SCHEME OF INSTRUCTION & EXAMINATION
B.E. - I SEMESTER
CSE (AI&ML)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hours/ Week	CIE	SEE	Duration in Hours	
Theory Courses										
	Three Week Induction Programme									
1	MC 801 PO	Indian Constitution	2	0	-	2	30	70	3	-
2	HS101EG	English	2	-	-	2	30	70	3	2
3	BS 202 PH	Physics	3	1	-	4	30	70	3	4
4	BS 201 MT	Mathematics-I	3	1	-	4	30	70	3	4
5	ES 301 EE	Basic Electrical Engineering	3	1	-	4	30	70	3	4
Practical/ Laboratory Courses										
6	HS151EG	English Lab	-	-	2	2	25	50	3	1
7	BS 251 PH	Physics Lab	-	-	3	3	25	50	3	1.5
8	ES353 CE	Engineering Graphics	-	-	3x2	6	50	50	3	3
9	ES354 CE	Basic Electrical Engineering Lab	-	-	2	2	25	50	3	1
Total			**13**	**03**	**13**	**29**	**275**	**550**		**20.5**

(Dr Abdul Rasool) Lords

13/7/23

(Dr DVSS Subrahmanyam) KMEC

13/7/23 (NGIT)

(Dr. T. Prem Chander)

(Tuvviy- fatima) (NSAKCET)

13/7

Dr. Uma N. Dulhare (MJCET)

→ 20-24 Batch

→ 22-23 Batch

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SCHEME OF INSTRUCTION & EXAMINATION
B.E. - I SEMESTER
CSE (AI&ML)

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2	HS101EG	English	2	-	-	2	30	70	3	2
3	BS 202 PH	Physics	3	1	-	4	30	70	3	4
4	BS 201 MT	Mathematics-I	3	1	-	4	30	70	3	4
5	ES 301 EE	Basic Electrical Engineering	3	1	-	4	30	70	3	4
Practical/ Laboratory Courses										
6	HS151EG	English Lab	-	-	2	2	25	50	3	1
7	BS 251 PH	Physics Lab	-	-	3	3	25	50	3	1.5
8	ES353 CE	Engineering Graphics	-	-	3x2	6	50	50	3	3
9	ES354 CE	Basic Electrical Engineering Lab	-	-	2	2	25	50	3	1
Total			**13**	**03**	**13**	**29**	**275**	**550**		**20.5**

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CHAIRMAN
Board of Studies in CSE
Dept. of Computer Science & Engg.
College Of Engg., O.U. Hyderabad.

For the academic years 2020-2024

INDIAN CONSTITUTION

MC 801PO

Instruction: 2 periods per week
CIE: 30 marks
Credits: 0

Duration of SEE: 3 hours
SEE: 70 marks

Objectives:

1. To create awareness among students about the Indian Constitution.
2.To acquaint the working conditions of union, state, local levels, their powers and functions
3. To create consciousness in the students on democratic values and principles articulated in the constitution.
4.To expose the students on the relations between federal and provincial units.
5.To divulge the students about the statutory institutions.

Outcomes: Student will be able to:

1. Know the background of the present constitution of India
2.Understand the working of the union, state and local levels
3.Gain consciousness on the fundamental rights and duties
4.Be able to understand the functioning and distribution of financial resources between the centre and states
5.Be exposed to the reality of hierarchical Indian social structure and the ways the grievances of the deprived sections can be addressed to raise human dignity in a democratic way.

UNIT – I
Evolution of the Indian Constitution: 1909 Act, 1919 Act and 1935 Act. Constituent Assembly: Composition and Functions; Fundamental features of the Indian Constitution
UNIT – II
Union Government: Executive-President, Prime Minister, Council of Minister ***State Government***: Executive: Governor, Chief Minister, Council of Minister ***Local Government***: Panchayat Raj Institutions, Urban Government
UNIT – III
Rights and Duties: Fundamental Rights, Directive principles, Fundamental Duties
UNIT – IV
Relation between Federal and Provincial units: Union-State relations, Administrative, legislative and Financial, Inter State council, NITI Ayog, Finance Commission of India.
UNIT – V
Statutory Institutions: Elections-Election Commission of India, National Human Rights Commission, National Commission for Women.

