searching for and replacing text in emacs, Other useful emacs commands ,Other UNIX editors. The superuserroot, Shutdown and system startup, Adding users, Controlling user groups, Reconfiguring and recompiling the Linux kernel ,Cronjobs, Keeping essential system processes alive.

UNIT V 8L

Unix Shell programming: Types of Shells, Shell Metacharacters, Shell variables, Shell scripts, Shell commands, the environment, Integer arithmetic and string Manipulation, Special command line characters, Decision making and Loop control, controlling terminal input, trapping signals, arrays. C/C++ code execute in Linux platform.

LEARNING OUTCOMES

After the completion of the course the students will able to learn:

CO1**.** About the Linux installation & working of Linux commands.

CO2. Know the network related activities on the computer system.

CO3. Expertise in shell programming using Linux.

CO4. The student will learn about System Administration in Linux.

Text Book:

1. Sumitabh Das, “Unix Concepts and applications”, TMH, 2003

2. *Mike Joy, Stephen Jarvis, Michael Luck, “Introducing Unix and Linux”, Palgrave Macmillan.*

Reference Book:

1. O'Reilly Media “Linux System Administration”

Subject Code	CS343	**Subject Title**	**Advanced Concepts in OOPs** ***(Department Elective)***						
LTP	3 0 2	**Credit**	4	**Subject**	DE	**Year**	3rd	**Semester**	V

				Category					

OBJECTIVES:

1. To understand the Object-based view of Systems
2. To develop robust object-based models for Systems
3. To inculcate necessary skills to handle complexity in software design.

UNIT 1 **(6 L)**

J2SE: Concepts and Prerequisites: Data Types, Arrays, Dynamic Arrays, Type Casting, Classes and Objects, Inheritance, Interfaces, Exception Handling, Multi-Threading.

J2EE Architecture: J2EE as a framework, Client Server Traditional model, Comparison amongst 2-tier, 3-tier and N-tier architectures.

UNIT 2 **(8 L)**

JDBC: Introduction, JDBC Architecture, Types of JDBC Drivers, The Connectivity Model, The java.sql package, Navigating the Result Set object's contents, Manipulating records of a Result Set object through User Interface , The JDBC Exception classes, Database Connectivity, Data Manipulation (using Prepared Statements, Joins, Transactions, Stored Procedures).

UNIT 3 **(8 L)**

Java Beans: The software component assembly model- The java beans development kit- developing beans JAR files-Introspection-Bound Properties-Persistence-customizers - java beans API. EJB: EJB architecture- EJB requirements –EJB session beans- EJB entity beans-EJB Clients.

UNIT 4 **(6 L)**

Java Servlet: Servlet overview, Brief origin and advantages over CGI, Writing small Servlet Programs,Deployment Descriptor, Servlet Life Cycle, Sharing Information, Initializing a Servlet, Writing Service Methods, Filtering Requests and Responses, Invoking Other Web Resources, Accessing the Web Context, Maintaining Client State, Finalizing a Servlet, Session: Definition, Different ways to track sessions.

UNIT 5 **(8 L)**

JSP: Introduction to JSP, JSP processing, JSP Application Design, Tomcat Server, Implicit JSP objects, Conditional Processing, Declaring variables and methods, Error Handling and Debugging, Sharing data between JSP pages-Sharing Session and Application Data. Accessing a database from a JSP page, Application-specific Database Action, Developing Java Beans in a JSP page, introduction to Struts framework.

LEARNING OUTCOMES

After the completion of the course students will able to learn

CO1. Ability to analyze and model software specifications.
CO2. Ability to abstract object-based views for generic software systems.
CO3. Ability to deliver robust software components.
CO4. The student will be able to design projects using Advance concepts of OOPs.

Text Book:

1. J. McGovern, R. Adatia,Y. Fain, J2EE 1.4 Bible, Wiley-dream tech India Pvt. Ltd, New Delhi, 2003.
2. H. Schildt, 2002, Java 2 Complete Reference, 5th Edition, Tata McGraw-Hill, New Delhi.

Reference Book:

1. K. Moss, Java Servlets, Second edition, Tata McGraw Hill, New Delhi, 1999

2. D. R. Callaway, Inside Servlets, Addison Wesley, Boston,1999.
3. Joseph O'Neil, Java Beans from the Ground Up, Tata McGraw Hill, New Delhi, 1998.
4. Tom Valesky, Enterprise JavaBeans, Addison Wesley.
5. Cay S Horstmann& Gary Cornell, Core Java Vol II Advanced Features, Addison Wesley

Subject Code	CS344	**Subject Title**	**Introduction to Cloud Technologies** *(Departmental Elective 1/2)*						
LTP	3 0 2	**Credit**	4	**Subject Category**	DE	**Year**	3rd	**Semester**	V

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

OBJECTIVES:

The objective of this course is to study in-depth understanding of various aspects of cloud computing and be able to implement cloud services in an effective manner cloud Technologies.

Unit I (6 L)

Overview of cloud computing : What is a cloud, Definition of cloud , Definition of cloud ,characteristics of cloud ,Why use clouds, How clouds are changing , How clouds are changing , Driving factors towards cloud, Comparing grid with cloud and other computing systems, workload patterns for the cloud, "Big Data", IT as a service.

Unit II (8 L)

Cloud computing concepts: Concepts of cloud computing, Cloud computing leverages the Internet, Positioning cloud to a grid infrastructure, Elasticity and scalability, Virtualization, Characteristics of virtualization, Benefits of virtualization, Virtualization in cloud computing, Hypervisors, Multitenancy, Types of tenancy, Application programming interfaces (API), Billing and metering of services , Economies of scale, Management, tooling, and automation in cloud computing, Management: Desktops in the Cloud, Security.

Unit III (8 L)

Cloud service delivery: Cloud service , Cloud service model architectures, Infrastructure as a service (IaaS) architecture, Infrastructure as a service (IaaS) details, Platform as a service (PaaS) architecture, Platform as a service (PaaS) details, Platform as a service (PaaS) , Examples of PaaS software, Software as a service (SaaS) architecture, Software as a service (SaaS) details, Examples of SaaS applications, Trade-off in cost to install versus ,Common cloud management platform reference architecture: Architecture overview diagram, Common cloud management platform.

Unit IV (6 L)

Cloud deployment scenarios: Cloud deployment models, Public clouds, Hybrid clouds, Community, Virtual private clouds, Vertical and special purpose, Migration paths for cloud, Selection criteria for cloud deployment.

Unit V (8 L)

Cloud computing Security : Cloud security reference model, How security gets integrated , Cloud security , Understanding security risks, Principal security dangers to cloud computing, Virtualization and multitenancy, Internal security breaches, Data corruption or loss, User account and service hijacking, Steps to reduce cloud security breaches, Steps to reduce cloud security breaches, Reducing cloud security, Identity management: Detection and forensics, Identity management: Detection and Identity management, Benefits of identity, Encryption techniques, Encryption & Encrypting data , Symmetric key encryption, Asymmetric key encryption, Digital signature, What is SSL? IBM Smart Cloud, Amazon Web Services, Google Cloud platform, Windows Azure platform, A comparison of Cloud Computing Platforms, Common building Blocks.

LEARNING OUTCOMES

At the end of course the students will able to learn:

CO1. Analyze the Cloud computing setup with its vulnerabilities and applications using different architectures. Design different workflows according to requirements and apply map reduce programming model.

CO2. Apply and design suitable Virtualization concept, Cloud Resource Management and design scheduling algorithms.

CO3. Create combinatorial auctions for cloud resources and design scheduling algorithms for computing clouds

CO4:.Assess cloud Storage systems and Cloud security, the risks involved, its impact and develop cloud application .

Text Book:

1. R. Buyya, C. Vecchiola, S. T. Selvi, Matering Cloud Computing, Ed. Third reprint, 2013
2. B. Sosinsky, Cloud computing Bible, Ed. Reprint Willy India Pvt. Ltd, 2014,

Reference Book:

1. M. Miller, Cloud Computing, Pearson education in South Asia,Ed. 9th 2014.

Subject Code	CS304	Subject Title	COMPILER DESIGN					
LTP	3 0 2	Credit	4	Subject Category	DC	Year	3rd	Semester	VI

OBJECTIVES:

1. To learn about different types of grammars used in Compilers
2. To learn about different phases of a Compiler.

Unit I: **Introduction** **(7L)**

Review of Languages & Grammar, Compiler and Interpreter- Basic Concepts.Phases and Passes, Design Issues using Finite State Machines, Scanner Generator- LEX. Formal Grammar and their application to Syntax Analysis, Ambiguous Grammar, The Syntactic specification of Languages: CFG, Derivation and Parse Trees, Capabilities of CFG, BNF Notation.

Unit II:**Basic Parsing Techniques** **(8L)**Parsing-Top Down and Bottom-Up Strategies: General Consideration. Top Down Parsing: Brute-Force Method, Recursive Descent, & Predictive Paring. Bottom-Up Parsing: Shift Reduce Parsing, Operator Precedence Parsing. LR Grammars-LR(0), SLR(1), Canonical LR(1) & LALR(1) Parser, Comparison of parsing methods.

Unit III :**Semantic Analysis** **(8L)**

Basic Concepts, Syntax Directed Definitions-Inherited & Synthesized Attributes, Evaluation Orders of SDDs. Syntax directed Translation Schemes, Intermediate Codes, Postfix notation, Parse Trees and Syntax Trees, Directed Acyclic Graphs, Three address Codes: Quadruple & Triples, Translation of Assignment Statements, Boolean expressions, Control Statements, Postfix Translation, Translation with a Top Down Parser, Array References in Arithmetic expressions, Procedure Calls, Declarations and Case statements Translations.

Unit IV:**Symbol Tables** **(8L)**

Organization of Non-Block Structured Language (Unordered /Ordered/ Tree/ Hash) and Block Structured Language (Stack Tables & Stack Implementation), Runtime Storage Management: Static Allocation, Dynamic Allocation- Activation Records and their usage, Recursive Procedure. Heap Allocation-Storage Registers and Release Strategies.

Unit V:**Error detection and Recovery** **(8L)**

Code Optimization- Basic Blocks and Optimization, Loop Optimization, Flow Graph Analysis, Machine Dependent Optimization.

Error Handling: Detection, Reporting, Recovery and Maintenance, Compiler-Compiler—YACC, Code Generation, Concept of Compiler Design for Object-Oriented Language.

LEARNING OUTCOMES

At the end of course the students will able to learn

CO1. Ability to use Lex for designing lexical analyzers
CO2. Ability to use Yacc for designing syntax Analyzers
CO3. Ability to design parsing tables from grammars
CO4. The student will be able to know the basic knowledge about the construction of Compiler.

Text Books:

1. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, “Compilers-Principles, Techniques & Tools”,Pearson Education, 2nd Edition, 2008.

Reference Books:

1. Robin Hunter, "Essence of Compilers", Pearson Education, 2004

2. Steven S. Muchnick, Advanced Compiler Design & Implementation, Morgan Kaufmann Publishers, 1997

Subject Code	IB343	**Subject Title**	**Artificial Intelligence Analyst**						
LTP	3 0 2	**Credit**	4	**Subject Category**	DC	**Year**	3rd	**Semester**	VI

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Prerequisite

- Computer science fundamentals
- Basic knowledge of applied math, algorithms,, and data modelling
- Basic knowledge of probability and statistics
- Basic knowledge of Node.js and cloud computing
- Access to IBM Cloud

Course Outline: The course prepares students to apply AI concepts to build real life solutions. This career path introduces students to basic concepts of AI, machine learning algorithms, natural language processing, chatbots, and computer vision. Students apply the concepts they learn to practical examples by using IBMWatson services and tools on IBM Cloud

Course Objective

Describe the field of AI and its subfields machine learning, NLP and computer vision
- Describe the types of AI
- List the factors that influenced the advancements of AI in recent years
- List applications of AI
- Explain what Machine Learning is
- Describe the types of machine learning: Supervise learning, unsupervised learning, and deep learning
- Explain neural networks
- Explain what NLP is and list its applications
- Explain what computer vision is and list its applications
- Explain what cognitive computing is and list the key characteristics of cognitive system
- Explain what IBM Watson is and how it works
- Explain how Watson technology is made available to developers and organizations
- Describe how Watson technology is being applied to solve real world problems
- Describe the evolution of Watson services from the original DeepQA architecture to the present
- List the Watson services available on the IBM Cloud
- Explain the capabilities of each Watson service
- Describe the purpose of training the various Watson services to adapt them to a closed-domain
- Use Watson API Explorer to interact with the Watson services REST API, to rest your cals to the API and to view live responses from the server
- Define NLP, its history, applications and use cases
- Understand the relationship between AI and NLP
- Define NLP tools and services, the NLP pipeline
- Gain hands-on experience with NLP
- Define chatbots
- Explain the factors that lead to the growing popularity of chatbots
- Identify applications that are good candidates to integrate with chatbots
- Describe the main components that are involved when building a chatbot and explain their purpose
- Describe how to build a chatbot by using the IBM Watson Conversation service
- Define what Computer Vision is
- Know the history and advancement of Computer Vision
- Identify some of the tools and services of Computer Vision
- Understand Computer Vision components
- Define the Vision pipeline.
- Learn about the Vision services that are available from IBM Watson.
- Create a service and train it to identify images.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Unit I 8 L

- Describing the eras of computing
- Explaining the difference between deterministic and probabilistic systems
- Describing the types of AI
- Explaining what the main focus of AI is
- Listing of practical applications of AI
- Explaining what machine learning is
- Describing the types of machine learning
- Explaining what neural networks are and why they are important in today's AI's field
- Explaining what domain adaptation is and its applications
- Explaining what NLP is
- Describing different NLP processes
- Listing tools and services for NLP
- Identifying NLP use cases
- Defining CV
- Knowing the history of CV and its advancement with AI
- Listing tools and services for CV
- Identifying CV use cases
- Explaining what cognitive computing is
- Describing the characteristics of cognitive systems
- Explaining the landscape of cognitive computing in the industry

Unit II7 L

- Explaining what IBM Watson is and how it works
- Explaining how Watson technology is made available to developers and organizations
- Describing how Watson technology is being applied to solve real world problems
- Explaining what the DeepQA architecture was
- Explaining why IBM decided to commercialize Watson
- Describing the evolution of Watson services from the original DeepQA architecture to the present
- Recognizing the Watson services available today on the IBM Cloud
- Listing the Watson services
-

UNIT III8 L

- Explaining the capabilities of each Watson service
- Describing the purpose of training the various Watson services to adapt them to a closed-domain
- Listing the Watson services that can be trained
- Listing the Watson services that cannot be trained
- Describing what Watson Knowledge studio is

- Listing the Watson services that can be trained with Watson Knowledge Studio
- Using Watson API Explorer to interact with the Watson services REST API, to test your cal s to the API, and to view live responses from the server.
-

UNIT IV8 L

- Explaining what NLP is
- Describing different NLP processes
- Listing tools and services for NLP
- Identifying NLP use cases
- Defining different components of NLP
- Defining challenges within NLU
- Explaining the NLP pipeline
- Explaining the concepts of information extraction and sentiment analysis
- Defining the capabilities of IBM Watson Natural Language Classifier (NLC)
- Describing how to train Watson NLC
- Defining the capabilities of Watson Natural Language Understanding (NLU) service and its
  input and output, along with the discovery service
- Explaining the capabilities of the Watson Tone Analyzer service and its input and output
- Creating a Watson Discovery service instance
- Creating a collection
- Adding content to a collection
- Building queries
- Using the Discovery API

UNIT V9 L

Introduction to ChatBot

- Explaining what a chatbot is
- Describe common applications of chatbots
- Identifying factors that drive the growing popularity of chatbots
- Listing examples of tools and services that you can use to create chatbots
- What a workspace is
- What an intent is
- What an entity is
- What a dialog is
- What dialog nodes are
- How the nodes in a dialog are triggered
- How the dialog flow is processed
- The advanced features of a chatbot
- Creating a workspace
- Defining intents
- Defining entities
- Building a dialog
- Creating a Watson Conversation service instance
- Creating a Conversation workspace
- Adding intents
- Building a dialog
- Test in Slack

- Defining CV
- Know the history of CV and its advancement with AI
- Listing tools and services for CV
- Identifying CV use cases
- Defining the main pipeline within a CV application.
- Understanding how feature extraction works.
- Understanding how image classification and recognition works.
- Defining known techniques and classifiers that are used today for CV.
- Describing the IBM Watson Visual Recognition service
- Listing the features available with Watson Visual Recognition
- Describing the output provided by the Watson Visual Recognition service
- Explaining the capabilities of the default classifier
- Explaining the difference between a default and a custom classifier
- Describing how to train a custom classifier
- Creating a Watson Visual Recognition service and obtain the API key value
- Using Visual Recognition API methods to:
- Classifying images
- Detecting faces in an image
- Recognizing text in an image
- Creating and training a custom classifier

LEARNING OUTCOME

To be able to understand field of AI and its subfields machine learning, NLP and computer vision

- Should know the types of AI
- To be able to factors that influenced the advancements of AI in recent years
- To be able to List applications of AI
- To be able to explain what Machine Learning is
- To be able to apply the types of machine learning: Supervise learning, unsupervised learning, and deep learning
- To be able to understand neural networks, NLP is and list the applications
- To be able to use cognitive computing is and list the key characteristics of cognitive system
- To be able to describe how Watson technology is being applied to solve real world problems
- To be able to use Watson API Explorer to interact with the Watson services REST API, to rest your cal s to the API and to view live responses from the server
- To be able to Understand the relationship between AI and NLP
- To be able to use NLP tools and services, the NLP pipeline
- To be able to factors that lead to the growing popularity of chatbots
- To be able to build a chatbot by using the IBM Watson Conversation service
- To Understand Computer Vision components
- To be able to design the Vision pipeline.
- To be able to use Vision services that are available from IBM Watson.
- To be able to create a service and train it to identify images.

ReferenceBook:

1. IBM COURSEWARE.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	IB344	Subject Title	Accelerating Deep Learning(T3 Mode)						
LTP	3 0 2	Credit	4	Subject Category	DC	Year	3rd	Semester	VI

PreRequisite: Knowledge of Python

Approved by the Academic Council at its 11th Meeting held on 29.04.2019

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

About the course

Deep Learning presents a simplified explanation of some of the hottest topics in data science today, The course will help to attempt PowerAI to understand different deep learning libraries better. PowerAI speeds up deep learning and AI. Built on IBM's Power Systems, PowerAI is a scalable software platform that accelerates deep learning and AI with blazing performance for individual users or enterprises. The PowerAI platform supports popular machine learning libraries and dependencies including Tensorflow, Caffe, Torch, and Theano To understand the process of training a complex model with large dataset, and the concept to be explored in the Deep Learning world. Leaning to apply TensorFlow for backpropagation to tune the weights and biases while the Neural Networks are being trained, also understanding types of Deep Architectures, such as Convolutional Networks, Recurrent Networks and Autoencoders.

Course Objective

- To introduce with Deep learning
- To attempt Power Artificial Intelligence for understanding various deep learning libraries
- To use Power Artificial Intelligence for increasing deep learning and Artificial Intelligence.
- To understand the various platform supports offered under Power Artificial Intelligence
- To Understand traditional neural networks
- To enable discovering hidden structures within unlabeled and unstructured data
- To use TensorFlow libraries to implement deep learning
- To enable using TesorFlow to develop solutions with Deep Learning
- To enable using TesorFlow in curve fitting, regression, classification and minimization of error functions
- To enable applying TensorFlow for backpropagation to tune the weights and biases while the Neural Networks are being trained
- To understand the types of Deep Architecture
- To enable using the PowerAI platform for popular machine learning libraries and dependencies including Tensorflow, Caffe, Torch, and Theano.
- To enable using hardware, liek Google's Tensor Processing Unit (TPU) or Nvidia GPU to accelerate convolutional neural network computations time on the cloud.
- To use TPU or GPU chips are particularly to support the training of neural networks, as well as use of trained NW.

Unit 1 **8L**

- **Module 1 - Introduction to Deep Learning**
    1. Why Deep Learning?
    2. What is a neural network?
    3. Three reasons to go Deep
    4. Your choice of Deep Net
    5. An old problem: The Vanishing Gradient

- **Module 2 - Deep Learning Models**
    1. Restricted Boltzmann Machines

2. Deep Belief Nets
3. Convolutional Networks
4. Recurrent Nets

- **Module 3 - Additional Deep Learning Models**
    1. Autoencoders
    2. Recursive Neural Tensor Nets
    3. Deep Learning Use Cases

Unit 2: **8 L**

- **Module - Deep Learning Platforms and Software Libraries**
    1. What is a Deep Learning Platform?
    2. H2O.ai
    3. DatoGraphLab
    4. What is a Deep Learning Library?
    5. Theano
    6. Caffe
    7. TensorFlow

Module – Introduction to TensorFlow

- HelloWorld with TensorFlow
- Linear Regression
- Nonlinear Regression
- Logistic Regression
- Activation Functions

Module – Convolutional Neural Networks (CNN)

- CNN History
- Understanding CNNs
- CNN Application

Unit 3: **7L**

Module – Recurrent Neural Networks (RNN)

- Intro to RNN Model
- Long Short-Term memory (LSTM)
- Recursive Neural Tensor Network Theory
- Recurrent Neural Network Model

Module - Unsupervised Learning

- Applications of Unsupervised Learning
- Restricted Boltzmann Machine
- Collaborative Filtering with RBM

Module - Autoencoders

- Introduction to Autoencoders and Applications
- Autoencoders
- Deep Belief Network

UNIT 4 **8L**

Module Quick review on Deep Learning

- Intro to Deep Learning
- Deep Learning Pipeline

Module – Hardware Accelerated Deep Learning

- How to accelerate a deep learning model?
- Running TensorFlow operations on CPUs vs. GPUs
- Convolutional Neural Networks on GPUs
- Recurrent Neural Networks on GPUs

UNIT 5: **8L**

Module – Deep Learning in the Cloud

- Deep Learning in the Cloud
- How does one use a GPU
- Stock Price Prediction

Module – Distributed Deep Learning

- Distributed Deep Learning

Learning Outcome:

- Be able to understand Deep learning
- Be able to attempt Power Artificial Intelligence for understanding various deep learning libraries
- Be able to use Power Artificial Intelligence for increasing deep learning and Artificial

Intelligence.

- Be able to understand and work on the various platform supports offered under Power Artificial Intelligence
- Be able to Understand traditional neural networks
- Be able to discover hidden structures within unlabeled and unstructured data
- Be able to use TensorFlow libraries to implement deep learning
- Be able to use TesorFlow to develop solutions with Deep Learning
- Be able to use TesorFlow in curve fitting, regression, classification and minimization of error functions.
- Be able to apply TensorFlow for backpropagation to tune the weights and biases while the Neural Networks are being trained
- Be able to understand and work of various types of deep architectures
- Be able to use the PowerAI platform for popular machine learning libraries and dependencies including Tensorflow, Caffe, Torch, and Theano.
- Be able to use hardware, liek Google's Tensor Processing Unit (TPU) or Nvidia GPU to accelerate convolutional neural network computations time on the cloud.
- Be able to use TPU or GPU chips to support the training of neural networks, as well as use of trained NW.

ReferenceBook:

1. IBM COURSEWARE.

Subject Code	CS345	**Subject Title**	**WEB TECHNOLOGY** *(Department Elective)*						
LTP	3 0 2	**Credit**	4	**Subject Category**	DE	**Year**	3rd	**Semester**	VI

OBJECTIVES: Students undergoing this course are exposed to

- Get introduction about various Scripting Languages.
- Familiar with an up-to-date survey of developments in. Web Technologies.
- To know techniques involved to support real-time Software development.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

UNIT 1 **(6 L)**

Web Essentials: Clients, Servers, and Communication. The Internet - Basic Internet Protocols - The World Wide Web-HTTP request message - response message - Web Clients Web Servers.

Markup Languages: An Introduction to HTML History-Versions-Basic Syntax and Semantics-Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms, Pages style sheets-CSS- Core Syntax- Properties-Box Model Normal Flow Box Layout-Other Properties.

UNIT 2 **(8 L)**

Client- Side Programming: The JavaScript Language-History and Versions Introduction JavaScript in Perspective-Syntax - Variables and Data Types – Statements – Operators – Literals – Functions – Objects – Arrays - Built-in Objects - JavaScript Debuggers, Browsers and the DOM.

PHP: Starting to script on server side, Arrays, function and forms, Advance PHP.

UNIT 3 **(8 L)**

Representing Web Data: XML-Documents and Vocabularies-Versions and Declaration-Namespaces JavaScript and XML: Ajax-DOM based XML processing Event-oriented Parsing: SAX-Transforming XML Documents-Selecting XML Data: XPATH-Template based Transformations: XSLT-Displaying XML Documents in Browsers-Case Study-Related Technologies, Introduction to JQuery.

UNIT 4 **(8 L)**

Web Services: Introduction to Web Services, UDDI, SOAP, WSDL, Developing and deploying web services. Ajax – Improving web page performance using Ajax, Programming in Ajax.

UNIT 5 **(7 L)**

Web 2.0: Interactive and social web**:** Blogs, wikis, and social networking sites – The technology behind these applications - AJAX, Open APIs.

Web 3.0: Semantic Web, Mashups, RDF, Web based Information Systems, Search engines, Recommender Systems, Web Mining.

LEARNING OUTCOMES

Upon the successful completion of the course, students will be able to-

CO1.Design a basic web site using HTML, XML, XHTML.

CO2. Use client side technology to design web site.

CO3.Recognize and evaluate website organizational structure and design elements.

CO4. The students will be able to do programming in Ajax

Text Book:

1. Jeffrey C.Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007.

Reference Book:

1. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.
2. Marty Hall and Larry Brown,"Core Web Programming" Second Edition, Volume I and II, Pearson Education, 2001.
3. Bates, "Developing Web Applications", Wiley, 2006

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS368	Subject Title	Machine learning using R *(Department Elective)*						
LTP	3 0 2	**Credit**	4	**Subject Category**	DE	**Year**	3rd	**Semester**	VI

OBJECTIVES: The objective of this course is to develop a broad perspective about the applicability of ML algorithms in different fields and understand the major ML algorithms, the problem settings, and assumptions that underlies them.

Unit 1: Introduction to Data Science andMachineLearning (7 L)

Digital Data – Structured, Unstructured, Semi-structured data, What is Machine Learning? Why Machine

Learning? Concept of Learning, Types of Machine Learning: Supervised Machine Learning, Unsupervised Machine Learning, Semi-supervised Machine Learning, Reinforcement Machine Learning, Industrial applications of Machine Learning across domains such as Healthcare, Finance, Retailetc.

Unit II: R Objects:DataHandling (6L)

Introduction to R, why R? Object, Vector, List, Factor, Matrix, Array, Data Frame, Manipulating Objects, Input/Output, R constructs

UNIT III:DescriptiveStatistics (7 L)

Central tendency – , Dispersion – variance, standard deviation, shape – skewness, kurtosis, percentiles, five point summary, boxplots, histograms, barplot, pie chart, scatter plot, two way tables, covariance, correlation, Chi-Square test for two way tables

Unit IV: Unsupervised Learning-Clustering (9 L)

What is Clustering? Applications of Clustering, Similarity measures, – K means clustering.

Supervised Learning:Regression,Classification

What is Regression? Simple Linear Regression, Multiple Linear Regression, What is Classification? Logistic Regression, Decision Tree, k-Nearest Neighbors, Support Vector Machine

Unit V:Neural Networks (10 L)

Introduction to Neural Networks, Activation functions, Learning rate, Stochastic Gradient Descent, Feed forward, Back propagation, Basics of Deep Learning Networks

Hands-On ProjectsusingR

Data Description, Data Visualization, Correlation analysis, Clustering, Regression, Classification, Neural networks.

LEARNING OUTCOMES

The student will be able to:

CO1. Identify the machine learning algorithms which are more appropriate for various types of learning tasks in various domains.
CO2. Implement machine learning algorithms on real datasets.
CO3. The student will learn about the basic concepts of Deep Learning.
CO4. To develop the projects using language R

TextBooks:

1. Practical Data Science with R. Author(s): Nina Zumel, John Mount, Manning Shelter Island, 2014
2. DataMiningConceptsandTechniques,3rdEdition.Author(s):J.Han,MKamber,JPei, 2011.

Reference Books:

1. Introduction to Data Mining. Author(s): Pang-Ning Tan, Steinberg, VipinKumar, 2016
2. Introduction to Statistical Learning using R. Author(s): Trevor Hastie,Tibshirani, 2016
3. Applied Predictive Modeling. Author(s): by Max Kuhn, KjellJohnson, 1st Edition, 2013

Subject Code	CS346	**Subject Title**	**Introduction to Big Data Analytics** ***(Department Elective)***						
LTP	3 0 2	**Credit**	4	**Subject Category**	DE	**Year**	3rd	**Semester**	VI

OBJECTIVES: The main goal of this course is to help students learn, understand, and practice big data analytics and machine learning approaches, which include the study of modern computing big data technologies and scaling up machine learning techniques focusing on industry applications. Mainly the course objectives are: conceptualization and summarization of big data and machine learning, trivial data versus big data, big data computing technologies, machine learning techniques, and scaling up machine learning approaches.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Unit 1 Introduction **(6 L)**

Examples, data science articulated, history and context, technology landscape.

Unit 2 Data Manipulation at Scale **(8 L)**

Databases and the relational algebra ,Parallel databases, parallel query processing, in-database analytics ,MapReduce, Hadoop, relationship to databases, algorithms, extensions, languages ,Key-value stores and NoSQL; tradeoffs of SQL and NoSQL

Unit 3 Analytics **(7 L)**

Topics in statistical modeling: basic concepts, experiment design, pitfalls, Topics in machine learning: supervised learning (rules, trees, forests, nearest neighbor, regression), optimization (gradient descent and variants), unsupervised learning.

Unit 4 Communicating Results **(7 L)**

Visualization, data products, visual data analytics, Provenance, privacy, ethics, governance.

Unit 5 Special Topics **(9 L)**

Graph Analytics: structure, traversals, analytics, PageRank, community detection, recursive queries semantic web.

LEARNING OUTCOMES

The students learning outcomes are designed to specify what the students will be able to perform after completion of the course:

CO1. Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications.

CO2. Ability to select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.

CO3. Ability to solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.

CO4. The student will learn about the graph analytics and its application.

Text Book:

1- Mayer-Schönberger, V., &Cukier, K.*Big Data: A Revolution That Will Transform How We Live, Work, and Think*. Boston: Houghton Miffin Harcourt, 2013.

Reference Book:

1- Frank J. OlhorstBig Data Analytics: Turning Big Data into Big Money (Wiley and SAS Business Series),2015

Subject Code	CS361	**Subject Title**	**Pattern Recognition in AI** ***(Department Elective)***						
LTP	3 0 2	**Credit**	4	**Subject Category**	DE	**Year**	3rd	**Semester**	VI

Course Objective:

This course aims to provide the knowledge to undergraduate students about the pattern recognition & its application in various area using AI.

Unit 1 (6 L)

Introduction to Pattern Recognition, Decision Trees: CART, C4.5, ID3, CHAID, Bayesian Decision Theory, Linear Discriminants Classifiers, Decision Boundary, Separability, Single and Multilayer perceptron, training set and test sets, standardization and normalization

Unit 2 (8 L)

Feature selection, Problem statement and Uses, Probabilistic separability based criterion functions, interclass distance based criterion functions, Branch and bound algorithm, sequential forward/backward selection algorithms, MRMR, FCBF, ReliefF, SVM-RFE

Unit 3 (8 L)

Unsupervised Methods Exploring the Data for Latent Structure, Component Analysis and Dimension Reduction, The Curse of Dimensionality, Principal Component Analysis, Kernel PCA, Fisher Linear Discriminant, Locally Linear Embedding, Clustering, Expectation Maximization, Single linkage and complete linkage clustering, MST, Medoids, DBSCAN, Visualization of datasets, existence of unique clusters or no clusters.

Unit 4 (8 L)

Optimization Techniques, Genetic Algorithms, Ant Colony Optimization,Particle Swarm Optimization, Cuckoo Search, Bee colony optimization, Classifier Ensembles,Selection of Classifiers, Bagging, Boosting , AdaBoost, , Random Forests, Rotation Forest.

Unit 5 (8 L)

Performance evaluation of classifier, k- fold cross validation, Jacknife and Bootstrap Methods, No Free Lunch Theorem, Ugly Duckling Theorem, Bias-Variance Dilemma, Syntactic Methods, Neural Networks, Deep learning

Course Outcome:

At the end of this course the student will able to learn about:

CO1. Concepts about pattern recognition.

CO2. Various optimization techniques

CO3. Knowledge about Deep learning

CO4. Performance evaluation of classifiers.

Text Book

1. Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classification. Wiley-Interscience. 2nd Edition. 2001.
2. Bishop, C. M. Pattern Recognition and Machine Learning. Springer. 2007.

Reference Book

1. Marsland, S. Machine Learning: An Algorithmic Perspective. CRC Press. 2009. (Also uses Python.)
2. Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4. Academic Press, 2008.

3. Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning. Springer. 2001.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS347	Subject Title	Digital Image Processing *(Department Elective)*						
LTP	3 0 2	**Credit**	4	**Subject Category**	DE	**Year**	3rd	**Semester**	VI

OBJECTIVES: in this course students will get the exposure to the origin and formation of digital imaging and will able to develop the understanding of different types of imaging techniques for different applications.

Unit I **(6 L)**

Introduction and Fundamentals

Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, a Simple Image Model, Sampling and Quantization.

Image Enhancement in Spatial Domain

Introduction; Basic Gray Level Functions – Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter, Ordered Statistic Filter; Sharpening – The Laplacian.

Unit II **(7 L)**

Image Enhancement in Frequency Domain

Fourier Transform and the Frequency Domain, Basis of Filtering in Frequency Domain, Filters – Low-pass, High-pass; Correspondence Between Filtering in Spatial and Frequency Domain; Smoothing Frequency Domain Filters – Gaussian Lowpass Filters; Sharpening Frequency Domain Filters – Gaussian Highpass Filters; Homomorphic Filtering.

Image Restoration

A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering – Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters – Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering – Bandpass Filters; Minimum Mean-square Error Restoration.

Unit III **(7 L)**

Color Image Processing

Color Fundamentals, Color Models, Converting Colors to different models, Color Transformation, Smoothing and Sharpening, Color Segmentation.

Morphological Image Processing: Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening

Unit IV **(8 L)**

Registration:

Introduction, Geometric Transformation – Plane to Plane transformation, Mapping, Stereo Imaging – Algorithms to Establish Correspondence, Algorithms to Recover Depth

Segmentation: Introduction, Region Extraction, Pixel-Based Approach, Multi-level Thresholding, Local Thresholding, Region-based Approach, Edge and Line Detection: Edge Detection, Edge Operators, Pattern Fitting Approach, Edge Linking and Edge Following, Edge Elements Extraction by Thresholding, Edge Detector Performance, Line Detection, Corner Detection.

Unit V **(9 L)**

Feature Extraction: Representation, Topological Attributes, Geometric Attributes Description, Boundary-based Description, Region-based Description and Relationship.

Object Recognition: Deterministic Methods, Clustering, Statistical Classification, Syntactic Recognition, Tree Search, Graph Matching

LEARNING OUTCOMES

At the end of the course students will able to learn

CO1. Ability to enhance image in spatial and frequency domain.

CO2. Ability to implement various aspects of image segmentation and compression.

CO3. Feature extraction & object recognition in an image.

CO4. Students will be able to use the concept of Image Processing for designing real world projects.

Text Book:

1. Rafael C. Gonzalvez and Richard E.Woods, Digital Image Processing 3rd Edition , Pearson Education, 2008.

Reference Book:

1. R.J. Schalkoff.,Digital Image Processing and Computer Vision, John Wiley and Sons, NY, 1st Edition, 1989

2. A.K. Jain. , Fundamentals of Digital Image Processing,Prentice Hall, Upper Saddle River, NJ.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS348	Subject Title	Advanced Computer Network						
LTP	3 0 2	Credit	4	Subject Category	DE	Year	3rd	Semester	VI

OBJECTIVES:

This course aims to provide the understanding of the algorithms for Routing, Forwarding, Lookup, Resource management in packet switching networks and understand the Internet architecture and router internals.

Unit I **(7 L)**

Network Layer design Issues, IPv4, IPv6, Shortest Path Routing, Distance Vector Routing, Flooding, Hierarchical Routing, Broadcast Routing, Multicast Routing.

Unit II **(7 L)**

Wireless Networks, GSM Architecture, CDMA, Mobility in networks, Handoffs.Mobile IP- IP Packet Delivery, Agent Discovery, Registration, Tunneling and Encapsulation.

Unit III **(8 L)**

Mobile TCP- Traditional TCP (Congestion Control, Slow Start, Fast Retransmit/Fast Recovery), Indirect TCP, Snooping TCP, Mobile TCP, Selective Retransmission, Transaction Oriented TCP.

Unit IV **(7 L)**

Wireless LAN- Infrared Vs Radio Transmission, Infrastructure and Ad-hoc Network, IEEE 802.11-System Architecture, Protocol Architecture, Physical Layer, Bluetooth.

Unit V **(8 L)**

IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management, SSL.

LEARNING OUTCOMES

At the end of the course the students will able to learn:

CO1. Ability to identify the essential components of networking

CO2. Ability to analyze the algorithms for routing, forwarding, lookup with respect to stability, robustness, scalability, security

CO 3. Ability to analyze the performance of congestion control and resource management techniques

CO4. Ability to carry out further research in recent networking architectures

Text Book:

1. Jochen Schiller" Mobile, "Communications", 2nd Edition, 2008.

2. Andrew S. Tanenbaum ,"Computer Networks," Pearson Education, 5th Edition, 2013.

Reference Book:

1. Forouzan, B.A., Data communication and Networking, McGraw Hill, 4th edition, 2006.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS352	Subject Title	Data Mining & Data Warehousing						
LTP	3 0 0	Credit	3	Subject Category	DE	Year	3rd	Semester	VI

OBJECTIVES: Students undergoing this course are expected -

To introduce the concept of data mining with in detail coverage of basic tasks, metrics, issues, and implication. Core topics like classification, clustering and association rules are exhaustively dealt with. And introduce the concept of data warehousing with special emphasis on architecture and design.

Unit I (6 L)

Overview, Motivation (for Data Mining), Data Mining-Definition & Functionalities.

Data Warehousing: Overview, Definition, Delivery Process, Difference between Database System and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept hierarchy, Process Architecture, 3 Tier Architecture, Data Marting. ROLAP, MOLAP, HOLAP.

Unit II (7 L)

Data Pre-Processing: Data Cleaning: Missing Values, Noisy Data,(Binning, Clustering, Regression, Inconsistent Data, Data Integration and Transformation.

Data Reduction: Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Clustering, Discretization and Concept hierarchy generation.

Unit III (7 L)

Concept Description: Definition, Data Generalization, Analytical Characterization,

Analysis of attribute relevance, Mining Class comparisions, Statistical measures in large Databases. Measuring Central Tendency, Measuring Dispersion of Data, Apriori Algorithm, Mining Multilevel Association rules from Transaction Databases

Unit IV (8 L)

Classification: What is Classification, Issues regarding Classification, Decision tree, Bayesian Classification, Classification by Back propagation.