Suggested Readings:

1	Durga Das Basu, –*Introduction to the Constitution of India*‖, Lexis Nexis Butterworths Wadhwa Nagpur, 2008
2	Subhash Kashyap, –*Our Parliament*‖, National Book Trust, India, 2004.
3	Peu Ghosh, –*Indian Government and Politics*‖, Prentice Hall of India, New Delhi,2012.

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For the academic years 2020-2024

ENGLISH

HS 101 EG

Instruction: 2 periods per week
CIE: 30 marks
Credits: 0

Duration of SEE: 3 hours
SEE: 70 marks

Objectives:

1.Using authentic material for language learning
2.Exposing them to a variety of content-rich texts
3.Strengthening their grammar and vocabulary
4.Improving their reading and comprehension skills
5.Honing their writing skills
6.Encouraging them to think creatively and critically

Outcomes: Student will be able to:

1.Read, understand, and interpret a variety of written texts
2.Use appropriate vocabulary and correct grammar
3. Undertake guided and extended writing with confidence

UNIT – I
Reading: RK Narayan, —A Horse and Two Goats‖ ***Vocabulary***: Word formation—Prefixes, Suffixes, Root Words ***Grammar:*** Articles, Prepositions, Determiners
UNIT – II
Reading: Rudyard Kipling, –If‖ ***Vocabulary***: Word formation—Compounding and Blending, Contractions ***Grammar***: Transitions, Connectives ***Writing***: Paragraph Writing
UNIT – III
Reading: Martin Luther King Jr., —I Have a dream‖ ***Vocabulary***: Synonyms, Antonyms, One Word Substitutes ***Grammar***: Voice ***Writing:*** Letter Writing
UNIT – IV
Reading: Robert Frost, —Road Not Taken‖ ***Vocabulary***: Homophones, Homonyms, Homographs ***Grammar***: Narration (Direct-Indirect Speech) ***Writing:*** Report Writing
UNIT – V
Reading: George Orwell, —The Sporting Spirit‖ (Excerpt) ***Vocabulary***: Inclusive Language, Euphemisms ***Grammar***: Tense ***Writing:*** SOP

Suggested Readings:

1	Board of Editors,‖ *Language and Life: A Skills Approach*‖, Orient Black Swan, 2018.
2	Sudharshana, NP and C Savitha,‖ *English for Engineers*‖, Cambridge University Press, 2018
3	Kumar, Sanjay and Pushp Lata,‖ *English Language and Communication Skills for Engineers*‖, Oxford University Press, 2018

For the academic years 2020-2024

PHYSICS

BS 202 PH

Instruction: 3+1 periods per week — *Duration of SEE: 3 hours*
CIE: 30 marks — *SEE: 70 marks*
Credits: 4

Objectives:

1. Aware of limits of classical free electron free theory and to apply band theory of solids
2.Acquire knowledge on various properties of semiconductors.
3. Grasp the intricacies in semiconductor-optical interaction

Outcomes: Student will be able to:

1.Distinguish materials based on band theory of solids.
2.Classify semiconductors on the basis doping and to estimate conductivity and learn transport phenomenon in semiconductors.
3.Appreciate use of optical absorption by semiconductors.

UNIT – I
Crystallography: Introduction, Types of crystal systems, Bravais lattices, Lattiee planes and Miller Indices (Cubic system), Inter planar spacing (Cubic system), Bragg's law, Powder diffraction method. ***Crystal Defects***: Classification of point defects, Concentration of Schottky defects in metals and ionic crystals, Concentration of Frankel defects, Line defects, Screw and Edge dislocations, Burger's vector.
UNIT – II
Band Theory of Solids & Semiconductors: Classical free electron theory (qualitative), Kronig Penney model (qualitative treatment), Energy band formation in solids, Intrinsic and Extrinsic semiconductors, Concept of a hole, Carrier concentration and conductivity in intrinsic semiconductors, Formation of P-N junction diode and its I – V characteristics, Thermistor and its characteristics, Hall effect and its applications. ***Dielectric Materials:*** Dielectrics, Types of polarizations, Electronic, Ionic, Orientational and Space charge polarizations, Expression for Electronic polarizability, Frequency and temperature dependence of dielectric polarizations, Determination of dielectric constant by capacitance Bridge method, Ferro electricity, Barium titanate, Applications of Ferroelectrics.
UNIT – III
Wave Mechanics: Matter waves –de-Broglie wavelength, properties of wave function, Physical significance, Schrodinger time dependent and time in-dependent wave equation. Particle in a 1-D box. ***Electromagnetic Theory***: Basic laws of electricity and magnetism, Maxwell's equations in integral and differential forms, Conduction and displacement current, Relation between D, E and P – Electromagnetic waves: Equation of plane wave in free space, Poynting theorem.
UNIT – IV
Magnetic Materials: Classification of magnetic materials: dia, para, ferro, antiferro and ferrimagnetic materials, Weiss molecular field theory of ferromagnetism, Magnetic domains, Hysteresis curve, soft and hard magnetic materials, Ferrites: Applications of ferrites. ***Superconductivity:*** Introduction, General properties of super conductors, Meissner effect, Type I and Type II superconductors, BCS theory (qualitative), Introduction to High T_c superconductors, Applications of superconductors
UNIT – V
Lasers: Characteristics of Lasers, spontaneous and stimulated emission of radiation, Einstein's Coefficients, population inversion, Ruby Laser, Helium Neon Laser, Semi-Conductor Laser and applications of lasers.