Unit V (8 L)

Cluster Analysis: Data types in cluster analysis, Partitioning methods. Hierarchical Clustering- CURE and Chameleon, Density Based Methods-DBSCAN, OPTICS, Grid Based Methods- STING, CLIQUE, Outlier Analysis

LEARNING OUTCOMES

At the end of the course the students will able to learn & having

CO1. Ability to explain the concepts of data warehouse.

CO2. Analyze OLAP tools and Apply Data mining techniques and methods on large data sets. Compare and contrast classification and prediction techniques.

CO3. Ability to explain data mining tools on various applications

CO4. Will able to learn density based methods.

Text Book:

1. Jiawei Han, Micheline Kamber, "Data Mining Concepts & Techniques" Elsevier, 2008

Reference Book:

1. M.H.Dunham,"DataMining:Introductory and Advanced Topics" Pearson Education,1st edition 2003

2. Mallach,"Data Warehousing System",McGraw –Hill, 2004

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS353	Subject Title	Grid Computing						
LTP	3 0 0	Credit	3	Subject Category	DE	Year	3rd	Semester	VI

OBJECTIVES:

The objective of the course is to explain the key concepts of Grid computing and the resource selection for Grid environment.

UNIT 1 ***(6 L)***

Definition of Grid; Basic Building Blocks; Issues in Management of Grid Models; Evolution of Grid Models, Anatomy and Physiology of Grid-Review of Web Services-OGSA-WSRF.

UNIT 2 ***(7 L)***

Fundamental system components of Grid Computing; Requirements concerning abstractions, behaviors, resources, connectivity, and protocols; Open grid service architectures.

UNIT 3 ***(11 L)***

Introduction to Grid computing environment: Overview of GCE; Programming models; Middleware for building grid computing environments; Language support (MPI-G, MPI-G2) for grid computing; Meta models for grid programming; Security.

UNIT 4 ***(6 L)***

Data Management in Grid Computing; Categories and Origins of Structured Data; Data Management Challenges; Architectural Approaches Collective Data Management Services Federation; Services-Grid Portals-First-Generation Grid Portals-Second-Generation Grid Portals.

UNIT 5 ***(6 L)***

Monitoring and evaluation: Monitoring; Scheduling; Performance tuning; Debugging and performance diagnostic issues.

LEARNING OUTCOMES

After this course students will understand the

CO1.key concepts of Grid computing and to identify the resource selection for Grid environment.

CO2. Ability to express and perform data management and transfer in Grid environments.

CO3. Data Management in Grid Computing.

Text Book:

1. Maozhen Li, Mark Baker, The Grid Core Technologies, John Wiley &Sons ,2005.
2. 2. Joshy Joseph & Craig Fellenstein, “Grid Computing”, Pearson Education 2004.

Reference Book:

1. Ian Foster & Carl Kesselman, The Grid 2 – Blueprint for a New Computing Infrastructure , Morgan Kaufman – 2004.
2. Fran Berman, Geoffrey Fox, Anthony J.G. Hey, “Grid Computing: Making the Global,Wiley ,1st edition 2003

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS355	Subject Title	Natural Language processing						
LTP	3 0 0	Credit	3	Subject Category	DE	Year	3rd	Semester	VI

OBJECTIVES:

To tag a given text with basic Language processing features, design an innovative application using NLP components, implement a rule based system to tackle morphology/syntax of a Language, design a tag set to be used for statistical processing keeping an application in mind, design a Statistical technique for a new application, Compare and contrast use of different statistical approaches for different types of applications.

UNIT 1 INTRODUCTION (9 L)

Natural Language Processing tasks in syntax, semantics, and pragmatics – Issues - Applications - The role of machine learning - Probability Basics –Information theory – Collocations -N-gram Language Models - Estimating parameters and smoothing - Evaluating language models.

UNIT 2 MORPHOLOGY AND PART OF SPEECH TAGGING (7L)

Linguistic essentials - Lexical syntax- Morphology and Finite State Transducers - Part of speech Tagging - Rule-Based Part of Speech Tagging - Markov Models - Hidden Markov Models – Transformation based Models - Maximum Entropy Models. Conditional Random Fields.

UNIT 3 SYNTAX PARSING (7L)

Syntax Parsing - Grammar formalisms and treebanks - Parsing with Context Free Grammars - Features and Unification -Statistical parsing and probabilistic CFGs (PCFGs)-Lexicalized PCFGs.

UNIT 4 SEMANTIC ANALYSIS (8L)

Representing Meaning – Semantic Analysis - Lexical semantics –Word-sense disambiguation - Supervised – Dictionary based and Unsupervised Approaches - Compositional semantics-Semantic Role Labeling and Semantic Parsing – Discourse Analysis.

UNIT 5 APPLICATIONS (7L)

Named entity recognition and relation extraction- IE using sequence labeling-Machine Translation (MT) - Basic issues in MT-Statistical translation-word alignment- phrase-based translation – Question Answering.

LEARNING OUTCOMES

After this course students will understand the

CO1. Key concepts in natural language processing.

CO2. Will learn about Morphology & Semantic Analysis.

CO3. Real world applications of NLP.

Text Book:

1. Daniel Jurafsky and James H. Martin Speech and Language processing (2nd Edition), Prentice Hall; 2 edition, 2008

2. Foundations of Statistical Natural Language Processing by Christopher D. Manning and HinrichSchuetze, MIT Press, 1999

3. Steven Bird, Ewan Klein and Edward Loper Natural Language Processing with Python, O'Reilly Media; 1st edition, 2009

4. Roland R. Hausser, Foundations of Computational Linguistics: Human- C o m p u t e r Communication in Natural Language, Paperback, MIT Press, 2011

Reference Book:

1. Pierre M. Nugues, An Introduction to Language Processing with Perl and Prolog: An Outline of Theories, Implementation, and Application with Special Consideration of English, French, and German (Cognitive Technologies) Softcover reprint, 2010
2. James Allen, Natural Language Understanding, Addison Wesley; 2 edition 1994

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	IB401	Subject Title	Advanced RDBMS						
LTP	3 0 2	Credit	4	Subject Category	DC	Year	4th	Semester	VII

OBJECTIVES: The objective of this course is give the understanding the advanced concepts of Retaional database management system and its applications, data modeling, database design, and query languages and query optimizations.

Unit I **(8 L)**

RDBMS: Entity –Relationship model – Relational Model – Relational constraints- Relational algebra ,Tuples and Domain Relational calculus, Database Administrator, Introduction to SQL, Data Definition Language, Data Manipulation Language, Data Control Language, Queries, Join, Functions, Operators, Invoking SQL *Plus, Commit, Rollback, Normal forms, ER Diagram, mapping.

Unit II **(8 L)**

Introduction to Pl/SQL, Control Statements, View, Indexes, Sequences, PL/SQL Cursor, Database Trigger, Function, Procedure, Exceptional Handling in Oracle 11i**.**

Unit III **(7 L)**

Query processing and optimization-Transactions-Properties of Transactions-Concurrency Control, Recovery, Security and Authorization, Storage-Indexing and Hashing, B+ Trees, Trees-X Trees, Dynamic Hashing .

Distributed Databases-Principles –Design-Queries Translation of queries optimization Access Strategies, Management of Distributed Transactions actions-concurrency Control-Reliability .

Unit IV **(7 L)**

Object Oriented Concepts-Data Object Models-Object Based Databases –Object Oriented Databases-Object Oriented Databases Relational Databases-Object Definition Languages-Object Query Languages-SQL3-Concurreency in OODBs-Storage and Access Data Access .

Unit V **(6 L)**

Other Database Models-Multimedia Databases-Parallel Databases Data Mining - Data Warehousing –Spatial Databases Concepts –Temporal Databases Concepts-Active Databases.

LEARNING OUTCOMES

At the end of the course students will learn

CO1. Ability to apply different data modeling methods in requirement analysis, design, and implementation of database system.

CO_2. Ability to apply the normal forms for efficient designing of relational database

CO3. Ability to use appropriate storage and access structures

CO4. Ability to use the concepts Object Oriented Data Base Modelling.

Text Book:

1. Fred R. McFadden, Jeffery A. Hoffer, Mary B. ,Modern Database Management, Prescott, Fifth Edition , Edition Wesley, 2000 .
2. Elmasri, Navathe, ,Fundamentals Of Database Systems, Third Edition,Addison Wesley, 2000 .
3. Abraham Silberchartz, Henry F. Korth, S. Sudarshan, Database System Concepts ,Third Edition, McGraw-Hill, 1996 .

Reference Book:

1. Jefry D. Ullman , Jenifer Widom ,A First Course in Database Systems, Pearson Education Asia, 2001 .
2. Stefano Ceri, Giuseppe Pelagatti, Distributed Databases Principles & Systems, McGraw-Hill International Editions, 1985
3. Rajesh Narang, Object Oriented Interfaces & Databases, Prentice Hall Of India, 2002.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	IB404	Subject Title	Block Chain						
LTP	3 0 2	Credit	4	Subject Category	DC	Year	4th	Semester	VII

CourseObjective:

The BlockChain career path prepares students to apply BlockChain in real-life. This will require skills in businesses exchange value with suppliers, partners, customers and others. Exchange of value is a transaction. Blockchain for business provides a way to execute many more of these transactions—a much better way.

Unit 1 **(7 L)**
Blockchain Introduction:

To introduce the content, learning objectives, and learning outcomes, To remind students of pre-requisite knowledge and/or pre-work, To provide an introduction to BlockChain with emphasis on key concepts, To introduce use cases from different industries, An overview of BlockChain key concepts and their domain of application in different industries,
Applying BlockChain concepts: To apply key BlockChain concepts on a particular given use case, An exercise on applying BlockChain concepts on a selected use case to identify assets, participants, and transactions. The use case is for the sample application that is used for the rest of the lab exercises.

Unit 2: **(7 L)**
Understanding Hyper ledger Composer &BlockChain solution architecture

To introduce Hyperledger Composer, To introduce the Hyperledger Composer Playground GUI, An exercise on using the Vehicle Manufacturing lifecylce project on Hyperledger Composer to implement the sample application and deploy it. Additionally, build a transaction and adding new participants.
Using Hyperledger Composer: To obtain hands-on knowledge of Hyperledger Composer including the Playground, An exercise on using Hyperledger Composer to implement the sample application and deploy it**., T**o understand the different components of Blockchain, To understand the architecture of a typical Blockchain solution, A closer look at Hyperledger Fabric and a typical Blockchain solution Architecture. Additionally, linkage to IoT and other technologies, **Exploring sample Blockchain application:** To deploy and explore a complete Blockchain sample and understand its different parts, To modify the artifacts of the sample (assets, participants, transactions), An exercise to explore the different parts of the sample application to highlight the different artifacts in design and runtime, Peer, certificate authority, ordering services, database, Docker image.

Unit 3: **(9 L)**
Blockchain deep dive

To understand network consensus, To understand Channels and Ordering Service, An explanation of how consensus works, how endorsements work, and ordering in the way Hyperledger Fabric operates, **Blockchain Composer Node.JS :** To modify and deploy the front-end application of the sample application, An exercise on developing and deploying a front end client application that consumes APIs exposed by Hyperledger Composer on the previous exercise, To understand business network setup, To understand Endorsement Policies, To

understand pluggable world-state, A description of the elements of a business network, role of channels, and how world state is maintained, **Building Hyperledger Fabric business network :** To apply Hyperledger Fabric network concepts, A exercise on building a Hyperledger Fabric business network to deploy the sample application.

Unit 4: **(7 L)**

Understanding Hyperledger Fabric application development and blockchain deployment:

To introduce Hyperledger Fabric chaincode development, A closer look at chaincode development for HyperledgerFabric,**Developingchaincode for Hyperledger Fabric :** To practice chaincode development for Hyperledger Fabric, An exercise on writing and deploying chaincode, To understand the different delivery options for Blockchain, A description of the different possible deployment options of Blockchain solutions including local, on IBM Container Service, and IBM Blockchain Platform, **Developing client app for Hyperledger Fabric:** To practice client app development for Hyperledger Fabric, An exercise on developing front end application for Hyperledger Fabric, and deploying the service, **Understanding Blockchain security:** To understand Hyperledger Fabric security including permissioned ledger access, To understand Hyperledger Composer security, A description of Hyperledger Composer and Hyperledger Fabric security.

Unit 5 : **(8 L)**

Securing a Blockchain application and integration options

To practice Hyperledger security concepts on the sample application, A description exercise on applying security concepts and access control to the sample application. The importance of GDPR, Learning Objectives:To understand the different integration options between Hyperledger and other systems, An exploration of the different integration options of Hyperledger Fabric, **Integrating Hyperledger with other systems:** To practice the integration topic with an example, An exercise on applying integration options to the sample application. Apply a node-red component on the front-end. Look at the REST APIs, triggering events, non-deterministic problems, etc…

LearningOutcomes:

Having successfully completed this course, the student can:

1. Blockchain Developer overview
2. What is Hyperledger Fabric
3. What is Hyperledger Composer
4. Simplifying BlockChain implementation
5. Applying BlockChain concepts
6. Hyperledger Composer capabilities

ReferenceBook:

1. IBM COURSEWARE.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	IB413	Subject Title	Data Science					
LTP	3 0 2	Credit	4	Subject Category	DC	Year	4th	Semester	VII

CourseObjective:

The Big Data Engineer career path prepares students to use the Big Data platform and methodologies in order to collect and analyze large amounts of data from different sources. This will require skills in Big Data architecture, such as Apache Hadoop, Ambari, Spark, Big SQL, HDFS, YARN, MapReduce, ZooKeeper, Knox, Sqoop, and HBase.

Unit 1 Introduction to the Big Data Ecosystem (8 L)

Understand what Big Data is, Develop an understanding of the complete open-source Hadoop ecosystem and its near term future directions, Understand the major challenges of data, Understand how the growth of interconnected devices helps big data, List some real life examples of Big Data, Learn the types of Big Data, Student some Big Data use cases, Develop an understanding of the complete open-source Hadoop, ecosystem and its near term future directions, Be able to compare and evaluate the major Hadoop distributions and their ecosystem components, both their strengths and their limitations, Gain hands-on experience with key components of various big data ecosystem components and their roles in building a complete big data, solution to common business problems, Learning the tools that will enable you to continue your big data education after the course, Describe the functions and features of HDP, List the IBM value-add components, Explain what IBM Watson Studio is, Give a brief description of the purpose of each of the value-add components, Explore the lab environment, Launch Apache Ambari, Start a variety of services using Apache GUI, Explore some of the directory structure on the Linux system, Understand the purpose of Apache Ambari in the HDP stack, Understand the overall architecture of Ambari, and Ambari's relation to other services and components of a Hadoop cluster, List the functions of the main components of Ambari, Explain how to start and stop services from Ambari Web Console, Managie Hadoop clusters with Apache Ambari, Start the Apache Ambari web console and perform basic start/stop services, Explore other aspects of the Ambari web server.

Unit 2: Hadoop and HDFS (8 L)

Understand the basic need for a big data strategy in terms of parallel reading of large data files and internode network speed in a cluster, Describe the nature of the Hadoop Distributed File System (HDFS), Explain the function of the NameNode and DataNodes in an Hadoop cluster, Explain how files are stored and blocks ("splits") are replicated, File access and basic commands with HDFS, Describe the MapReduce model v1, List the limitations of Hadoop 1 and MapReduce 1, Review the Java code required to handle the Mapper class, Reducer class, and the program driver needed to access MapReduce, Describe the YARN model, Compare Hadoop 2/YARN with Hadoop 1, Run MapResuce and YARN jobs, Create and code a simple MapReduce job, Understand the nature and purpose of Apache Spark in the Hadoop ecosystem, List and describe the architecture and components of the Spark unified stack, Describe the role of a Resilient Distributed Dataset (RDD), Understand the principles of Spark programming, List and describe the Spark libraries, Launch and use Spark's Scala and Python shells, Work with Spark RDD with Scala, List the characteristics of representative data file formats, including flat/text files, CSV, XML, JSON, and YAML, List the characteristics of the four types of NoSQL datastores, Describe

the storage used by HBase in some detail, Describe and compare the open source programming languages, Pig and Hive, List the characteristics of programming languages typically used by Data Scientists: R and Python, Use Hive to access Hadoop/HBase data, Understand the challenges posed by distributed applications and how ZooKeeper is designed to handle them, Explain the role of ZooKeeper within the Apache Hadoop infrastructure and the realm of Big Data management, Explore generic use cases and some real-world scenarios for ZooKeeper, Define the ZooKeeper services that are used to manage distributed systems, Explore and use the ZooKeeper CLI to interact with ZooKeeper services, Understand how Apache Slider works in conjunction with YARN to deploy distributed applications and to monitor them, Explain how Apache Knox provides peripheral security services to an Hadoop cluster, Connect to ZooKeeper and explore the ZooKeeper files, List some of the load scenarios that are applicable to Hadoop, Understand how to load data at rest, Understand how to load data in motion, Understand how to load data from common sources such as a data warehouse, relational database, web server, or database logs, Explain what Sqoop is and how it works, Describe how Sqoop can be used to import data from relational systems into Hadoop and export data from Hadoop into relational systems, Brief introduction to what Flume is and how it works, Move data into HDFS with Sqoop, Explain the need for data governance and the role of data security in this governance, List the Five Pillars of security and how they are implemented with HDP, Discuss the history of security with Hadoop, Identify the need for and the methods used to secure Personal & Sensitive Information, Describe the function of the Hortonworks DataPlane Service (DPS), Define streaming data, Describe IBM as a pioneer in streaming data - with System S èIBM Streams, Explain streaming data - concepts & terminology, Compare and contrast batch data vs streaming data, List and explain streaming components & Streaming Data Engines (SDEs).

Unit 3: Introduction to Data Science **(8 L)**

Have a better understanding of methodology “scientific approach” methods used & skills practiced by Data Scientists , Recognize the iterative nature of a data science project, Outline the benefits of using Data Science Notebooks, Describe the mechanisms and tools used with Data Science Notebooks, Compare and contrast the major Notebooks used by Data Scientists, Getting started with Jupyter Notebook, Data and notebooks in Jupyter, How notebooks help data scientists, Essential packages: NumPy, SciPy, Pandas, Scikit-learn, NLTK, Beautiful Soup, Data visualizations: matplotlib, …, PixieDust, Using Jupyter “Magic” commands, Start Jupyter - it will open in a web browser, Import the lab file (all Jupyter files have a.ipynb suffix) into your default workspace, This is now a copy of the provided lab file and you can do anything with it o If you mess it up, you can re-import again later, Explore the component panels - some are markdown, some are code, some are results of running the code (output data, visualizations, …), Learn how to run single panels - and then the whole script o You may need to adjust the provided script to locate the data files thataccompany the Jupyter.ipynb file o Add some additional panels, as described in the lab script

Unit 4: Big SQL **(7 L)**

Overview of Big SQL, Understand how Big SQL fits in the Hadoop architecture, Start and stop Big SQL using Ambari and command line, Connect to Big SQL using command line, Connect to Big SQL using IBM Data Server Manager, Configure images, Start Hadoop components, Start up the Big SQL and DSM services, Connect to Big SQL using JSqsh, Execute basic Big SQL statements, Explore Big SQL through Ambari using DSM, Describe and create Big SQL schemas and tables, Describe and list the Big SQL data types, Work with various Big SQL DDLs, Load data into Big SQL tables using best practices, Create and drop simple Big SQL table, Create sample tables, Move data into HDFS, Load data into Big SQL tables, Create and work with views, Create external tables, Describe Big SQL supported file formats, Query Big SQL tables using various DMLs, Connect to Big SQL, Query data with Big SQL, Work with the ARRAY type, Work with Big SQL functions, Store data in an alternate file format (Parquet), Configure the Big SQL Server, Configure the Big SQL Scheduler, List the registries for compiler and runtime performance improvement, Backup and restore Big SQL, Update the database resource percentage for the Big SQL database instance, Inspect the Big SQL scheduler configuration file, View the registries for the compiler and runtime performance improvement, Configure authentication for Big SQL, Manage security with Apache Ranger,

Enable SSL encryption, Configure authorization of Big SQL objects, Configure impersonation in Big SQL, Understand the concept of Big SQL federation, List the supported data sources, Set up and configure a federation server to use different data sources, Configure Fluid Query with Big SQL.