Fiber Optics: Introduction, Propagation of light through an optical fiber, Acceptance angle, Numerical aperture (NA), Types of Optical fibers and Refractive index profiles, Fiber drawing process (double Crucible Method), Losses in optical fibers, applications of optical fibers.

Suggested Readings:

1	B.K. Pandey and S. Chaturvedi,‖ *Engineering Physics*‖, Cengage Learning, 2012
2	A.K. Bhandhopadhya, -*Nano Materials*‖, New Age International, 1st Edition, 2007
3	M.S. Avadhanulu and P.G. Kshirusagar,‖ *Engineering Physics*‖, S. Chand & Co. 1st Edition,1992
4	C.M. Srivastava and C. Srinivasan , -*Science of Engineering Materials*‖, New Age International, 2001
5	R.K Gaur and S.L Gupta, -*Engineering Physics*‖, McGraw-Hill Education (India) Pvt Limited, 1992
6	Sanjay D Jain and Girish G Sahasrabudhe, -Engineering Physics‖, Orient Black swan Pvt Limited, 2016

For the academic years 2020-2024

MATHEMATICS-I

BS 202 MT

Instruction: 3+1 periods per week — *Duration of SEE: 3 hours*

CIE: 30 marks — *SEE: 70 marks*

Credits : 4

Objectives:

1.To introduce the concepts of sequences, series and their properties
2.To introduce the concepts of functions of several variables and multiple integrals
3.To study vector differential and integral calculus

Outcomes: Student will be able to:

1.Find the nature of sequences and series
2.Apply this knowledge to solve the curriculum problems
3.Evaluate multiple integrals

UNIT – I
Sequences and Series: Sequences, Series, General properties of series, Series of positive terms, Comparison tests, tests of Convergence D'Alembert's ratio test, Cauchy's n^{th} root test, Raabe's test, Logarithmic test, Alternating series, Series of positive and negative terms, Absolute convergence and Conditional convergence.
UNIT – II
Calculus of one Variable: Rolle's theorem, Lagrange's, Cauchy's mean value theorems, Taylor's series, Curvature, Radius of curvature, Circle of curvature, Envelope of a family of curves, Evolutes and Involutes.
UNIT – III
Multivariable Calculus (Differentiation): Functions of two variables, Limits and continuity, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule), Change of variables, Jacobian, Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum values of functions of two variables, Lagrange's method of undetermined multipliers.
UNIT – IV
***Multivariable Calculus (Integration)*:** Double integrals, Change of order of integration, Change of Variables from Cartesian to plane polar coordinates, Triple integrals
UNIT – V
Vector Calculus: Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, Line, Surface and Volume integrals, Green's theorem in a plane, Gauss's divergence theorem, Stoke's theorem (without proofs) and their verification.

Suggested Readings:

1	R.K. Jain & S.R.K Iyengar, -*Advanced Engineering Mathematics"*, Alpha Science International Limited, 2014.
2	Erwin Kreyszig, -*Advanced Engineering Mathematics"*, John Wiley, 9th Edition, 2012.
3	B.S. Grewal, -*Higher Engineering Mathematics"*, Khanna Publishers, 43rd Edition, 2014.
4	G.B. Thomas, Maurice Weir and Joel Hass, -*Thomas' Calculus"*, Pearson Education, 12th Edition,2010.
5	B.V. Ramana, -*Higher Engineering Mathematics*I, Tata Mc Graw Hill Education, 23rd reprint, 2017.

For the academic years 2020-2024

BASIC ELECTRICAL ENGINEERING

ES 301 EE

Instruction: 3+1 periods per week | *Duration of SEE: 3 hours*
CIE: 30 marks | *SEE: 70 marks*
Credits: 4

Objectives:

1. To provide an understanding of basics in Electrical circuits.
2. To provide an overview of ordinary differential equations

Outcomes: Student will be able to:

1. To analyse Electrical circuits to compute and measure the parameters of Electrical Energy
2.To comprehend the working principles of Electrical DC Machines
3. To Identify and test various Electrical switchgear, single phase transformers and assess the ratings needed in given application
4.To comprehend the working principles of electrical AC machines

UNIT – I	
	DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.
UNIT – II	
	AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, and RL, RC, RLC combinations (series only). Three phase balanced circuits, voltage and current relations in star and delta connections.
UNIT – III	
	Transformers and 3-ph Induction Motors: Transformers: Electromagnetic induction, Faradays laws, statically induced emf, Lenz law, BH characteristics, ideal and practical transformer, losses and efficiency, Auto-transformer and three-phase transformer connections. ***Three Phase Induction motor:*** Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, squirrel cage IM, slip-ring IM, Applications
UNIT – IV	
	Single-phase induction motor and DC Machines: Single-phase induction motor: Construction and principle of operation, Capacitor start & capacitor run motor, applications. ***DC Generators***: Dynamically induced emf, Flemming's Right hand and Left hand rules, Construction and principle of operation of DC generator, EMF equation, Types of DC Generators, OCC characteristics, applications. ***DC Motors:*** principle of operation of DC Motor, Types of DC motors, applications
UNIT – V	
	Electrical Installations: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Readings:

1	N. K. De, *-Basic Electrical Engineering*‖, Universities Press, 2015.
2	J.B. Gupta, *-Fundamentals of Electrical Engineering and Electronics*‖ S.K. Kataria & Sons Publications, 2002
3	J.B. Gupta, *-Utilization of Electric Power and Electric Traction*‖ S.K. Kataria & Sons Publications,

	2010
4	Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda, –*Basic Electrical Engineering*‖ Tata McGraw Hill, Publications, 2009
5	Hughes, "*Electrical Technology*", 7th Edition, Addison Welsey Longman Inc., 1995

For the academic years 2020-2024

ENGLISH LAB

HS 151 EG

Instruction: 2 periods per week
CIE: 25 marks
Credits: 1

Duration of SEE: 3 hours
SEE: 50 marks

Objectives:

1. Giving them sufficient practice in listening with comprehension
2. Providing them ample opportunities to improve their public speaking skills
3. Training them in the use of correct pronunciation, stress, and intonation
4. Sensitizing them to the use of verbal and non-verbal communication appropriate to the context
5. Encouraging them to learn the art of conversation to suit formal and informal situations
6.Preparing them to make formal presentations and face interviews

Outcomes: Student will be able to:

1.Listen, understand, and interpret formal and informal spoken language
2. Speak English with acceptable pronunciation, stress, and intonation
3.Present themselves with confidence in formal situations
4. Participate in individual and group activities with relative ease

List of Experiments:

1. Listening for Comprehension
2. Pronunciation, Intonation, Stress, and Rhythm
3. Conversation Skills
4. Introducing Oneself and Others
5. Asking for and Giving Information
6. Making Requests and Responding to them Appropriately
7. Giving Instructions and Responding to them Appropriately
8. Making Formal Announcements and Emceeing
9. Group Discussions
10. JAM
11. Role Play
12. Debate
13. Public Speaking Skills and Body Language
14. Interviews
15. Formal Presentations

Suggested Readings:

1	Board of Editors, –*Language and Life: A Skills Approach*‖, Orient Black Swan, 2018
2	T. Balasubramanian, –*Textbook of English Phonetics for Indian Students*‖, Macmillan publishers, 1981
3	CIEFL Exercises in Spoken English. Parts. I-III. Oxford University Press
4	Pillai, Radhakrishna G, –*Spoken English For You - Level II*‖, 8th Edition, Emerald Publishers, 2014
5	Sethi, J and PV Dhamija, –*A Course in Phonetics and Spoken English*‖, 2nd Edition, Prentice Hall India Learning Private Limited, 1999