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Unit 5: IBM Watson Studio (8 L)

Define a package dependency, Create an Express server object, Handle inbound HTTP method calls for a server resource, and Create a callback function to intercept HTTP method calls. Parse JSON data from an HTTP message-, Create a Hello World Express application, Create Simple HTML view for your application, Understand Express routing, Use third-party modules in Node.js.

Understand the Watson Natural Language Understanding service Clone a cloud application, Use Bootstrap to create a responsive web page, Use AngularJS, Controllers to create interactive web pages, Use AngularJS Services to, interact with back-end web services Use AngularJS directives, such as ng- repeat, to enrich your user interface (UI).

LearningOutcomes:

Having successfully completed this course, the student can:

1. Big Data and Data Analytics
2. Hortonworks Data Platform (HDP)
3. Apache Ambari
4. Hadoop and the Hadoop Distributed File System
5. MapReduce and Yarn
6. Apache Spark
7. Storing and Querying data

ReferenceBook:

1. IBM COURSEWARE.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS451	Subject Title	ADVANCED COMPUTER ARCHETECTURE (Department Elective)						
LTP	3 0 0	Credit	3	Subject Category	DE	Year	4th	Semester	VII

OBJECTIVES:

The objective of this course is to give the knowledge & understanding about different architectures of computers & its evaluation of their performance.

UNIT 1 ***(6L)***

Introduction: Parallel Computing, Parallel Computer Model, Program and Network Properties, Parallel (Architectural Classification Schemes, Flynn's & Feng's Classification, Performance Metrics and Measures, Speedup Performance Laws: Multiprocessor System and Interconnection Networks; IEEE POSIX Threads: Creating and Exiting Threads, Simultaneous Execution of Threads, Thread Synchronization using Semaphore and Mutex, Canceling the Threads.

UNIT 2 ***(8L)***

Pipelining and Memory Hierarchy: Basic and Intermediate Concepts, Instruction Set Principle; ILP: Basics, Exploiting ILP, Limits on ILP; Linear and Nonlinear Pipeline Processors; Super Scalar and Super Pipeline Design; Memory Hierarchy Design: Advanced Optimization of Cache Performance, Memory Technology and Optimization, Cache Coherence and Synchronization Mechanisms.

UNIT 3 ***(8L)***

Thread and Process Level Parallel Architecture: Introduction to MIMD Architecture, Multithreaded Architectures, Distributed Memory MIMD Architectures, Shared Memory MIMD Architecture, Clustering, Instruction Level Data Parallel Architecture, SIMD Architecture, Fine Grained and Coarse Grained SIMD Architecture, Associative and Neural Architecture, Data Parallel Pipelined and Systolic Architectures, Vector Architectures.

UNIT 4 ***(8L)***

Parallel Computing model: Sequential model, need of alternative model, parallel computational models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW Models.

UNIT 5 ***(8L)***

Parallel Algorithms: PRAM Algorithms: Parallel Reduction, Prefix Sums, Preorder Tree Traversal, Merging two Sorted lists; Matrix Multiplication: Row Column Oriented Algorithms, Block Oriented Algorithms; Parallel Quicksort, Hyper Quicksort; Solving Linear Systems: Gaussian Elimination, Jacobi Algorithm; Parallel Algorithm Design Strategies.

LEARNING OUTCOMES

CO1. Ability to identify the basic components and design of a computer, including CPU, memories, and input/output units

CO2. Ability to identify the issues involved in the instruction execution and various stages of instruction life stage

CO3. Ability to identify the issues related to performance improvement

CO4. Ability to distinguish performance tradeoff between different memory units and instruction sets

Text Book:

1. Kai Hwang," Advance Computer Architecture", McGraw Hill Education; 2nd edition, 2010.

2. Quinn, "Parallel Computing: Theory & Practice", McGraw Hill Education,2nd edition ,1994

Reference Book:

1. Hennessy and Patterson," Computer Architecture: A Quantitative Approach", Elsevier,4th edition 2007
2. Dezso and Sima, "Advanced Computer Architecture", Pearson,1st edition 2002
3. Quinn, "Parallel Programming in C with MPI and Open MP",2nd edition , McGraw Hill ,2003

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS452	Subject Title	Information Storage and Management *(Department Elective)*						
LTP	3 0 0	**Credit**	3	**Subject Category**	DE	**Year**	4th	**Semester**	VII

OBJECTIVES:

The objective of the course to provide the knowledge to students about components of managing and monitoring the data center and define information security and identify different storage virtualization technologies.

UNIT-I **(7 L)**

Introduction to Storage Technology: Data creation and The value of data to a business, Information Lifecycle, Challenges in data storage and data management, Solutions available for data storage, Core elements of a Data Center infrastructure, role of each element in supporting business activities.

UNIT-II **(7 L)**

Storage Systems Architecture: Hardware and software components of the host environment, Key protocols and concepts used by each component ,Physical and logical components of a connectivity environment ,Major physical components of a disk drive and their function, logical constructs of a physical disk, access characteristics, and performance Implications, Concept of RAID and its components, Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Integrated and Modular storage systems ,high-level architecture and working of an intelligent storage system

UNIT-III **(7 L)**

Introduction to Networked Storage: Evolution of networked storage, Architecture, components, andtopologies of FC-SAN, NAS, and IP-SAN, Benefits of the different networked storage options, Understand the need for long-term archiving solutions and describe how CAS fulfil the need, Understand the appropriateness of the different networked storage options for different application environments.

UNIT-IV **(8 L)**

Information Availability, Monitoring & Managing Data Center: Reasons for planned/unplanned outagesand the impact of downtime, Impact of downtime. Differentiate between business continuity (BC) and disaster recovery (DR), RTO and RPO, Identification of single points of failure in a storage infrastructure and solutions to mitigate these failures, Architecture of backup/recovery and the different backup/ recovery topologies, replication technologies and their role in ensuring information availability and business continuity, Remote replication technologies and their role in providing disaster recovery and business continuity capabilities. Key areas to monitor in a data center, Industry standards for data center monitoring and management, Key metrics to monitor storage infrastructure.

UNIT-V **(8 L)**

Securing Storage and Storage Virtualization: Information Security, Critical security attributes forinformation systems, Storage security domains, Analyze the common threats in each domain. Storage Virtualization: Forms, Configurations and Challenges. Types of Storage Virtualization: Block-level and File-Level.

LEARNING OUTCOMES

CO1. Explain the data storage technologies and storage system environment

CO2. Discuss about different network storage and content addressed storage.

CO3. Apply the RAID concepts for data protection and explain the working of intelligent storage system.

CO4. Describe the storage virtualization techniques and Information Availability & Monitoring & Managing Datacenter

Text Books:

1. Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, New Delhi, 2006.
2. Somasundaram G, AlokShrivastava, "ISM – Storing, Managing and Protecting Digital Information", EMC Education Services, Wiley India, New Delhi, 2012.

Reference Books:

1. Gerald J Kowalski, Mark T Maybury, "Information Storage and Retrieval Systems: Theory and Implementation", BS Publications, New Delhi, 2009.
2. Marc Farley Osborne, "Building Storage Networks", Tata McGraw Hill, New Delhi, 2001.
3. Meeta Gupta, "Storage Area Network Fundamentals", Pearson Education, New Delhi, 2002

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS453	Subject Title	Parallel Computing *(Department Elective)*						
LTP	3 0 0	**Credit**	3	**Subject Category**	DE	**Year**	4th	**Semester**	VII

OBJECTIVES: Students undergoing this course are expected to learn different parallel programming models along with the technologies that enabling parallel computing

Unit-1 **(5 L)**

Introduction

Why parallel computing? Shared memory and distributed memory parallelism, Amdahl's law, speedup and efficiency, supercomputers.

Unit-2 **(8 L)**

Message passing

MPI basics, point-to-point communication, collective communication, synchronous/asynchronous send/receive, algorithms for gather, scatter, broadcast, reduce.

Unit -3 **(9 L)**

Parallel communication

Network topologies, network evaluation metrics, communication cost, routing in interconnection networks, static and adaptive routing, process-to-processor mapping.

Unit- 4 **(8 L)**

Performance, Designing Parallel codes

Scalability, benchmarking, performance modeling, impact of network topologies, parallel code analysis and profiling.

Domain decomposition, communication-to-computation ratio, load balancing, adaptivity.

Unit -5 **(8 L)**

Parallel I/O

MPI I/O algorithms, contemporary large-scale I/O architecture, I/O bottlenecks.

RDMA, extreme scale computing: issues and trends.

LEARNING OUTCOMES

CO1. Ability to explain the different types of interconnection networks.

CO2. Ability to demonstrate the concepts Parallel Algorithms

CO3. Ability to demonstrate the concepts of Shared memory Based parallel Computers

CO4. Ability to demonstrate different parallel programming models

Text Book:

1. Peter S Pacheco, An Introduction to Parallel Programming, Morgan Kaufmann, 2011.
2. DE Culler, A Gupta and JP Singh, Parallel Computer Architecture: A Hardware/Software Approach Morgan-Kaufmann, 1998.
3. Marc Snir, Steve W. Otto, Steven Huss-Lederman, David W. Walker and Jack Dongarra, MPI - The Complete Reference, Second Edition, Volume 1, The MPI Core.
4. William Gropp, Ewing Lusk, Anthony Skjellum, Using MPI : portable parallel programming with the message-passing interface, 3rd Ed., Cambridge MIT Press, 2014.
5. A Grama, A Gupta, G Karypis, and V Kumar, Introduction to Parallel Computing. 2nd Ed., Addison-Wesley, 2003.

Reference Book:

1. JL Hennessy and DA Patterson, Computer Architecture: A Quantitative Approach, 4th Ed., Morgan Kaufmann /Els India, 2006.
2. MJ Quinn, Parallel Computing: Theory and Practice, Tata McGraw Hill, 2002.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS454	Subject Title	Introduction to Genetic Algorithms & Fuzzy Logic *(Department Elective)*						
LTP	3 0 0	**Credit**	3	**Subject Category**	DE	**Year**	4th	**Semester**	VII

OBJECTIVES:

This course aims to give the students to the knowledge & applications in various areas of Fuzzy logic & Genetic algorithms.

UNIT 1 **(7L)**

Fuzzy Sets (Introduction)

Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory, Basic operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

UNIT2 **(7L)**

Fuzzy Logic (Fuzzy Membership, Rules)

Membership functions, Propositional logic and predicate logic, Inference in fuzzy logic, Fuzzy if-then rules, Fuzzy mapping rules, Fuzzy implications, Min-Max Theorem, Resolution Rule under Fuzzy environment, Refutation method for theorem proving, Defuzzifications,

UNIT3 **(8L)**

Reasoning with uncertain and incomplete information: The statistical approach to uncertainty, Introduction, Uncertain & incomplete knowledge. Review of Probability theory

UNIT4 **(8L)**

Bayes Theorem, Bayesian Networks, Bayesian reasoning. Decision Making, Joint Probabilities, Relationships, Polytrees.,Dempster-Shafer theory of evidence, Certainty Factor, Non-monotonic systems.

UNIT 5 **(8L)**

Theoretical Foundation of Genetic Algorithms

Introduction: Basic Operators: Reproduction, Crossover & Mutation. Fitness function. Search Space, Schemas & Two-Armed and k-armed problem, Exact mathematical models, Applications of Genetic Algorithms.

LEARNING OUTCOMES

At the end of the course students will get exposure about

CO1. Introduction of fuzzy logic.

CO2. Fuzzy membership and its rules.

CO3. Genetic algorithm with its applications

Text Book:

1. G.J.Klir ,Yuan,"Fuzzy Sets and fuzzy logic, Theory and applications", Prentice Hall India, 1995.
2. David E. Goldberg, "Genetic algorithms in search, optimization & Machine Learning" Pearson Education, 2006
3. Stuart Russel, Peter Norvig, "Artificial Intelligence A Modern Approach" Pearson 3rd Edition 2015.

Reference Book:

1. John Yen, Reza Langari, “Fuzzy Logic Intelligence, Control and Information”, Pearson Education, 2006.
2. Timothy J Ross, “Fuzzy Logic with Engineering Applications”, 2nd Edition, John Wiley, 2004.
3. H. Zimmermann, “Fuzzy Set Theory and its applications”, 2nd Edition, Allied Publishers, 1996.
4. Melanle Mitchell, “An introduction to genetic algorithms”, Prentice Hall India, 2002.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS477	Subject Title	Data Analysis & Modelling						
LTP	3 0 0	Credit	3	Subject Category	DE	Year	4th	Semester	VII

OBJECTIVES:

This course aims to acquaint students with major statistical and quantitative tools used in modeling and analysis of business decision involving alternative choices.

UNIT 1 **(7L)**

Simple Correlation and Regression Models:

Correlation: Meaning, Scatterplot, Karl Pearson correlation coefficient, Test of correlation coefficient.

Simple Linear Regression: Predicting of One Variable from Another

Statistical model, least square regression- assumptions, Standard error of estimate, Coefficient of determination, Residual Analysis, Testing of regression coefficient

UNIT2 **(7L)**

Multiple Regression Models:

Multiple regression model, Standard error of estimate, Coefficient of determination, Significance of regression model, Test of significance of regression coefficients (Which variables are significant and explaining the most?), Model building, Curvilinear models, Qualitative variables, Stepwise regression, Residual analysis, Multi-colinearity.,

UNIT3 **(7L)**

Index Number and its Construction Models

Introduction, Definition of index number, Uses of index number, Types of index number, Methods of constructing index number ,Base shifting, Deflation, Cost of living index.

UNIT4 **(7L)**

Introduction to Optimization Models

Review of Linear Programming Model: Problem formulation, Graphical solution, special cases, Duality in LP

Transportation Model: Vogel's Approximation Method only

Assignment Model: Hungarian Method only

UNIT 5 **(8L)**

Network Models

Introduction, Critical Path Method (CPM), Project Evaluation and Review Technique (PERT), Network diagram, Probability in PERT analysis.

LEARNING OUTCOMES

By the end of this course students would be able to

1. calculate and interpret the meaning of correlation coefficient to measure the strength of relationship between two numerical variables,
2. calculate and interpret the meaning coefficient of determination to measure the predictive power of the simple as well as multiple regression,
3. forecast the future values using various models, and
4. Optimize the resources in the business decision making process.

Text Book:

1 Berenson, M. L. & David M. L.*Basic Business Statistics: Concepts and Applications.* Upper Saddle River, New Jersey: Pearson Prentice Hall of USA.

2.

Eppen, G. D., Gould, F. J. & Schmidt, C.P. *Introductory Management Science*. New Delhi: Prentice Hall

Reference Book:

1. Levin, R. I., & David S. R. *Statistics for Management*. New Delhi: Prentice Hall of India.
2. Panneerselvam, R. *Research Methodology*. New Delhi: PHI Learning Private Limited.
3. Allbright, S. C., Winston, W., & Zappe, C. J. Data Analysis and Decision Making with Microsoft Excel. Pacific Grove: Duxubury Press.
4. Argyrous, G. *Statistics for Research with a Guide to SPSS* . New Delhi: Sage South India Edition

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	IT353	Subject Title	Basics of Data Science						
LTP	3 0 0	Credit	3	Subject Category	DE/OE	Year	4th	Semester	VII

Course Objective:

1. The objective of the course is to make the students understand the different techniques for efficient mining of the data.
2. To introduce students to the concepts, processes and practice of Inference Rules at different abstraction levels of Data.
3. To provide an understanding of the Data management perspective regarding the use of business intelligence (BI), Data Mining systems and Advanced Applications.

Detailed Syllabus

UNIT 1

Data Science :Introduction to Data Science, Overview, Motivation, Data Mining-Definition & Functionalities.

Data Warehousing: Overview, Definition, Delivery Process, Difference between Database System and Data Warehouse, Multi-Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept hierarchy, Process Architecture, 3 Tier Architecture, Data Marting.

(12L)

UNIT 2

Data Pre-Processing: Data Cleaning: Missing Values, Noisy Data,(Binning, Clustering, Regression, Inconsistent Data, Data Integration and Transformation.

Data Reduction: Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Clustering, Discretization and Concept hierarchy generation.

Data objects and attribute types, Measuring Data Similarity and Dissimilarity, Cosine Similarity.

(**7 L)**

UNIT 3

Concept Description: Definition, Data Generalization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases. Measuring Central Tendency, Box Plots, Measuring Dispersion of Data, Apriori Algorithm, Mining Multilevel Association rules from Transaction Databases , FP-growth algorithm.

(7 L)

UNIT 4

Classification: What is Classification, Issues regarding Classification, Attribute selection measures, Information Gain, Gain Ratio, Gini Index, Decision tree, Naïve Bayesian Classification, Metrics for evaluating classifier performance, Confusion matrix. **(6 L)**

UNIT 5

Cluster Analysis: Data types in cluster analysis, Overview of basic clustering methods, Partitioning methods: K-Means and K-medoids technique, Hierarchical Clustering: Agglomerative and Divisive, Density Based Methods :DBSCAN and OPTICS, Grid Based Methods: STING and CLIQUE, Outlier Analysis.

(8 L)

Learning Outcome

The course provides the students the ability to:

1 - Undertake systematic investigation/research related to the Data mining Concepts

2- Understand advanced Database systems and technologies for today's dynamic business environment.

Text book [TB]:

1. Jiawei Han, MichelineKamber, ”Data Mining Concepts & Techniques” Elsevier.

Reference books [RB]:

1. M.H.Dunham,”DataMining :Introductory and Advanced Topics” Pearson Education
2. Mallach,”Data Warehousing System” ,McGraw –Hill

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	IT356	Subject Title	Multimedia						
LTP	3 0 0	Credit	3	Subject Category	DE/OE	Year	4th	Semester	VII

Course Objective:

1. To make students learn about basic understanding of the multimedia objects and tools for object generation
2. To teach students audio and video file formats used now days as a part of IT generation.
3. To make students learn clear understanding of multimedia projects.
4. To make students learn different compression techniques.

Detailed Syllabus

UNIT 1

Introduction: Introduction to Multimedia, Multimedia Information, Multimedia Objects, Multimedia in business and work, Stages of Multimedia Projects, presentation tools, tools for object generations, video, sound, image capturing, authoring tools, card and page based authoring tools **(8 L)**

UNIT 2

Multimedia Building Blocks: Text, Sound MIDI, Digital Audio, audio file formats, MIDI under windows environment Audio & Video Capture.
(8 L)

UNIT 3

Data Compression: Introduction to data compression, Compression ratio, loss less & lossy compression, Huffman Coding, Shannon Fano Algorithm, Huffman Algorithms, Adaptive Coding, Arithmetic Coding ,Finite Context Modelling, Dictionary based Compression, Sliding Window Compression, LZ77,LZ78, LZW compression.
(8 L)

UNIT 4

Image, Audio and Video Compression: Digital Audio concepts, Sampling Variables, Loss less compression of sound, loss compression & silence compression, lossy graphic compression, image file format, animations Images standards, JPEG Compression, Zigzag Coding, Multimedia Database. Content based retrieval for text and images, Video Compression, MPEG standards, MHEG Standard Video Streaming on net.
(8 L)

UNIT 5

Advanced forms of interaction in Multimedia: Video Conferencing, Elements of (immersive/non-immersive) Virtual Reality, Augmented Reality, Tele presence, Mobile technologies.
Multimedia Security: Overview- Multimedia Systems, Secured Multimedia, Digital Rights Management Systems and Technical trends, Multimedia Encryption and Digital Watermarking, Security Attacks and Multimedia Authentication. **(8 L)**

Learning Outcome

At the end of the course, Learning Outcomes Having successfully completed this course, the student will demonstrate:

1. Students will understand various multimedia tools available.
2. Students will be able to learn with Multimedia projects
3. Students can differentiate between lossy and lossless compression.

Text Book [TB]:

1. Tay Vaughan "Multimedia, Making IT Work" Osborne McGraw Hill,7th edition
2. Khalid sayood "Introduction to data compression" Morgan Kaufmann Publishers,3rd edition

Reference Book [RB]:

1. Buford "Multimedia Systems" Addison Wesley.,4th edition
2. Mark Nelson "Data Compression Book" BPB.,3rd edition
3. Sleinreitz "Multimedia System" Addison Wesley,5th edition

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	EC383	Subject Title	Consumer Electronics						
LTP	3 0 0	Credit	3	Subject Category	DE/OE	Year	4th	Semester	VII

Objectives of the Course: The students will learn

- Consumer Electronics and its application
- Concept of audio and video related system.
- Concepts of recording and power supplies.

UNIT-I

Audio Systems: Microphones, Loudspeakers, Speaker baffle and enclosure, Acoustics, Mono, Stereo, Quad, Amplifying Systems, Equalisers and Mixers, Electronic Music Synthesisers, Commercial Sound, Theater Sound System

8LU

UNIT – II

Video Systems and Displays: Monochrome TV, Colour TV standards and systems, TFT, Plasma, HDTV, Digital TV, Video Telephone and Video Conferencing **8L**

UNIT III:

Domestic Appliances: Washing machines, Microwave ovens, Air- conditioners and Refrigerators, In car computers Office Systems: FAX, Xerox, Telephone Switching System, Mobile Radio System

8L

UNIT IV:

Recording and Reproduction Systems: Disc recording and reproduction, Magnetic recording and reproduction, Video tape recording and reproduction, Video disc recording and play back, Distortion and Noise reduction in Audio and Video System **8L**

UNIT-V

Power Supplies and other systems: SMPS, UPS and Preventive Maintenance, Set Top Boxes, Remote controls, Bar codes, ATM **8L**

Text Books:

1. Consumer Electronics S P Bali Pearson ed 2005

OUTCOMES OF THE COURSE:

The course provides an understanding of:

- Electronic systems related to consumer applications.
- Principle of working of various home appliances.
- Skills to use modern consumer electronics systems used in day to day life.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	EC385	Subject Title	Analog Electronics						
LTP	3 0 0	Credit	3	Subject Category	DE/OE	Year	4th	Semester	VII

Objectives of the Course: To teach the fundamental concepts of various electronic devices, circuits and their application. To develop ability among students for problem formulation, system design and solving skills.

UNIT-I

Semiconductor materials and properties Group-IV materials, Covalent bond, electron-hole concepts Basic concepts of energy bands in materials, concepts of forbidden gap Intrinsic and extrinsic semiconductors, donors and acceptors impurities **4L**

UNIT-II

Junction diode and diode applications p-n junction, depletion layer, v- i characteristics, diode resistance, capacitance diode ratings (average current, repetitive peak current, non-repetitive current, peak-inverse voltage). **4L**

Diode Applications Rectifiers (half wave and full wave), filter (C – filter), clipping circuits, clamping circuits, voltage multipliers **4L**

UNIT-III

Breakdown diodes Breakdown mechanisms (zener and avalanche), breakdown characteristics, zener diode application as shunt regulator **4L**

UNIT-IV

Bipolar Junction Transistor Basic construction, transistor action, CB, CE and CC configurations, input/output Characteristics, Transistor Amplifier Graphical analysis of CE amplifier, concept of voltage gain, current gain. **6L**

UNIT-V

Field Effect Transistor

JFET: Basic construction, transistor action, concept of pinch off, maximum drain saturation current, input and transfer characteristics, characteristics equation CG, CS and CD configurations,

MOSFFT: depletion and enhancement type MOSFET-construction, operation and characteristics.

6L

Reference Books:

1. Boylestad and Nashelsky, 'erlectronic Decvices and circuits' PHI, 6e, 2001.
2. A Mottershead, 'Electronic devices and circuits'. PHI, 2000.
3. Morris Mano, 'Digital Computer Design', PHI, 2003.
4. R.K. Singh & Ashish, Basic Electronics Engg. Laxmi Publication, 2007.

5. Milman & Halkias, Integrated electronics Electronics, PHI, 2005.

OUTCOME OF THE COURSE:

- Students will be able to build, develop, model, and analyze the electronic circuits along with learning the device ratings and characteristics
- Students will be able to design and analyse electronic circuits

List of Experiments:

1. To study V-I characteristics of p-n junction diode.
2. To study V-I characteristics of zener diode.
3. To study half-wave rectifier and calculate ripple factor and efficiency.
4. To study full-wave rectifier and calculate ripple factor and efficiency.
5. To study clipper circuits.
6. To study clamper circuits.
7. To study the input and output characteristics of CB and CE transistor.
8. To study drain and transfer characteristics of JFET.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	EE481	Subject Title	NEW AND RENEWABLE ENERGY SOURCES						
LTP	3 0 0	Credit		Subject Category	Open Elective	Year	4th	Semester	VII

Objectives of the Course

- To introduce fundamentals of various renewable energy source
- To introduce fundamentals of technologies used to harness usable energy from solar, wind,
- To introduce fundamentals of technologies used to harness usable energy from ocean and Biomass energy sources.

Unit 1	**Introduction :**Energy resources and their classification, oil crisis of late 20th century and its impacts on energy planning, consumption trend of primary energy sources, world energy future, energy audit and energy conservation, energy storage.	**8L**
Unit 2	**Solar Energy Conversion** :Solar resources, passage through atmosphere, solar thermal energy conversion: solar energy collectors, solar thermal power plant, solar PV conversion: solar PV cell, V-I characteristics, MPPT, Solar PV power plant and applications.	**8L**
Unit 3	**Biomass Energy Conversion :** Usable forms of Bio Mass, Biomass energy resources, biomass energy conversion technologies, ethanol blended petrol and diesel, biogas plants. Energy farming.	**8L**
Unit 4	**Wind Energy Conversion :** Wind Power: Energy estimation, Power extraction, lift and drag forces, horizontal axis wind turbine, vertical axis wind turbine, wind energy conversion and control schemes, environmental aspects.	**8L**
Unit 5	**Other Alternate Energy Sources/Technologies:** Geothermal Energy: geothermal fields, types, geothermal energy generation systems, ocean tidal energy systems, fuel cell: basic operation and classification, principle of MHD generation, output voltage and power, environmental aspects.	**8L**

Text Books:

1. B.H. Khan, Non conventional Energy Resources, 2nd edition, 2009.

Reference Books

1. G.D. Rai, Non Conventional Sources of Energy, (Khanna Publishers).
2. J.W. Twidell& A.D. Weir, Renewable Energy Resources, (ELBS / E. & F.N. Spon., London).
3. Godfrey Boyle, Renewable Energy, Oxford, 2nd edition 2010.

Outcome of the Course:

- **Identify renewable energy sources.**
- **Understand the mechanism of solar, wind and ocean energy sources.**
- **Demonstrate the understanding of various technologies involved in power generation from renewable energy sources.**

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	ME342	Subject Title	Composite Materials						
LTP	30 0	Credit	3	Subject Category	DE/OE	Year	4th	Semester	VII

Course Objective: To enable the students, know and understand the mechanical behavior of composite materials
Course Pre/Co- requisite (if any): Strength of Materials, Materials Engineering

Detailed Syllabus

UNIT 1:
Definition and applications of composite materials, classifications, Fibers- glass, carbon, ceramic and aramid fibers. Matrices- polymer, graphite, ceramic and metal matrices; characteristics of fibers and matrices. Fillers and whiskers. Advantages and limitations of composites

UNIT 2:
Mechanical behaviour of composite materials, surface treatment of fibers, thermosets matrix materials, Thermoplastics and other matrix materials, Manufacturing of thermoset composites, bag moulding, compression moulding, pultrusion, filament welding, other manufacturing processes

UNIT 3:
Composite mechanics Terminology, Behaviour of unidirectional composites, Behaviour of short fiber composites Analysis of orthotropic ply. Hook's Law for orthotropic lamina, Relation between Engg. constants and Elements of matrices for orthotropic ply, Transformation of Engg. constants, Failure in isotropic materials

UNIT 4:
Analysis of laminated composites, symmetric laminates, angle ply laminates, cross ply laminates, laminate, evaluation of lamina properties, determination of stress and strain in laminate, maximum stress and strain criteria, von Mises Yield criterion for isotropic materials, .

UNIT 5:
Residual stresses during curing, prediction of laminate failure, thermal analysis of composite laminates. Analysis of laminated plates - equilibrium equations of motion, static bending analysis, buckling analysis, free vibrations, natural frequencies.

Learning Outcome

At the end of the course the student can:
CO1:Have an overview of the mechanical behaviour and application of composite materials.
CO2:Get an overview of the methods of manufacturing composite materials
CO3: students will understand various mechanics of composite materials.

Text book [TB]:

1. Gibson R.F. Principles of Composite Material Mechanics, second edition, McGraw Hill, 1994.
2. Hyer M.W., Stress Analysis of Fiber- Reinforced Composite Materials, McGraw Hill, 1998.

Reference books [RB]:

1. F. L. Matthews, Rees D. Rawlings , Composite Materials: Engineering and Science Woodhead Publishing, 1999 - Composite materials.
2. Autar K. Kaw**,** Mechanics of Composite Materials,CRC Press, 30-May-1997

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	ME445	Subject Title	Total Quality Management						
LTP	3 0 0	Credit	3	Subject Category	DE/OE	Year	4th	Semester	VII

Course Objective: To facilitate the understanding of total quality management principles and processes.

Course Pre/Co- requisite (if any): Manufacturing Process, Industrial Engineering and Management

Detailed Syllabus

UNIT 1:

Introduction, need for quality, evolution of quality; Definitions of quality, product quality and service quality; Basic concepts of TQM, TQM framework, contributions of Deming, Juran and Crosby. Barriers to TQM; Quality statements, customer focus, customer orientation & satisfaction, customer complaints, customer retention; costs to quality.

UNIT 2:

TQM principles; leadership, strategic quality planning; Quality councils- employee involvement, motivation; Empowerment; Team and Teamwork; Quality circles, recognition and reward, performance appraisal; Continuous process improvement; PDCE cycle, 5S, Kaizen; Supplier partnership, Partnering, Supplier rating & selection.

UNIT 3:

The seven traditional tools of quality; New management tools; Six sigma- concepts, methodology, applications to manufacturing, service sector including IT, Bench marking process; FMEA- stages, types.

UNIT 4:

TQM tools and techniques, control charts, process capability, concepts of six sigma, Quality Function Development (QFD), Taguchi quality loss function; TPM- concepts, improvement needs, performance measures.

UNIT 5:

Quality systems, need for ISO 9000, ISO 9001-9008; Quality system- elements, documentation, Quality auditing, QS 9000, ISO 14000- concepts, requirements and benefits; TQM implementation in manufacturing and service sectors.

Learning Outcome

At the end of the course the student can:
CO1: To facilitate the understanding of total quality management principles and processes.
CO2: Student will learn about ISO systems
CO3: Student will learn about various quality tools to improve products quality.

Text book [TB]:

1. Besterfield D.H. et al., Total quality Management, 3rd ed., Pearson Education Asia, 2006.
1. Evans J.R. and Lindsay W.M., The management and Control of Quality, 8th ed., first Indian edition, Cengage Learning, 2012.
2. SubburajRamasamy, McGraw-Hill Education, 2012 - Total quality management.

REFERENCES [RB]:

1. Janakiraman B. and Gopal R.K., Total Quality Management, Prentice Hall India, 2006.
2. Suganthi L. and Samuel A., Total Quality Management, Prentice Hall India, 2006.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	PE481	Subject Title	Fuel Technology						
LTP	3 0 0	Credit	3	Subject Category	DE/OE	Year	4th	Semester	VII

1. **Course Summary**

This course will introduce students to classification of fuel and their properties. In this course, students unable to understand coal preparation, coal storage process, coal gasification process. This course also covers various topics which includes Fischer Tropsch Synthesis, Gaseous and liquid fuels i.e. natural gas, producer gas, water gas, coal gas, biogas, LPG, kerosene, diesel. Students will also learn combustion mechanism for solid, liquid and gaseous fuel.

2. **Course Objectives**

The students should be able to:

1. Understand different types of fuel, basic terms in fuels and combustion
2. Understand the coal preparation and conversion of coal into suitable products using gasification and Fishers Tropsch Synthesis process.
3. Understand physical and chemicals properties of different types of fuel and their storage techniques, combustion mechanism
4.

3. **Course Outcomes**

A good knowledge of this course will enable students to:

1. Understand origin of different of types of fuel and their properties and classification
2. Understand the Coal preparation and storage techniques, Physical and chemical properties of coal, Briquetting and liquefaction of solid fuels
3. Understand the conversion of coal into useful products using gasification techniques and Fischer Tropsch Synthesis
4. Understand about gaseous and liquid fuels, their physical and chemical properties and Testing methods for these fuels
5. Understand about combustion mechanism for different types of fuels and Furnace elements.

4. **Curriculum Content**

UNIT 1

Classification of Fuel- Solid Fuels, Liquid Fuels, Gaseous Fuels, Various Terms Related to the Study ofFuels and Combustion. Coal-Origin, Composition, Petrography,Analysis and Properties of Coal,Classification of coal

UNIT 2

Coal Preparation, Coal Storage, Coal Carbonization and by-product Recovery. Physical and Chemical, Properties of Coke.Briquetting of Solid Fuels. Liquefaction of Solid Fuels

UNIT 3

Coal: A Source of Energy- Gasification of Coal. Fixed Bed Gasification, Fluidized Bed Gasification,Entrained Bed Gasification. Integrated Gasification Combined Cycle (IGCC).Underground Gasificationof Coal. Indian Scenario related to Coal Gasification. Coal to Liquid (CTL) via Fischer – Tropsch (F-T)Synthesis.

UNIT 4

Gaseous and Liquid Fuels- Natural gas, Producer gas, Water gas, Carbureted Water gas, Coal gas, Gasesfrom biomass, LPG. Gasoline, Kerosene, Diesel.Physico Chemical Properties and Testing of LiquidFuels. Coal Tar Fuels (CTF).

UNIT 5

Combustion: General Principle of Combustion, Combustion of Solid Fuels – Grate Firing and Pulverized Fuel Firing System. Combustion of Liquid Fuels, Burners for Liquid and Gaseous Fuels Combustion

Text book [TB]:

1. **Kuo, K.K., Principles of Combustion, John Wiley and Sons, Inc. (2005).**
2. **Sarkar, S., Fuels and Combustion, Orient Longman, (1990).**

Reference books [RB]:

1. **Sharma, S.P., and Chander, M., Fuels and Combustion, Tata Mcgraw Hill (1984)**

5. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	PE482	Subject Title	Health Safety and Environment in Industry						
LTP	3 0 0	Credit	3	Subject Category	DE/OE	Year	4th	Semester	VII

1. Course Summary

The course will introduce students to the need and scope of health, safety and environment in industry. The students will learn about the sources and causes of pollution, effects of the pollutants on livings and environment, and the safety and remedial measures that should be adopted to reduce the pollution.

2. Course Objectives

The students should be able to:

1. Understand the sources of pollutions.
2. Understand the effects of pollutions on health and environment.
3. Understand the remedial measures and safety precautions associated with each source of pollution.

3. Course Outcomes

On successful completion of the course, students have the understanding of the following:

1. Understand the scope of HSE in industry.
2. Understand the sources, effects and remedies of air pollution.
3. Understand the sources, effects and remedies of water pollution.
4. Understand the sources, effects and remedies of liquid and solid wastes.
5. Understand the sources, effects and remedies of noise pollution.

4. Curriculum Content

UNIT 1

Introduction: Man And Environment: Overview (Socio-Economic Structure & Occupational Exposures); Scope Of Environmental Engineering; Pollution Problems Due To Urbanization & Industrialization.

UNIT 2

Air Pollution : Causes Of Air Pollution; Types & Sources Of Air Pollutants; Climatic & Meteorological Effect On Air Pollution Concentration; Formation Of Smog And Fumigation; Analysis Of Air Pollutants Collection Of Gaseous Air Pollutants; Collection Of Particulate Pollutants; Analysis Of Air Pollutants Like : Sulphur Dioxide, Nitrogen Oxide, Carbon Monoxide, Oxidants &Ozone; Hydrocarbons; Particulate Matter; Control Of Particulate Emission- Control Of Gaseous Emission; Flue Gas Treatment Methods : Stacks Gravitational And Inertial Separation; Settling Chambers; Dynamic Separators; Cyclone; Filtration; Liquid Scrubbing; Spray Chambers; Packed Towers; Orifice And Venturi Scrubbers; Electrostatic Precipitators.

UNIT 3

Water Pollution & Its Control - Origin Of Waste Water – Types Of Water Pollutants And Their Effects ; Adverse Effects On: Human Health & Environment; Aquatic Life; Animal Life; Plant Life; Water Pollution Measurement Techniques; Water Pollution Control Equipments& Instruments; Indian Standards For Water Pollution Control.

UNIT 4

Liquid & Solid Wastes – Domestic & Industrial Wastes; Pesticides; Toxic: Inorganic & Organic Pollutants; Soil Deterioration; Ground Water Pollution; Concentration Of Infecting Agents In Soil; Solid Waste Disposal; Dumping Domestic & Industrial Solid Wastes; Advantages & Disadvantages; Incineration- Advantages & Disadvantages – Sanitary Land Field: Advantages & Disadvantages; Management Of Careful & Sanitary Disposal Of Solid Wastes.

UNIT 5

Noise Pollution & Control: Intensity; Duration; Types Of Industrial Noise; Ill Effects Of Noise; Noise Measuring & Control; Permissible Noise Limits.

Text book [TB]:

1. J. Turk & A. Turk, "Environmental Science Environmental Pollution".

Reference books [RB]:

1. Odum, "Fundamental of Ecology.

5. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	MA541	Subject Title	STATISTICAL TECHNIQUE AND APPLICATIONS						
LTP	3 0 0	Credit	3	Subject Category	Open Elective	Year	4th	Semester	VII

OBJECTIVE: The objective of this subject is to give the basic knowledge of descriptive and mathematical part of statistics. Applications of various probability distribution in the field of insurance and finance. The course will focus on the different situations in the field of actuarial science which can be dealt with transformation of variables. The course will make able the students to understand the association between two random quantities and to find their mathematical measure.

Unit I

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, absolute moments, factorial moments, skewness and kurtosis, Sheppard's corrections.

Unit II

Bivariate data: Definition, scatter diagram, simple, partial and multiple correlation, rank correlation. Simple linear regression.

Unit III

Principle of least squares and fitting of polynomials and exponential curves. Theory of attributes Independence and association of attributes, consistency of data, measures of association and contingency, Yule's coefficient of colligation.

Unit IV

Testing of hypothesis: Z-test, t-test, F-test, Chi-square test for goodness of fit, Introduction to analysis of variance.

LEARNING OUTCOME: Students will able to:

- Analyze given statistical data.
- Have confidence to deal with real life situation, especially, in insurance and finance.
- Understand applications of standard probability distributions in every span of life.
- Find the association between two random quantities using mathematical theory.

Text Books:

1. Gupta, S.C. and Kapoor, V.K. (2007): Fundamental of Mathematical Statistics, 11thEdition. (Reprint), Sultan Chand & Sons.
2. Y.P. Agarwal (2012) Statistical Methods: Concepts, Application and Computation, 3rd edition; Sterling Publishers.