For the academic years 2020-2024

PHYSICS LAB

BS 251 PH

Instruction:2 periods per week — *Duration of SEE: 3 hours*

CIE: 25 marks — *SEE: 50 marks*

Credits: 1.5

Objectives:

1. Make precise measurements using basic physical principles and acquire skills to handle the instruments
2. Relates the theoretical Knowledge to the behavior of Practical Physical world
3.Analyse errors in the experimental data
4.Plot graphs between various physical parameters

Outcomes: Student will be able to:

1.Conduct experiments, take measurements independently
2. Write appropriate laboratory reports
3.Compute and compare the experimental results and draw relevant conclusions
4.Use the graphical representation of data and estimate results from graphs

List of Experiments:

1. To determine the Dielectric constant and Phase transition temperature of Lead Zirconium Titanate (PZT).
2. To draw the I - V Characteristics of P-N Junction diode and to evaluate the resistance.
3. To find the values of Electrical conductivity and energy gap of Ge crystal.
4. Determination of rigidity of modulus of Torsion pendulum.
5. Determination of carrier concentration, Mobility and Hall Coefficient of Ge crystal using Hall Effect Experiment.
6. To determine the constants of A, B and α using Thermistor characteristics.
7. To draw the curve between the magnetizing field and the intensity of magnetization of the specimen (soft iron rod) and to find out
   i) Coercivity ii) Retentivity and iii) Hysteresis loss.
8. To draw the I - V Characteristics of a solar cell and to calculate the
   i) Fill factor Efficiency and ii) Series resistance.
9. To Determine the Numerical Aperture (NA) of Optical fiber.
10. To determine the wave length of the given Laser source.

Note: Minimum eight experiments should be conducted in the semester

Suggested Readings:

1	N.K. De, –*Basic Electrical Engineering*‖, Universities Press, 2015
2	J.B. Gupta, –*Fundamentals of Electrical Engineering and Electronics*‖ S.K. Kataria & Sons Publications, 2002
3	J.B. Gupta, –*Utilization of Electric Power and Electric Traction*‖ S.K. Kataria & Sons Publications, 2010

For the academic years 2020-2024

ENGINEERING GRAPHICS

ES 353 CE

Instruction:6 periods per week — *Duration of SEE: 3 hours*

CIE: 50 marks — *SEE: 50 marks*

Credits: 3

Objectives:

1.To prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
2. To prepare you to use the techniques, skills, modern engineering tools to use for Engineering practice.

Outcomes: Student will be able to:

1. Introduction to engineering design and its place in society
2. Exposure to the visual aspects of engineering design
3. Exposure to engineering graphics standards
4. Exposure to solid modelling
5.Exposure to computer-aided geometric design
6. Exposure to creating working drawings
7. Exposure to engineering communication

S.No	Description	Lectures	Drawing
1	Principles of Engineering Graphics and their significance, usage of drawing instruments	1	
2	Conic Sections – I, Construction of ellipse, parabola and hyperbola given focus and eccentricity.	1	2
3	Conic Sections – II, Construction of ellipse (given major and minor axis), parabola (given bas and height), rectangular hyperbola	-	2
4	Cycloids (cycloid & epicycloid)	1	2
5	Involutes (involute of triangle, square & circle)	-	2
6	Scales (plain & diagonal scales)	1	2+2
7	Introduction to AutoCAD –Basic commands and simple drawings	-	2+2
8	Orthographic Projection , Projection of points situated in different quadrants	1	2
9	Projections of straight lines-I Lines parallel to both the reference planes, lines perpendicular or inclined to one reference plane	1	2
10	Projections of straight lines-II Lines parallel to both the reference planes	1	2
11	Projections of planes-I Perpendicular planes	1	2
12	Projections of planes-II Oblique planes	-	2
13	Projections of solids – I Polyhydra and solids revolution, projections of solids in simple position	1	2
14	Projections of solids – II	1	2