Reference Books:

1. Freund E F John, Mathematical statistics, 6th edition, Prentice Hall International, 1999.
2. Hogg, R. V. and Craig, T. T. (1978) Introduction to Mathematical Statistics (Fourth Edition) (Collier-McMillan).
3. Rohatgi, V. K. (1988) Introduction to Probability Theory and Mathematical Statistics (Wiley Eastern).

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Code	AR-481	Subject Title	GRAPHICS & PRODUCT DESIGN						
LTP	3 0 0	Credit	3	Subject Category	OE	Year	4th	Semester	VII

Course Objective:

To introduce the various aspects og graphics design and important stages of product design and development.

Unit 1: Introduction

Introduction and importance of graphics and product design.Principles and elements of design. History of Design.Colour Theory. Techniques and processes to communicate graphically.

Unit 2: Product Design Cycle

Stages of product development. Introduction to ergonomics

Unit 3: Design Process

Introduction to concept. Concept development. Role of sketching in concept development. Implementation stages of concept for product development

Unit 4: Technology & Market Assessment

Customer needs identification, Market research essentials. Advertising and marketing tools.

Unit 5: Design Tools

Introduction to various design tools.

LEARNING OUTCOME:

1. The student will be able to understand the importance of Graphics.
2. The students will be able to understand and demonstrate their ideas visually.
3. The students will be able to understand the various stages of product development.

Text Books:

1. The Elements of Graphic Design, Alex W. White
2. The Design of Everyday Things, Don Norman

Reference Books:

1. Product Design & Development, Karl T. Ulrich & Steven D. Eppinger

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS442	Subject Title	CRYPTOGRAPHY AND NETWORK SECURITY *(Department Elective)*						
LTP	3 0 2	**Credit**	4	**Subject Category**	DE	**Year**	4th	**Semester**	VIII

OBJECTIVES:

Students undergoing this course are expected to learn fundamentals and advanced concepts of cryptography and its application to network security, security services, and firewalls & threats.

Unit I : (6 L)

Introduction to security attacks, services and mechanism, introduction to cryptography.

Conventional Encryption: Conventional encryption model, classical encryption techniques-substitution ciphers and transposition ciphers, cryptanalysis, steganography,stream and block ciphers.

Modern Block Ciphers: Block ciphers principals, Shannon's theory of confusion and diffusion, fiestal structure, data encryption standard(DES), strength of DES, differential and linear crypt analysis of DES, block cipher modes of operations, triple DES, confidentiality using conventional encryption, traffic confidentiality, key distribution

Unit II : (8 L)

Introduction to prime and relative prime numbers, finite field of the form GF(p), modular arithmetic, Fermat's and Euler's theorem, primarily testing, Euclid's Algorithm, Chinese Remainder theorem, Principals of public key crypto systems, RSA algorithm, security of RSA, key management, Diffie-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elgamel encryption.

Unit III : (8 L)

Message Authentication and Hash Function: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions and MACS, MD5 message digest algorithm, Secure hash algorithm(SHA).Digital Signatures: Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm.

Unit IV : (7 L)

Authentication Applications: Kerberos and X.509, directory authentication service, electronic mail security-pretty good privacy (PGP), S/MIME.

Unit V : (8 L)

IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management.

Web Security: Secure socket layer and transport layer security, secure electronic transaction (SET).

System Security: Intruders, Viruses and related threads, firewall design principals, trusted systems.

LEARNING OUTCOMES

After completing the course the students have knowledge

Co1. To compare various Cryptographic Techniques

CO2. Demonstrate various data encryption techniques

CO3. Explain the various Security Application

CO4 Students will learn about use and application of cryptography on networks.

Text Book:

1. William Stallings, "Cryptography and Network Security: Principals and Practice", Pearson Education; Seventh edition,2017

Reference Book:

1. Johannes A. Buchmann, "Introduction to Cryptography", Springer-Verlag., 2nd edition 2004
2. Bruce Schiener, "Applied Cryptography",Wiley; 2nd edition 2007

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS461	Subject Title	Fundamentals of Machine Learning *(Department Elective)*					
LTP	3 0 2	**Credit**	4	**Subject Category**	DE	**Year**	4th	**Semester**	VIII

OBJECTIVES: The objective of this course is to introduce the students about fundamental concepts in machine learning and different models associated with them.

Unit I Introduction: Probability Theory, Overview of supervised learning, Curse of dimensionality, Decision theory, Information theory, Minimax theory, Parametric versus non-Parametric methods, Bayesian versus non-Bayesian approaches, Classification, Regression, Density estimation, Bias-variance, Lasso, MLE.

Unit II Parametric and Nonparametric Methods: Linear regression, Model selection, Generalized linear models, Classification, Structured prediction, Hidden Markov models; Regression: Linear smoothers, Variance estimations, Confidence bands, Average coverage, Space-scale smoothing, Multiple regression; Density estimation: Cross-validation, Histograms, Kernel density estimation, Local polynomials, Classification, Bootstrap and sub-sampling, Nonparametric Bayes.

Unit III Kernel Methods and Machines: Dual representations, Kernel construction, Selecting the width of the kernel, Kernel density estimation and classification, Radial basis functions and kernel, Gaussian processes, Maximum margin classifiers, Relevance vector machines.

Unit IV Graphical and Mixture Models: Bayesian networks: Generative models, Linear-Gaussian models; Conditional independence: D-separation; Markov random fields: Factorization properties, Relation to directed graphs; Inference in graphical models: Inference on a chain, Trees, Factor graphs, Sum-product & max-sum properties, Loopy belief propagation; K-means clustering, Mixtures of Gaussians, EM, An alternative view of EM.

Unit V Other Learning Methods: Unsupervised learning, Semi-supervised learning, Reinforcement learning, Ensemble learning, Online learning, Active learning.

LEARNING OUTCOMES

At the end of the course students will able to learn about
CO1. Fundamental concepts used in machine learning.
CO2. Parametric & non- parametric methods used in learning
CO3. Graphical & hybrid models in machine learning
CO4. Exposure to different kinds of machine learning

Text Book

1. Bishop C. M., Pattern Recognition and Machine Learning, Springer,1st edition, 2006.
2. Hastie T., Tibshirani R., Friedman J., The Elements of Statistical Learning, Springer 2nd edition, 2008.

Reference Book

1. Wasserman L., All of Statistics: A Concise Course in Statistical Inference, Springer 1st edition 2010.
2. Devroye L., Gyorfi L., Lugosi G., A Probabilistic Theory of Pattern Recognition, Springer,1st edition, 1996.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS478	Subject Title	Advanced Concepts in AI & its Applications					
LTP	3 0 2	Credit	4	Subject Category	DE	Year	4th	Semester	VIII

OBJECTIVES: This course provides a technical introduction to fundamental concepts of artificial intelligence (AI). Topics include: history of AI, agents, search (search spaces, uninformed/informed search, game playing, constraint satisfaction), planning, and knowledge representation (ontologies). The course is suitable to gain a solid technical background and as a preparation for more advanced work in AI.

Unit 1 **(8 L)**

Introduction and Problem Solving: Various definitions of AI, Introduction to AI applications and AI techniques, Production systems, control strategies, reasoning - forward & backward chaining

Unit 2 **(9 L)**

Intelligent Agents: Definitions of a rational agent, reflex, model-based, goal-based, and utility-based agents, the environment in which a particular agent operates Search and Game Playing: Breadth first search, depth first search, iterative deepening, uniform cost search, hill climbing, simulated annealing, genetic algorithm search, heuristic search, Best first search, A* algorithm, AO* algorithm, Minmax& game trees, refining minmax, Alpha – Beta pruning, constraint satisfaction

Unit 3 **(7 L)**

Knowledge Representation: First order predicate calculus, resolution, unification, natural deduction system, refutation, logic programming, PROLOG, semantic networks, frame system, value inheritance, conceptual dependency, Ontologies.

Unit 4 **(8 L)**

Planning: basic representation for planning, symbolic-centralized vs. reactive-distributed, partial order planning algorithm Uncertainty: different types of uncertainty - degree of belief and degree of truth, various probability constructs - prior probability, conditional probability, probability axioms, probability distributions, and joint probability distributions, Bayes' rule, other approaches to modeling uncertainty such as Dempster-Shafer theory and fuzzy sets/logic.

Unit 5 **(7 L)**

Applications: Expert systems, vision, Philosophical issues, Natural language processing: component steps of communication, contrast between formal and natural languages in the context of grammar, parsing, and semantics Readings.

LEARNING OUTCOMES

At the end of the course students will able to learn about

CO1. AI and its applications.

CO2. Knowledge Processing.

CO3. Expert System.

Text Book

1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach (2nd ed.), Pearson Education, 2005.

2. Elaine Rich and Kelvin Knight, Artificial Intelligence, Tata McGraw Hill, 2002.

3. Nils J Nilson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publishers, Inc., San Francisco, California, 2000.

Reference Book

1. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, Prentice Hall of India, 2006.

2. Nils J. Nilson, Principles of Artificial Intelligence, Narosa Publishing House, 2001

3. Clocksin and C.S. Mellish, Programming in PROLOG, Narosa Publishing House, 2002.

4. Saroj Kaushik, Logic and Prolog Programming, New Age International Publisher, 2006

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS457	Subject Title	SOFT COMPUTING *(Department Elective)*						
LTP	2 0 2	**Credit**	3	**Subject Category**	DE	**Year**	4th	**Semester**	VIII

OBJECTIVES:

Students undergoing this course are exposed to learn an overall knowledge of soft computing theories and fundamentals & understanding on the fundamentals of non-traditional technologies and approaches to solving hard real-world problems

Unit I : (8 L)

Introduction of Soft Computing: Introduction to soft computing techniques, Basic concepts of fuzzy logic, artificial neural networks, Genetic algorithm and probabilistic reasoning, application areas of soft computing techniques. **Artificial Neural Networks:** Basic concepts - Single layer perception - Multilayer Perception - Supervised and Unsupervised learning – Backpropagation networks - Kohnen's self-organizing networks - Hopfield network.

Unit II : (9 L)

Fuzzy Systems: Fuzzy sets, Fuzzy Relations and Fuzzy reasoning, Fuzzy functions.
Decomposition – Fuzzy automata and languages - Fuzzy control methods - Fuzzy decision making.
Neuro - Fuzzy Modeling: Adaptive networks based Fuzzy interface systems - Classification and Regression Trees – Data clustering algorithms - Rule based structure identification - Neuro- Fuzzy controls – Simulated annealing – Evolutionary computation.

UNIT III : (9 L)

Application of Soft Computing: Optimization of traveling salesman problem using Genetic Algorithm, Genetic algorithm based Internet Search Techniques, Soft computing based hybrid fuzzy controller, Introduction to MATLAB Environment for Soft computing Techniques.

LEARNING OUTCOMES

Upon the successful completion of the course, Students will be able to

CO1.Discuss about the use of neural network and its architecture.

CO2. Understanding the application of Soft Computing

CO3. Will understand the MATLAB setup for soft computing.

Text Book:

1. Sivanandam, Deepa, " Principles of Soft Computing", Wiley,2nd edition 2011
2. Jang J.S.R, Sun C.T. and Mizutani E, "Neuro-Fuzzy and Soft computing", Prentice Hall,1997
3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill,3rd edition 2010
4. LaureneFausett, "Fundamentals of Neural Networks", Prentice Hall,1st edition 1993.
5. D.E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley,1989.

Reference Book:

1. Hongxing Li, C.L. Philip Chen and Han Pang Huang, Fuzzy Neural Intelligent Systems, Prentice-Hall (1997).
2. Haykin Simon, Neural Networks and Learning Machines, Imperial College Press (2007).

3. Goldberg, David E. Genetic Algorithms in Search, Optimization, and Machine Learning, Pearson Education(2007).
4. Rosen, Kenneth H. Discrete Mathematics and its Applications, Tata Mcgraw-Hill (2003)

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS443	Subject Title	LAMP Technologies *(Department Elective)*					
LTP	2 0 2	**Credit**	3	**Subject Category**	DE	**Year**	4th	**Semester**	VIII

OBJECTIVES:

The objective of this course is to provide the necessary knowledge to design and develop dynamic, database-driven web applications using PHP version 5. Students will learn how to connect to any ODBC-compliant database, and perform hands on practice with a MySQL database to create database-driven HTML forms and reports etc. Students also learn how to configure PHP and Apache Web Server. Comprehensive lab exercises provide facilitated hands on practice crucial to develop competence web sites.

Unit I: (9 L)

Introduction to Lamp, Linux operating system, Apache web server, Mysql database server, PHP scripting, purpose of using Lamp, Lamp versus other solutions; installing linux, choosing the correct linux, hardware requirements, installing fedora, pre-installation, type of installation, hard disk partitioning, boot loader selection, network configuration, firewall configuration, package selection, package installation, bootable disk creation, post installation setup.

Unit II (8 L)

Booting linux, initialization scripts, rc scripts, run level scripts, login process, exploring linux shell, understanding bash, understanding linux filesystem: /bin, /boot, /dev, /etc, /home, /lib, /lost+found, /mnt, /opt, /proc, /root, /sbin, /tmp, /usr, /var; managing users and groups, /etc/passwd, /etc/group, linux passwords, user administration, group administration, modifying users or groups, managing services, creating disk quotas, starting and stopping system services, controlling access to services, managing software, source tarballs, source code vs binary packages, RPM and RPM source packages, performing system backup and recovery, critical data, backup media, backing up your system, system restoration.

Unit III (9 L)

Apache web server, apache 1.3 vs apache 2.0, new features of apache 2.0, module enhancements, apache 1.3 features, apache 1.3 modules, installing apache web server, removing apache web server RPMs, apache installation methods, apache directories, apache programs, understanding *httpd.conf* file, apache virtual host, enabling directory listings, password protecting web directories, configuring *cgi-bin* directories, using *.htaccess* file for configuration; understanding mysql, flat file vs relational databases, advantages and limitations of mysql, mysql versions, installing mysql, common configuration directives, mysql server and client, editing configuration files, enhancing security, mysql administration, performance and replication. purpose of PHP, PHP versions, installing PHP, configuration options and extensions, compiling and installing PHP, apache configuration to handle PHP, PHP INI file.

Purpose of PHP, PHP versions, installing PHP, configuration options and extensions, compiling and installing PHP, apache configuration to handle PHP, PHP INI file; setting up apache virtual host, preparing mysql database, testing apache, PHP and mysql, scripting database connection, scripting data insertion, scripting data extraction and formatting.

LEARNING OUTCOMES

After the completion of course, students will get hands on experience on

CO1. Uses of Linux & MySQL.

CO2. Understanding & working of Apache Web server

CO3. Understanding of PHP & its uses in web development.

Text Book:

1. James Lee, Brent Ware*, Open Source Development with LAMP,* Addison-Wesley Professional, 2002.

Reference Book:

1. Jason Gerner, Elizabeth Naramore*, Professional LAMP,* John Wiley &Sons., 2005.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS475	Subject Title	Software Testing *(Department Elective)*					
LTP	2 0 2	**Credit**	3	**Subject Category**	DE	**Year**	4th	**Semester**	VIII

OBJECTIVES:

The objective of this course is to provide the necessary knowledge and understanding the different tools used in current software industries for the testing of Software.

Unit I **(8 L)**

Introduction: Terminology, evolving nature of area, Errors, Faults and Failures, Correctness and reliability, Testing and debugging, Static and dynamic testing, Exhaustive testing: Theoretical foundations: impracticality of testing all data, impracticality of testing all paths, no absolute proof of correctness.

Unit II **(8 L)**

Software V & V Approaches and their Applicability: Software technical reviews; Testing techniques and their applicability -functional testing and analysis, structural testing and analysis, error-oriented testing and analysis, hybrid approaches, integration strategies, transaction flow analysis, stress analysis, failure analysis, concurrency analysis, performance analysis; Proof of correctness; simulation and prototyping; Requirement tracing.

Unit III **(9 L)**

Software Testing: Levels of Testing, Functional Testing, Structural Testing, Test Plan, Test Case Specification, Software Testing Strategies, Verification & Validation, Unit, Integration Testing, Top Down and Bottom Up Integration Testing, Regression and Stress Testing , Alpha & Beta Testing, White box and black box testing techniques, System Testing and Debugging.

Test Generation: Test generations from requirements, Test generation pats, Data flow analysis, Finite State Machines models for flow analysis, Regular expressions based testing, Test Selection, Minimizations and Prioritization, Regression Testing.

LEARNING OUTCOMES

After the completion of course, students will have skill to

CO1. Know the introductory concepts about software testing.

CO2. Know the prototyping of software for testing

CO3. Knowledge about different types models for testing of software.

CO4. Knowledge about different kind of testing.

Text Book:

1. Boris Beizer, Software Testing Techniques, John Wiley &Dreamtech ,2002.
2. William Perry, Effective Methods for Software Testing, John Wiley & Sons, Inc. ,3rd edition,2006.
3. Aditya P. Mathur, Foundations of Software Testing, Pearson Education 2008.

Reference Book:

1. Glenford J. Myers, The Art of Software Testing, Wiley India Pvt. Ltd 2nd edition 2006.
2. Roger S. Pressman, Software Engineering, A Practitioner's Approach, McGrawHill ,7th edition 2009.
3. Ian Sommerville, Software Engineering, Addison-Wesley Publishing Company, 8th Edition,2006.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS471	Subject Title	Data Base Administration *(Department Elective)*					
LTP	2 0 2	**Credit**	3	**Subject Category**	DE	**Year**	4th	**Semester**	VIII

OBJECTIVES:

The objective of this course is to provide the necessary knowledge and understanding the concepts of Oracle architecture components along with the overview of Storage Structure and Relationships

UNIT I Introduction (8 L)

Oracle Architectural Components, Getting Started With Oracle Server , Managing an Oracle Instance, Creating a Database, Data Dictionary Contents and Usage, Maintaining the Control File, Redo Log Files, Managing Tablespaces and Data Files, Storage Structures and Relationships, Managing Undo Data, Tables, Indexes, Maintaining Data Integrity, Managing Password, Managing Security, Resources, users, Privileges & Roles, Loading Data Into a Database & Globalization Support

UNIT II DBA Fundamentals (9 L)

Networking Overview, Basic Oracle Net Architecture, Server-Side Configuration, Basic Oracle Net Services Client-Side Configuration, Usage and Configuration of the Oracle Shared Server, Backup and Recovery Overview, Instance and Media Recovery Structures, Configuring the Database Archiving Mode, Oracle Recovery Manager Overview and Configuration, User Managed Backups, RMAN Backups, User Managed Complete & Incomplete Recovery, RMAN Complete Recovery, Incomplete Recovery & Maintenance, Recovery Catalog Creation and Maintenance, Transporting Data Between Databases

UNIT III Managing Oracle (9 L)

Oracle10i: Overview, Preparing the Operating System & Install Oracle9i Software, Create a Custom Oracle Database, Install and Configure Enterprise Manager, Customize the Oracle Database Linux Measurement Tools, Oracle Measurement Tools, Tuning Oracle

Database Troubleshooting

One Time Troubleshooting, Adhoc Troubleshooting, Escalations, Connectivity, Business Continuity, High Availability and Scalability, Data Sharing and information Integration

LEARNING OUTCOMES

After the completion of course, students will have skill to

1. CO1. Explain the concepts of Oracle architecture components.
2. CO2. Explain the overview of Storage Structure and Relationships
3. CO3. Illustration of the concepts of Managing Process in Databases

Text Book:

1. Oracle Database Administrator's Guide,Wiley ,2014
2. Oracle DBA Handbook,McGraw Hill Education; 1st edition 2007

Reference Book:

1. Michael Wessler Oracle DBA on Unix and Linux,Prentice Hall; 1 edition, 2001

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS472	Subject Title	Information Security *(Department Elective)*						
LTP	2 0 2	**Credit**	3	**Subject Category**	DE	**Year**	4th	**Semester**	VIII

OBJECTIVES:

This course aims to give the students about the knowledge & various applications of information security in the area of computer science.

UNIT I **(8 L)**

Introduction: Security problem in computing, Secure system characteristics, what to secure –How to secure- at what cost?
Elementary Cryptography – DES – AES – Public Key Encryption – Uses of Encryption
Program Security: Security Programs – Non-malicious Program Errors – Virus and other Malicious Code – Targeted Malicious Code – Control against program Threats.

UNIT II **(9 L)**

Security in Operating Systems: Protected Objects and Methods of Protection – Memory and Address Protection –Control of Access generated Objects – File Protection Mechanisms – User Authentication – Trusted Operating Systems – Models of Security.

UNIT III **(9 L)**

Administering Security and Ethical Issues: Security Planning – Risk Analysis – Organizational Security Policies – Physical Security – Protecting Programs and Data – Information and the Law –Software Failures – Computer Crime – Privacy – Ethical Issues.

LEARNING OUTCOMES

At the end of the students shall able to learn about:
CO1. Identify and explain symmetric algorithms for encryption-based security of information.
CO2. Identify and explain public-key based asymmetric algorithms for encryption-based security of information.
CO3. Examine the issues related to administration security, physical security, and program security.

Text Book:

1. Charles B. Pfleeger, and Shari Lawrence Pfleeger, “Security in Computing”, Pearson Education, Third edition, 2003.

Reference Book:

1. Matt Bishop, “Computer Security – Art and Science”, Pearson Education, First edition, 2003.
2. William Stallings, “Cryptography and Network Security – Principles and Practices”, Prentice-Hall of India, Third edition, 2003.
3. AtulKahate, “Cryptography and Network Security”, Tata McGraw-Hill, 2003.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS473	Subject Title	Computer Vision *(Department Elective)*					
LTP	2 0 2	**Credit**	3	**Subject Category**	DE	**Year**	4th	**Semester**	VIII

OBJECTIVES:

The objectives of this course is to get the exposure to students about computer vision and its application in image analysis.

Unit I (8 L)

Introduction: What is computer vision, The Marr paradigm and scene reconstruction, Other paradigms for image analysis. Image Formation, Image Geometry, Radiometry, Digitization.

Unit II (9 L)

Binary Image Analysis and Segmentation: Properties, Digital Geometry, Segmentation.
Image Processing for Feature Detection and Image Synthesis, Edge detection, corner detection Line and curve detection, SIFT operator, Image-based modelling and rendering, Mosaics, snakes.

Unit III (9 L)

Stereo: Shape from shading, Photometric stereo, Texture, Occluding contour detection, Motion Analysis: Motion detection and optical flow Structure from motion

LEARNING OUTCOMES

At the end of the course students should be able to:
CO 1. Implement fundamental image processing techniques required for computer vision .
CO2. Perform shape analysis
CO3. Implement boundary tracking techniques
CO4. Apply chain codes and other region descriptors
CO5. Implement motion related techniques. CO6: Develop applications using computer vision techniques.

Text Book:

1. D. Forsyth and J. Ponce, *Computer Vision - A modern approach*, Prentice Hall *Robot Vision*, by B. K. P. Horn, McGraw-Hill,2nd edition ,2015

Reference Book:

1. E. Trucco and A. Verri ,*Introductory Techniques for 3D Computer Vision*, Publisher: Prentice Hall,1998

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS456	Subject Title	Business Intelligence *(Department Elective)*						
LTP	2 0 0	**Credit**	2	**Subject Category**	DE	**Year**	4th	**Semester**	VIII

OBJECTIVES:

The objectives of this course is to the comprehensive and in-depth knowledge of Business Intelligence (BI) principles and techniques by introducing the relationship between managerial and technological perspectives. This course is also designed to expose students to the frontiers of BI-intensive BIG data computing and information systems, while providing a sufficiently strong foundation to encourage further research.

Unit I (9 L)

Introduction to Business Intelligence,

Introduction to OLTP and OLAP, BI Definitions & Concepts, Business Applications of BI, BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities

Unit II (8 L)

Basics of Data Integration (**E**xtraction **T**ransformation **L**oading)**,**

Concepts of data integration need and advantages of using data integration, introduction to common data integration approaches, introduction to ETL using SSIS, Introduction to data quality, data profiling concepts and application

Unit III (9 L)

Introduction to Multi-Dimensional Data Modeling**,**

Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies,

Basics of Enterprise Reporting

Introduction to enterprise reporting, concepts of dashboards, balanced scorecards, introduction to SSRS Architecture, enterprise reporting using SSRS

LEARNING OUTCOMES

After completing this course, students will be able to:

Co1. Identify the major frameworks of computerized decision support: decision support systems (DSS), data analytics and business intelligence (BI).

CO2. Explanation about the foundations, definitions, and capabilities of DSS, data analytics and BI.

CO3. Demonstration about the impact of business reporting, information visualization, and dashboards.

Text Book:

1. David Loshin ,Business Intelligence Elsevier, 2nd edition, 2012
2. Mike Biere ,Business intelligence for the enterprise ,IBM Press; 1st edition 2003
3. Larissa Terpeluk Moss, Shaku Atre ,Business intelligence roadmap, Addison-Wesley Professional; 1st edition , 2003.

Reference Book:

1. Cindi Howson ,Successful Business Intelligence: Secrets to making Killer BI Applications ,McGraw-Hill Education; 2nd edition ,2013
2. Brain, Larson ,Delivering business intelligence with Microsoft SQL server 2008 .

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS458	Subject Title	Mobile Computing *(Department Elective)*						
LTP	2 0 0	**Credit**	2	**Subject Category**	DE	**Year**	4th	**Semester**	VIII

OBJECTIVES:

This course aims to make students aware about different techniques for mobile computing.

Unit I (9 L)

Introduction: Introduction to mobile computing. Convergence of Internet, digital communication and computer networks. Sharing of wireless channels: FDMA, TDMA, CDMA. MAC layer issues in wireless communication

Unit II (8 L)

Mobility Management: Impacts of mobility and portability in computational model and algorithms for mobile environment. Disconnected operation, handling handoffs.Analysis of algorithms and termination detection.Types of Mobility. Mobility in cellular based wireless network: channel allocation, interferences, handoffs and location management. IP mobility: Mobile IP and IDMP

Unit III (9 L)

Wireless LAN: Infrared vs. Radio transmission, Infrastructure and Ad hoc Networks, IEEE 802.11: System architecture, Protocol architecture, Physical layer, Medium access control layer, MAC management, Future development; HIPERLAN: Protocol architecture, Physical layer, Channel access control.Sub layer, Medium access control Sub layer, Information bases and Networking; Bluetooth: User scenarios, Physical layer, MAC layer, Networking. Security, Link management. Personal Area Network: Bluetooth and ZigBee. Network layer issues ad hoc and sensor networks

Distributed Mobile Environment: Distributed file system for mobile environment, Mobile Middleware: Service discovery, adaptation, mobile agents.

LEARNING OUTCOMES

At the end of this course students shall understand and:

CO1. Learn the basics of wireless communication systems.

CO2. Learn the Wireless application Protocols to develop mobile content application and to appreciate the social and ethical issues of mobile computing, including privacy.

CO3. To Develop and demonstrate various routing protocols.

Text Book:

1. Schiller, “Mobile Communications”, PHI/Pearson Education, Second Edition, 2004.
2. William Stallings, “Wireless Communications and Networks”, PHI/Pearson Education,2nd edition 2002.

Reference Book:

1. T. Rappaport, "Wireless Communication: Principles and Practice", Pearson Education,2008
2. Reza B'Far (Ed), "Mobile Computing Principles", Cambridge University Press,1st edition 2009.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CS459	Subject Title	IOT Concepts *(Department Elective)*						
LTP	2 0 0	**Credit**	2	**Subject Category**	DE	**Year**	4th	**Semester**	VIII

OBJECTIVES:
Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to understand the design principles of IOT Devices.

Unit -1 (8 L)
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

Unit -2 (9 L)
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.

Unit-3 (9 L)
Network & Communication Aspects in IoT: Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.
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.

LEARNING OUTCOMES
At the end of course students will become proficient in the following aspects of IOT:

CO1. Able to understand the application areas of IOT ·

CO2. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks ·

CO3. Able to understand building blocks of Internet of Things and characteristics.

Text Book:

1. Olivier Hersent,DavidBoswarthick, Omar Elloumi"The Internet of Things key applications and protocols", willey,2nd edition ,2012
2. Jeeva Jose, Internet of Things, ,Khanna Publishing; First edition 2018.
3. Michael Miller "The Internet of Things" Pearson Education India; 1 edition 2015)

Reference Book:

1. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016
2. ArshdeepBahga, Vijay Madisetti" Internet of Things(A hands on approach)" 1st edition, VPI publications,2014
3. Adrian McEwen,HakinCassimally "Designing the Internet of Things" ,Wiley ,2015

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	IT357	Subject Title	Internet of Things						
LTP	3 0 0	Credit	3	Subject Category	DE /OE	Year	4th	Semester	VIII

Course Outline: To provide a detailed idea how the internet is connecting the entire world and helps to live a smart life with its technology.

Course Objective:

1. Vision and Introduction to IoT.
2. Understand IoT Market perspective.
3. Data and Knowledge Management and use of Devices in IoT Technology.
4. Understand State of the Art – IoT Architecture.
5. Real World Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

Course Pre/Co- requisite (if any): Wireless Sensor Networks

Detailed Syllabus

UNIT 1: M2M to IoT(05 Lectures)

The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, use case example, Differing Characteristics.

UNIT 2: M2M to IoT (A Market Perspective)(10 Lectures)

Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.
IOT related open source software tools introduction; tools like IoTivity, IBM Blue Mix. Introduction to Contiki, Cooja, Raspberry Pi etc.

UNIT 3:M2M and IoT Technology Fundamentals(05 Lectures)

Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management.

UNIT 4: IoT Architecture-State of the Art(12 Lectures)

Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model
IoT Reference Architecture: Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

UNIT 5:Industrial Automation(08 Lectures)

Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things
Commercial Building Automation: Introduction, Case study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future.

Learning Outcome

- Explain the definition and usage of the term 'The Internet of Things' in different contexts
- Understand where the IoT concept fits within the broader ICT industry and possible future trends
- Able to build and test a complete working IoT system Pursue lifelong learning for professional advancement.

Text book [TB]:

Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.

Reference books [RB]:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	IT359	Subject Title	Mobile Computing and Services						
LTP	3 0 0	Credit	3	Subject Category	DE /OE	Year	4th	Semester	VIII

Course Objective:

1. Understand the fundamentals of wireless networks.
2. Understand and evaluate emerging wireless technologies and standards
3. To explore mobile security issues
4. To explore the mobility concept.

Detailed Syllabus

UNIT 1

Introduction: Mobile computing with functions & devices, Networks, Middleware & gateways, Application & services, Developing mobile computing applications, Security & standards why it necessary, Architecture for mobile computing. **(3 L)**

UNIT 2

Emerging Technologies: Bluetooth, Rfid, WiMAX, Mobile IP, IPv6, GSM architecture, Call routing in GSM, Mobile computing over SMS, Value added service through SMS, GPRS architecture & operations, 3G & applications **(10 L)**

UNIT 3

Wireless Transmission:
Signal propagation- path loss of radio signals, additional signal propagation effects, Multipath propagation,
Multiplexing- Space division, frequency division, time division, code division,
Modulation- ASK, FSK, PSK, AFSK, APSK, Multi-carrier modulation
Spread spectrum- Direct sequence & frequency hopping
Mac- Hidden & exposed terminals, near- far terminal, SDMA, TDMA, FDMA, Fixed TDM, CSMA, PRMA, Multiple access with collision avoidance **(12 L)**

UNIT 4

Wireless LAN: IEEE 802.11 in details, HIPERLAN, Link manager protocol, L2CAP, security, SDP. **(5 L)**

UNIT 5

Mobility & Security in mobile computing: HTTP,
Wireless application protocol- architecture, wireless datagram protocol, wireless transport layer security, wireless transaction & session protocol, WML, Push architecture, push/ pull services, i-mode & SyncML
Information security, Security techniques & algorithms, public key infrastructure, **(10 L)**

Learning Outcome

At the end of the course, Learning Outcomes Having successfully completed this course, the student will demonstrate:
1: Apply the fundamental design paradigms and technologies to mobile computing applications.
2: Develop consumer and enterprise mobile applications using representative mobile devices and platforms using modern development methodologies.

3: Appraise the quality and performance of mobile applications.
4: Assess and implement security principles in mobile applications.
5: Evaluate wireless network topologies, wireless connectivity and characteristics, and the impact of wireless networks on security and Internet communications.
6: Select appropriate wireless technologies in commercial and enterprise applications.

Text book [TB]:

- Jochen H. Schiller: Mobile Communications - Second Edition, Pearson
- Asoke K Talukder & Roopa R Yavagal: Mobile Computing Technology, Applications and Service Creation – Tata McGraw-Hill Publishing Company Limited

Reference books [RB]:

- William Stallings: Wireless Communications & Networks - Second Edition, Pearson
- Theodore S. Rappaport : Wireless Communications Principles & Practice - Second Edition, Pearson

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	EC386	Subject Title	Fundamental of Communication & Networks						
LTP	3 0 0	Credit	3	Subject Category	DE /OE	Year	4th	Semester	VIII

Objectives of the Course:

- To understand the concept of Computer Communication.
- To learn the basics of Data communication and Networks
- To develop and design the protocol systems for advance computer communication.

UNIT I: Introduction to Communication:

Communication system, Analog and Digital Communication, channel bandwidth. Ideal and Practical Filters, Concept of Signal Distortion over a Communication Channel, Energy Signal and Power Signal, Introduction to noise in Communication systems. **6L**

UNIT II: Introduction to Modulation techniques:

Concept of Amplitude Modulation, Concept of Frequency & Phase Modulation, Concept of ASK, FSK & PSK, Concepts of PCM. **8L**

UNIT III: Introduction to Data Communication Network & OSI Model:

Switching systems, network hardware and software, Layering, design issues for layering, reference models and their comparison, example of networks. Concepts of OSI model. **6L**

UNIT IV: Introduction to Data Communication Protocols and transmission media

MAC protocols- Aloha, CSMA, collision free protocols, Ethernet, IEEE 802.3 standard, IP protocols, IP addressing, OSPF, IPv4, IPv6. Transmission media and channel impairments, multiplexing, digital channels, switching. Repeaters, bridges, routers and gateways. **8L**

Text Books:

1. Forouzan, B.A., "Data Communication and Networking", 4th Ed., Tata McGraw-Hill.
2. Tanenbaum, A.S, "Computer Networks", 4th Ed., Pearson Education.
3. Stallings W., "Data and Computer Communication", 8th Ed., Prentice-Hall.
4. Simon Haykins, 'Communication Systems', John Wiley,5th edition

Reference Books:

1. Kurose, J.F. and Ross, K.W., "Computer Networking: A Top-Down Approach Featuring the Internet", 3rd Ed., Addison Wesley.

List of Experiments:

1. To generate amplitude modulated wave and determine the percentage modulation and Demodulate the modulated wave using envelope detector.
2. To generate AM-Double Side Band Suppressed Carrier (DSB-SC) signal.
3. To generate the SSB modulated and Demodulated wave.
4. To generate frequency modulated signal and determine the modulation index and bandwidth for various values of amplitude and frequency of modulating signal and to demodulate a FM signal
5. To study ASK modulation and Demodulation.
6. To study FSK modulation and Demodulation.
7. To study PSK modulation and Demodulation.
8. To Study TDM/PCM Transmitter /Receiver.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

OUTCOMES OF THE COURSE:

The course provides an understanding of:

- Computer Communication and networks.
- Protocol design and their design issues.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	EC382	Subject Title	Biomedical Instrumentation						
LTP	3 0 0	Credit	3	Subject Category	DE /OE	Year	4th	Semester	VIII

Objectives of the Course: The students will learn

- Requirement of bio-medical and its application
- Concept of bio-potential electrodes and measurements related to them.
- Concepts of bio-transducers and measurements related to them.
- Concept of bio-medical instruments and their uses experimentally.

UNIT I: ANATOMY AND PHYSIOLOGY:

Basic Cell Functions, Origin of Bio-potentials, Electrical Activity of Cells, components of man Instrument system, types of bio-medical stems, design factors and limitations of biomedical instruments, terms and transducers to various physiological events. **8L**

UNIT II: BIO-POTENTIAL ELECTRODE:

Types of bio-potential electrodes., Electrode-Electrolyte interface, half cell potential, Polarization- polarisable and non-polarisable electrodes, Ag/AgCl electrodes, Electrode circuit model; Electrode and Skin interface and motion artifact. Body surface recording electrodes for ECG. Electrodes standards. **8L**

UNIT III: BIO-TRANSDUCER:

Transduction Principles: Resistive Transducers Strain Gauge- types, construction, selection materials, Gauge factor, Bridge circuit, Temperature compensation. Strain Gauge type Blood pressure transducers. Inductive Transducers, Capacitive Transducer, Piezoelectric Transducer. **8**

UNIT IV: BIOTELEMETRY AND ELECTRICAL SAFETY:

Bio-telemetry design, single channel bio telemetry transmitter and receiver system based on AM, FM and, pulse modulation. Significance of Electrical Danger, physiological effect of current, ground shock Hazards. **8L**

Text Books:

1. Joseph J. Carr & John. M. Brown, 'Introduction to Biomedical Equipment technology'
2. R.S. Khandpur, 'Handbook of Biomedical Instrumentation', McGraw Hill.

Reference Books:

1. J.G. Webster, 'Medical instrumentation application and design', Houghton Miffin Co., Boston USA.
2. Mohan Murali H, 'Monograph on Biomedical engineering', O.U. Press 1985.
3. Geddes L. A. & L. E. Baker, 'Principles of Applied Biomedical Instrumentation', Wiley, 1989.
4. Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer, 'Biomedical Instrumentations and Measurements' (2nd edition), PHI, 1991.

OUTCOMES OF THE COURSE:

The course provides an understanding of:

- Bio-medical instruments and measurements.
- Principle of working of bio-medical transducers.
- Skills to use modern bio-medical tools and equipment for measurements related to human body.

LIST OF EXPERIMENTS

2. Pulse measurement

3. Heartbeat measurement
4. Automatic BP measurement
5. Heart sound study using electronics stethoscope
6. ECG measurement

Following experiments to be done on the breadboard

7. Design of low noise and low frequency amplifier for biomedical application
8. Design of Instrumentation amplifier
9. Construction of chopper amplifier

Two Value Added Experiments to be added by Instructor.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	EE485	Subject Title	BASIC INSTRUMENTATION AND PROCESS CONTROL						
LTP	3 0 0	Credit		Subject Category	Open Elective	Year	4th	Semester	VIII

Objectives of the Course

- To make students understand the construction, working principle and application of various transducers used for flow measurement, strain measurement, pressure and vacuum measurement,
- force, torque and power measurement
- To develop an understanding about the different types of telemetry systems used and types of instruments required for display and recording of the data to be transmitted
- Understand about components, characteristics of various control processes used and their modes of operation.