	Polyhydra and solids when the axes inclined to one or both the reference planes.		
15	Section of solids – I When the sectional plane is parallel or perpendicular to one reference plane	1	2
16	Section of solids – II When the sectional plane is inclined to one reference plane	-	2
17	Development of surfaces – I Prisms and Cylinders	1	2
18	Development of surfaces – II Pyramids and Cones	-	2
19	Intersection of surfaces – I Intersection of cylinder and cylinder	1	2
20	Intersection of surfaces – I Intersection of cylinder and cones	-	2
21	Isometric projection – I- planes and simple solids	1	2
22	Isometric projection – I – Combination of two or three solids	-	2
23	Conversion of Isometric Views to Orthographic Views	1	2
24	Floor plans of 2 or 3 rooms including windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1	2

Suggested Readings:

1	Bhatt N.D., Panchal V.M. & Ingle P.R.,‖*Engineering Drawing*", Charotar Publishing House, 2014
2	Shah, M.B. & Rana B.C., — *Engineering Drawing and Computer Graphics*", Pearson Education, 2008
3	S.N Lal, — *Engineering Drawing with Introduction to Auto CAD*", Cengage Learning India Pvt Ltd, New Delhi, 2018
4	Agarwar B. & Agrawal C. M., -*Engineering Graphics*‖, TMH Publication, 2012
5	Narayana, K.L. & P Kannaiah,‖ *Text book on Engineering Drawing*‖, Scitech Publishers, 2008
6	(Corresponding set of) CAD Software Theory and User Manuals

NOTE:

1. At least 20 sheets must be covered.
2. Sheet number 1 to 6 (Graph sheets / drawing sheets)
3. Sheet number 7 to 24 (AutoCAD drawings.

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For the academic years 2020-2024

BASIC ELECTRICAL ENGINEERING LAB

ES 354 EE

Instruction: 2 periods per week — *Duration of SEE: 3 hours*

CIE: 25 marks — *SEE: 50 marks*

Credits: 1

Objectives:

1. To impart the practical knowledge on testing of DC and AC Machines.
2. To learn the usage of common electrical measuring instruments

Outcomes: Student will be able to:

1.Get an exposure to common electrical components and their ratings
2. Analyse the performance of DC and AC Machines
3.Comprehend the usage of common electrical measuring instruments
4. Test the basic characteristics of transformers and electrical machines

List of Experiments:

Dem1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.

Exp 1. Verification of KVL and KCL, superposition theorem (with DC excitation)

Exp 2 Verification of Thevinens and Nortons theorems (with DC excitation)

Exp 3. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Power factor calculation

Exp 4. Transformers: Observation of the no-load current waveform on an oscilloscope (nonsinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics).

Exp 5. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.

Exp 6. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).

Exp 7. Measurement of phase voltage/current, line voltage/current and power in a balanced three-phase circuit connected in star and delta.

Dem2. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.

Exp 8. OCC characteristics of DC Generator

Exp 9. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections.

Exp 10. Power factor improvement of Induction Motor using static capacitors

Exp 11. Load Test of DC Motor

13/2

Note - 1:

(i) List of Experiments and Demonstrations suggested above are already available in the Laboratory of the electrical department. No need to purchase any extra equipment except Demonstration2 equipments

(ii) Procurement of Demonstration 2 equipments can be done during the course work of that semester. It can be included in the laboratory.

Suggested Readings:

1	J.B. Gupta, –*Fundamentals of Electrical Engineering and Electronics*‖ ,S.K. Kataria & Sons Publications, 2002.
2	J.B. Gupta, –*Utilization of Electric Power and Electric Traction*‖ S.K. Kataria & Sons Publications, 2010
3	Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda, –*Basic Electrical Engineering*‖, Tata McGraw Hill, Publications, 2009
4	Hughes, "*Electrical Technology*", 7th Edition, Addison Wesley Longman Inc., 1995

13/2

SCHEME OF INSTRUCTION & EXAMINATION
B.E. - II SEMESTER
CSE (AI&ML)

S.No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		
			L	T	P	Contact Hrs/Wk	CIE	SEE	Credits
Theory Courses									
1	MC 802 CE	Environmental Sciences	2	-	-	2	30	70	-
2	MC 803 PY	Essence of Indian Traditional Knowledge	2	-	-	2	30	70	-
3	BS 201 MT	Mathematics-II	3	1	-	4	30	70	4
4	BS 204 CH	Chemistry	3	1	-	4	30	70	4
5	ES 302 CS	Programming for Problem Solving	3	1	-	4	30	70	4
Practical/ Laboratory Courses									
6	BS 252CH	Chemistry Lab			3	3	25	50	1.5
7	ES 351 CS	Programming for Problem Solving Lab			2	2	25	50	1
8	ES 352ME	Workshop Practice	-	-	2x3	6	50	50	3
Total			**13**	**3**	**11**	**27**	**250**	**500**	**17.5**