Unit 1	**Transducer – I :** Definition, advantages of electrical transducers, classification, characteristics, factors affecting the choice of transducers, Potentiometers, Strain guages, Resistance thermometer, Thermistors, Thermocouples, LVDT,RVDT	**8L**
Unit 2	**Transducer – II: Capacitive**, Piezoelectric Hall effect and opto electronic transducers. Measurement of Motion, Force pressure, temperature, flow and liquid level.	**8L**
Unit 3	**Telemetry: General** telemetry system, land line & radio frequency telemetering system, transmission channels and media, receiver & transmitter. Data Acquisition System: Analog data acquisition system, Digital data acquisition system, Modern digital data acquisition system.	**8L**
Unit 4	**Telemetry: General** telemetry system, land line & radio frequency telemetering system, transmission channels and media, receiver & transmitter. Data Acquisition System: Analog data acquisition system, Digital data acquisition system, Modern digital data acquisition system. **Display Devices and Recorders:** Display devices, storage oscilloscope, spectrum analyser, strip chart & x-y recorders, magnetic tape & digital tape recorders.	**8L**
Unit 5	**Process Control:** Principle, elements of process control system, process characteristics, proportional (P), integral (I), Derivative (D), PI, PD and PID control modes. Electronic, Pneumatic & digital controllers.	**8L**

Text Books:

1. A.K.Sawhney, “Advanced Measurements & Instrumentation”, Dhanpat Rai & Sons
2. B.C. Nakra&K.Chaudhry, “Instrumentation, Measurement and Analysis”, Tata Mc Graw Hill 2nd Edition.
3. Curtis Johns, “Process Control Instrumentation Technology”, Prentice Hall

Reference Books

1. E.O. Decblin, “Measurement System – Application & design”, Mc Graw Hill.
2. W.D. Cooper and A.P. Beltried, “Electronics Instrumentation and Measurement Techniques” Prentice Hall International

3.RajendraPrasad,”Electronic Measurement and Instrumentation Khanna Publisher

4. M.M.S. Anand, “Electronic Instruments and Instrumentation Technology” PHI Learning.

Outcome of the Course:

- **Identify the appropriate instruments for measurement of different quantities.**
- **Ability to analyze, formulate and select suitable sensor for the given industrial applications**
- **Ability to analyze various control processes used and their modes of operation.**

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	ME382	Subject Title	Ergonomics and Value Engineering						
LTP	3 0 0	Credit	3	Subject Category	DE/OE	Year	4th	Semester	VIII

Course Objective: This course provides an overview on principles of ergonomics and human factors, their applications to the design and management of industrial systems, Engineering anthropometry, Human performance, human-technology interaction, work place and work station design and concept of value engineering. To address the underlying concepts, methods and application of Value Engineering

Course Pre/Co- requisite (if any):

Detailed Syllabus

UNIT 1: Introduction of Ergonomics

Background of ergonomics, historical evolution of ergonomics, definition of ergonomics, aspect of ergonomics, man machine interaction, and man machine closed loop system, man machine system (MMS)

Work physiology

Muscle structure, metabolisms, circulatory and respiratory systems, energy expenditure and workload

UNIT 2: work related MSDs risk and work postures assessment

Introduction, assessment of work postures using RULA Methods, work posture assessment using rapid entire body assessment tool (REBA)

Office Ergonomics-

Introductions, Issues in workstation design, seat design, engineering anthropometry and work design, A case study: an investigation on passenger seat design in sleeper class coaches in Indian trains.

UNIT 3: Physical stress- Introduction, vibration, occupational noise exposure, sound, source of noise and vibration, basic theory of noise measurement, Noise measuring meters, basic sound level meters, noise control , permissible limits of exposure with respect to occupational noise.

UNIT 4: Value Engineering Introduction: Definition, value engineering recommendations, programs, advantages, Evaluation of function, determining function, classifying function, evaluation of costs, evaluation of worth, determining worth, and evaluation of value.

Value Engineering Job Plan: Introduction, orientation, information phase, Function phase, creation phase, evaluation phase, Investigation phase, implementation phase, speculation phase, analysis phase.

UNIT 5: Selection of Evaluation of Value Engineering Projects: Project selection, Methods selection, value standards, application of Value Engineering methodology.

Initiating Value Engineering Program: Introduction, training plan, career development for Value Engineering specialties.

Fast Diagramming: Cost models, life cycle costs.

Value Engineering level of Effort: Value Engineering team, Co-ordinator, designer, different services, definitions, construction management contracts, value engineering case studies

Learning Outcome

At the end of the course the student can:

CO1: Specify and design ergonomically appropriate industrial workstations for the industrial and office work environment.

CO2: Identify information-centered human factors relating to visual, illumination, controls, displays and symbols.

CO3: Compare, contrast and assess human body-centered ergonomic designs for posture, material handling, repetitive motion factors, heat stress, noise and vibration.
CO4: Define the ergonomic factors intrinsic in evaluating accidents, human errors and safety related incidents.
CO5: Student will understand the concepts, methods and application of Value Engineering

Text book [TB]:

1. Lakhwinder Pal Singh, "Work Study and Ergonomics:Cambridge University Press,2018.
2. Value Engineering : A Systematic Approach by Arthur E. Mudge - McGraw Hill 2010

Reference books [RB]:

1. The Power of Ergonomics as a Competitive Strategy By Gross & Right (Productivity Press) 2010.
2. MartandTelsang, Industrial Engineering and Production Management,S. Chand &Compagny Limited, 2006.
3. Value Engineering A how to Manual S.S.Iyer, New age International Publishers 2009.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	ME366	Subject Title	Product Design And Development					
LTP	3 0 0	Credit	3	Subject Category	DE /OE	Year	4th	Semester	VIII

Course Objective: This course aims at introducing the students to the basic concepts of engineering design and product development with focus on the front end processes. At the end of this course the student is expected to demonstrate an understanding of the overview of all the product development processes and knowledge of concept generation and selection tools.

Course Pre/Co- requisite (if any): Manufacturing Process, Industrial Engineering and Management

Detailed Syllabus

UNIT 1:

Significance of product design, Need for developing products, product design and development process, the importance of engineering design, sequential engineering design method, relevance of product lifecycle issues in design, the challenges of product development.

Product Planning and Project Selection: generic product development process, Identifying opportunities, evaluate and prioritize projects, allocation of resources, various phases of product development-planning for products.

UNIT 2:

Identifying Customer Needs voice of customer, customer populations, Interpret raw data in terms of customers need, hierarchy of human needs, need gathering methods, establish the relative importance of needs.

Product Specifications: Establish target specifications, setting final specifications

Concept Generation: Activities of concept generation, clarifying problem, search both internally and externally, explore the output

UNIT 3:

Industrial Design: Assessing need for industrial design, industrial design process, management, assessing quality of industrial design, human factors design, user friendly design

Concept Selection: Overview, concept screening and concept scoring, methods of selection, case studies.

UNIT 4:

Theory of inventive problem solving (TRIZ): Fundamentals, methods and techniques, General Theory of Innovation and TRIZ, Value engineering Applications in Product development and design, Model based technology for generating innovative ideas measurement of customers response.

Concept Testing: Elements of testing: qualitative and quantitative methods including survey.

UNIT 5:

Intellectual Property: Elements and outline, patenting procedures, claim procedure.

Design for Environment: Impact, regulations from government, ISO system, case studies.

Learning Outcome

At the end of the course the student can:

CO1:Product Design and Innovation course is intended to introduce overall awareness of the product design process.

CO2:This course will give an understanding of methods, tools and techniques applied in product design.

CO3:This course includes overview of innovation, product design process, user study, need/problem identification, development of design brief, understanding competitive benchmarking, aspects of human factors in product design, tools for creative concept generation, and prototyping/model making and evaluation techniques for user-product interaction.

CO4:This course will be explained with lectures including case studies and hands-on exercises. This will help students to generate creative ideas in to product design, considering human factors aspects.

Text book [TB]:

1. Anita Goyal, Karl T Ulrich, Steven D Eppinger, "Product Design and Development", Tata McGraw-Hill Education, 4th Edition, 2009.
2. Kevin Otto, Kristin Wood, "Product Design", Pearson Education, Indian Reprint 2004.

REFERENCES [RB]:

1. Yousef Haik, T. M. M. Shahin, "Engineering Design Process Cengage Learning, 2010", 2nd Edition Reprint.
2. Kevin Otto, Kristin Wood, "Product Design", Pearson Education Indian Reprint 2004.
3. Clive L.Dym, Patrick Little, "Engineering Design: A Project-based Introduction", John Wiley & Sons, 3rd Edition 2009.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	ME452	Subject Title	Renewable Energy Sources						
LTP	3 0 0	Credit	3	Subject Category	DE/OE	Year	4th	Semester	VIII

Course Objective: To provide students an overview of global energy resources with focus on renewable energy sources and their importance in the context of limited supply of conventional energy resources & global warming.

Course Pre/Co- requisite (if any): Basic Thermodynamics, Heat Transfer

Detailed Syllabus

UNIT 1: ENERGY RESOURCES

Introduction: Energy & its importance in social & economic development; energy demand & supply, world energy status, energy scenario in India; energy & environment, greenhouse effect & global warming; role of renewable energy sources; a brief introduction to various renewable energy sources – hydro, solar, biomass, wind, geothermal & ocean energy – their availability & present status.

UNIT 2: SOLAR ENERGY

The sun as a source of energy, extraterrestrial & terrestrial solar radiation; solar radiation data & geometry, solar radiation on horizontal & inclined surfaces; solar thermal systems – various types of solar collectors & their applications in cooking, drying, water heating, distillation, space heating & cooling, refrigeration and power generation.

Solar photovoltaic systems, solar cell fundamentals, performance & characteristics, types of solar cells; solar cell, module, and array construction; solar PV applications.

UNIT 3: BIOMASS ENERGY

Origin of biomass, photosynthesis & generation of biomass, availability of biomass, usable forms of biomass – fuel wood, charcoal, fuel pellets, biodiesel, bioethanol, biogas and producer gas; biomass conversion technologies, thermochemical & biochemical methods, biomass gasification, classification & operational parameters of biogas plants, energy recovery from urban waste, sewage to energy conversion.

UNIT 4: WIND ENERGY

Origin & nature of winds; history of power from winds; global & local winds; estimation of wind energy at a site; maximum power extraction from wind – Betz criterion; capacity factor of wind power plants; types of wind turbines – horizontal and vertical axis wind turbines; wind energy storage; environmental & economic aspects; present status of wind energy systems.

UNIT 5: GEOTHERMAL & OCEAN ENERGY

Structure of earth's interior; origin & distribution of geothermal energy, types of geothermal resources – exploration & development of hydrothermal, geo-pressured & hot dry rock resources; electrical power generation from geothermal energy; environmental & economic considerations.

Ocean energy; tidal, wave & ocean thermal energy, energy from tidal streams (marine currents); technology for harnessing tidal & wave energy; ocean thermal energy conversion technology.

Learning Outcome

At the end of the course the student will:

CO1: Understand about the interaction between energy, economy, environment, and social development.

CO2: Appreciate the importance of renewable energy sources & future energy systems based on them.

CO3: Possess the basic technical knowledge to develop energy systems based on solar, biomass, wind, geothermal & ocean energy.

Text book [TB]:

1. B. H. Khan, "Non-Conventional Energy Resources", 3rd edition (2017), McGraw Hill Education (India) Private Limited, Chennai.
2. S. P. Sukhatme& J. K. Nayak,"Solar Energy", 4th edition (2018), McGraw Hill Education (India) Private Limited, Chennai.

References [RB]:

1. G. N. Tiwari & M. K. Ghosal, "Renewable Energy Resources – Basic Principles and Applications", 2005, Narosa Publishing House, New Delhi.
2. D.P. KOTHARI, K. C. SINGAL, RAKESH RANJAN, Renewable Energy Sources And Emerging Technologies, PHI Learning Pvt. Ltd., 25-Nov-2011.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	CE483	**Subject Title**	**GIS**						
LTP	3 0 0	**Credit**	3	**Subject Category**	DE/OE	**Year**	4th	**Semester**	VIII

Course Objective: The course provides wide knowledge about basics of GIS and its applications in various fields

Unit-1: Introduction

8L

Definition of GIS, Cartography and GIS, GIS database: spatial and attribute date; Spatial models: Semantics, spatial information, temporal information, conceptual models of spatial information, representation of geographic information: point, line and area futures, topology,

Unit-2: Components

12L

Raster and vector data, raster to vector data conversion, map projection, analytical transformation, rubber sheet transformation, manual digitizing and semi-automatic line following digitizer; Remote sensing data as an input to GIS data;

Unit-3: Classifications and Functions

10L

Attribute database: scale and source of inaccuracy; GIS functionality; data storage and data retrieval through query, generalization, classification, containment search within a spatial region;

Unit-4: Analysis

5L

Overlay: arithmetical, logical and conditional overlay, buffers, inter visibility, aggregation; Network analysis;

Unit-5: Applications

4L

Applications of GIS in planning and management of utility lines and in the filed of environmental engineering, geotechnical engineering, transportation engineering and water resources engineering.

Course Outcome: The students will learn from this course:

- Basic understanding of GIS concepts, components.
- Analyzing geo-spatial data with various techniques and GIS tools
- Apply the concepts in solving environmental and engineering problems
- Create new information and theoretical knowledge after applying GIS tools

Books Recommended:

1. Geographic Information Systems: A Management Perspective, by Stan Arnoff, WDL Publications.
2. Fundamentals of Spatial Information Systems by Robert laurini and Derek Thompson, Academic Press.
3. Geographical Information Systems, Vol. I and II edited by Paul Longely, M.F. Good child, et.al, John Wiley and Sons, Inc. 1999

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	PE491	Subject Title	Carbon Capture and Sequestration Technology						
LTP	3 0 0	Credit	3	Subject Category	DE/OE	Year	4th	Semester	VIII

1. Course Summary

The course provides information about the students to learn the basic concept and Applications of Carbon capture and storage process. In this course, students will learn about carbon capture techniques and the concept of the contribution of fossil fuel to climate change. During this course students will examine the Co2 emission and Carbon dioxide recycling.

2. Course Objectives

The students should be able to:

1. The objective of this course is make students familiar with the principles and applications of carbon capture and storage capture techniques and role of CCS.

3. Course Outcomes

1. To acquaint the students substantially to the objectives and necessity of Carbon Sequestration and capture.
2. To introduce the contribution of fossil fuel to climate change.
3. To understand the concept of emission and recycling of CO2.
4. To introduce the candidates to the concept of underground storage and other Carbon Capture and sequestration concepts.
5. To understand the implementation of CCS technology and IPCC.

4. Curriculum Content

UNIT 1

Introduction: Scope, Objectives and Necessity of CCS.

UNIT 2

The contribution of fossil fuels emission to Climate change and global warming. Concept of Carbon Credit and carbon footprint.

UNIT 3

Carbon capture techniques: Carbon-di-oxide emission, Scrubbing of CO2, Carbon dioxide recycling.

UNIT 4

Carbon dioxide sequestration: Underground storage, Potential for Geologic Storage, Application in Oil and gas industry, Carbon di oxide flooding projects, Methane recovery projects.

UNIT 5

Strategy for implementing CCS technology: Modelling of Cost and Performance of CCS Plants. Role and function of IPCC.

Text book [TB]:

1. Carbon Capture; Jennifer Wilcox; Springer
2. Capturing Carbon – The new weapon in the War Against Climate Change; Mills, Robin M.; Columbia University Press

Reference books [RB]:

1. Piping and pipeline engineering, George A. Antaki, Marcel Dekker Inc. New York.

2. Fundamentals of pipeline engineering by J. Vincent Genod, Technip Editions

5. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Subject Code	MA452	Subject Title	Optimization Techniques						
LTP	3 0 0	Credit	3	Subject Category	Open Elective	Year	4th	Semester	VIII

Unit 1:Introduction to optimization, Statement and classification of optimization problem, Multi-objective optimization, Multi-variable optimization problem with equality and inequality constraints, Classical optimization techniques, Single variable and multivariable optimization problems,Operation Research approach, general methods for Operation Research models, methodology and advantages of Operation Research.

Unit 2: Introduction to LPP and formulation of Linear Programming problems, Graphical solution method, alternative or multiple optimal solutions, Unbounded solutions, Infeasible solutions, Maximization – Simplex Algorithm, Minimization – Simplex Algorithm using Big-M method, Two phase method, Duality in linear programming.

Unit 3: Introduction to Transportation problems, various methods of Transportation problem, Variations in Transportation problem, introduction to Assignment problems, variations in Assignment problems. Sequential optimization, Representation of multistage decision process; Types of multi stage decision problems; Concept of sub optimization and the principle of optimality.

Unit 4:Optimization techniques,Memetic algorithm, Differential evolution, Evolutionary algorithms,Dynamic relaxation,Genetic algorithms, Hill climbing with random restart, Genetic Algorithm (GA), Artificial Bee Colony (ABC), Particle Swarm Optimization (PSO),Firefly algorithm, Fish School Search, Fly algorithm, Ant colony optimization algorithms

References:

1. S.S. Rao, "Engineering Optimization: Theoryand Practice", New Age International P)Ltd.,New Delhi, 2000.
2. G. Hadley, "Linear programming", NarosaPublishing House, New Delhi, 1990.3.
3. H.A. Taha, "Operations Research: AnIntroduction", 5th Edition, Macmillan, New York, 1992.4.
4. K. Deb, "Optimization for Engineering Design-Algorithms and Examples", Prentice-Hall ofIndia Pvt. Ltd., New Delhi, 1995.
5. S.D. Sharma, “Operations Research”, Kedar Nath Ram Nath Publishers, 2009.

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Code	AR-485	Subject Title	ART APPRECIATION						
LTP	3 0 0	Credit	3	Subject Category	OE	Year	4th	Semester	VIII

Course Objective:

To create an overview and understanding of various art forms that exists from ancient to modern times.

Unit 1: INTRODUCTION

Understanding various art forms in society and in different cultures.

Unit 2: Sociological Perspective

Relationship between art, culture and society. Influence of art forms on people.

Unit 3: Appreciation-I: Painting/ Sculptures

Understanding and appreciating films/ documentaries from past to present timesand between east and west

Unit 4: Appreciation-II: Films/ Documentries

Understanding and appreciating painting and sculptures from past to present times and between east and west

Unit 5: Appreciation-III: Indigenous/ Folk Art

Understanding and appreciating Indigenous/ Folk art from past to present times and between east and west.

LEARNING OUTCOME:

4. The student will be able to understand the various art forms.
5. The students will be able to understand and establish a relationship between art, culture and society.
6. The students will be able to appreciate the various art.

Text Books:

3. Creative Authenticity: 16 Principles to Clarify and Deepen Your Artistic Vision, Ian Roberts

Reference Books:

The Writer: A Concise Complete and Practical Text Book of Rhetoric. Designed to Aid in The Appreciation, George Lansing Raymond

Course Structure& Syllabus of B.Tech – Computer Science & Engineering (with AI & Data Science) Applicable for Batch: 2019-23

Code	PY481	Subject Title	Nano scale science and technology						
LTP	3 0 0	Credit	3	Subject Category	DE/OE	Year	4th	Semester	VIII

Unit 1 **(10L)**

Introduction to nanotechnology, definition, history of nanotechnology, nanotechnology in relation to other branches of engineering, characteristic length scale of materials and their properties, classification of nano materials, dimensionality and size dependent phenomena, confinement in 0-D, 1-D, 2-D and 3-D,surface to volume ratio, fraction of surface atoms, surface energy.

Unit 2 **(7L)**

Nanomaterials synthesis techniques; top-down and bottom-up techniques, ball milling, PVD, CVD, self-assembly.

Unit 3 **(8L)**

Nanomaterials characterization; XRD, SEM, TEM, AFM, UV-VIS.

Unit 4 **(8L)**

Nanomaterials and their properties: carbon based nano materials, metal based nano materials, quantum dots, biological nano materials.

Unit 5 **(7L)**

Applications of nanotechnology in engineering, solar energy conversion, nanomedicine.

Text Books:

1. Poole, Jr. CP and Owens, FJ, “Introduction to Nanotechnology”, Wiley India. 2006.
2. Cao, G., Nanostructures and Nanomaterials: Synthesis, Properties and Applications, Emperial College Press (2004).
3. Edward L. Wolf: Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience, 2nd ed., Wiley-VCH, 2006.