(Dr Abdul Rasool)
Lords

13/7/23
(Dr DVSS Subrahmayam)
KMEC

13/7/23 (NGIT) (Dr. T. Prem Chander)

For the academic years 2020-2024

ENVIRONMENTAL SCIENCES

MC 802CE

Instruction: 3 periods per week
CIE: 30 marks
Credits : 0

Duration of SEE: 3 hours
SEE: 70 marks

Objectives:

1. To create awareness and impart basic knowledge about the environment and its allied problems.
2. To know the functions of ecosystems, social and environment related issues and their preventive measures
3. To understand importance of biological diversity, different pollutions and their impact on environment

Outcomes: Student will be able to:

1. Adopt environmental ethics to attain sustainable development
2. Develop an attitude of concern for the environment
3. Conservation of natural resources and biological diversity
4. Creating awareness of Green technologies for nation's security
5. Imparts awareness for environmental laws and regulations

UNIT – I

The Multidisciplinary Nature of Environmental Studies: Definition, scope and importance, need for public awareness.

Natural Resources: Water Resources – Use and over utilization of surface and ground water, flood, drought, conflicts over water, Dams: Benefits and Problems. Food Resources –World Food Problems, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, Forest Resources – Use and over exploitation, deforestation & its effect on tribal people.Land Resources –Land Degradation, environmental effect of mining, man induced landslides, soil erosion and desertification. Energy Resources –Growing energy needs, Renewable and Non-renewable energy resources.

UNIT – II

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in ecosystem, food chains, ecological pyramids, ecological succession, types of ecosystems (marine, pond, river, forest, grassland, desert)

UNIT – III

Biodiversity: Levels of Biodiversity, Bio-geographical classification of India, Value of biodiversity, Threats to biodiversity, endangered and endemic species of India, Conservation of biodiversity, global and national efforts.

UNIT – IV

Environmental Pollution: Definition, Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution, solid waste management.

Environment Protection Act: Air, water, forest and wildlife Acts, issues in the enforcement of environmental legislation

UNIT – V

Social Issues and the Environment: Watershed management and environmental ethics. Climate change, global warming, acid rain, ozone layer depletion.

Environmental Disaster Management: Types of disasters, impact of disasters on environment,

infrastructure, and development. Basic principles of disaster mitigation, disaster management, and methodology. Disaster management cycle and disaster management in India. ***Field Work:*** Visit to a local area to document environmental issues- agricultural area/ pond/lake/terrestrial ecosystem. Visit to a local polluted area- market/slum area/Industrial area/traffic area.

Suggested Readings:

1	De Anil Kumar, *–Environmental Chemistry"*, New Age Publisher International Pvt Ltd, New Delhi , 2016
2	E.P. Odum, *_Fundamentals of Ecology'*, W.B. Sunders Co., USA.,1971
3	M.N. Rao and A.K. Datta, *–Waste Water Treatment"*, Oxford and IBK Publications, New Delhi, 2009.
4	Benny Joseph, *–Environmental Studies"*, Tata McGraw Hill, New Delhi, 2009
5	V.K. Sharma, *–Disaster Management"*, National Centre for Disaster Management, IIPE, New Delhi, 1999

For the academic years 2020-2024

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

MC 803 PY

Instruction: 2 periods per week — *Duration of SEE: 3 hours*
CIE: 30 marks — *SEE: 70 marks*
Credits : 0

Objectives:

1.	To get a knowledge in Indian Culture
2.	To Know Indian Languages and Literature and the fine arts in India
3.	To explore the Science and Scientists of Medieval and Modern India

Outcomes: Student will be able to:

1.	Understand philosophy of Indian culture
2.	Distinguish the Indian languages and literature.
3.	Learn the philosophy of ancient, medieval and modern India.
4.	Acquire the information about the fine arts in India
5.	Know the contribution of scientists of different eras.

UNIT – I

Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT – II

Indian Languages, Culture and Literature: Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India.

Indian Languages and Literature-II: Northern Indian languages & literature

UNIT – III

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT – IV

Fine Arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India.

UNIT – V

Education System in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Suggested Readings:

1	Kapil Kapoor, -*Text and Interpretation*: *The India Tradition*‖, D. K. Print world, 2005
2	Gopala Krishnan , -*Science in Samskrit*‖, Samskrita Bharti Publisher, New Delhi, 2017
3	NCERT, -*Position paper on Arts, Music, Dance and Theatre*‖ NCERT, New Delhi, 2010.

4	S. Narain, –*Examinations in Ancient India*‖, Arya Book Depot, New Delhi, 1993
5	Satya Prakash, –*Founders of Sciences in Ancient India*‖, Vijay Kumar Publisher, New Delhi, 1989
6	M. Hiriyanna, –*Essentials of Indian Philosophy*‖, Motilal Banarsidass Publishers, New Delhi, 2005

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For the academic years 2020-2024

MATHEMATICS-II

BS 203 MT

Instruction: 3+1 periods per week — *Duration of SEE: 3 hours*

CIE: 30 marks — *SEE: 70 marks*

Credits: 4

Objectives:

1.To study matrix algebra and its use in solving system of linear equations and in solving eigen value problems
2. To provide an overview of ordinary differential equations
3. To study special functions like Legendre and Beta Gamma functions
4.To learn Laplace Transforms and its properties

Outcomes: Student will be able to:

1.Solve system of linear equations and eigen value problems
2.Solve certain first order and higher order differential equations
3.Solve basic problems of Beta Gamma and Legender's Function
4.Apply Laplace Transforms; solve ordinary Differential Equations by using it

UNIT – I
Matrices: Rank of a matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Linear transformation, Orthogonal transformation, Eigen values, Eigenvectors, Properties of eigen values, Cayley - Hamilton theorem, Quadratic forms, Reduction of quadratic form to canonical form by orthogonal transformation, Nature of quadratic forms.
UNIT – II
Differential Equations of First Order: Exact differential equations, Integrating factors, Linear differential equations, Bernoulli's, Riccati's and Clairaut's differential equations, Orthogonal trajectories of a given family of curves.
UNIT – III
Differential Equations of Higher Orders: Solutions of second and higher order linear homogeneous equations with constants coefficients, Method of reduction of order for the linear homogeneous second order differential equations with variable coefficients, Solutions of non-homogeneous linear differential equations, Method of variation of parameters, solution of Euler-Cauchy equation.
UNIT – IV
Special Function: Gamma Functions, Beta Functions, Relation Between Beta and Gamma Function, Error Functions. Power Series Method, Lengender's Differential Equations and Legender's Polynomial $P_n(x)$, Rodrigue's Formula (without proof).
UNIT – V
Laplace Transforms: Laplace Transforms, Inverse Laplace Transforms, Properties of Laplace Transforms and inverse Laplace Transforms, Convolution Theorem (without proof). Solution of ordinary Differential Equations using Laplace Transforms.

Suggested Readings:

1	R.K. Jain & S.R.K. Iyengar, *–Advanced Engineering Mathematics"*, Narosa Publications, 4th Edition, 2014.

2	Erwin Kreyszig, -*Advanced Engineering Mathematics"*, John Wiley, 9th Edition, 2012
3	Dr.B.S. Grewal, *"Higher Engineering Mathematics"*, Khanna Publications, 43rd Edition, 2014
4	B.V. Ramana, -*Higher Engineering Mathematics"*, Tata Mc Graw Hill, 2008
5	N. Bali and M. Goyal,‖ *A text book of Engineering Mathematics"*, Laxmi Publications, 7th Edition, 2010
6	H.K. Dass, Er. Rajnish Varma, -*Higher Engineering Mathematics"*, S. Chand and Company Ltd, 3rd Edition, 2008

For the academic years 2020-2024

CHEMISTRY

BS 204 CH

Instruction: 3+1 periods per week | *Duration of SEE: 3 hours*
CIE: 30 marks | *SEE: 70 marks*
Credits : 4

Objectives:

1. Correlate the properties of materials with their internal structure and use for Engineering applications
2. Apply the principles of electrochemistry in storage of electrical energy in batteries.
3. Gains knowledge about the causes of corrosion and its prevention.
4.Attains knowledge about the hard water and treatment of water for drinking purpose.
5.Exposed to qualitative and quantitative parameters of chemical fuels and aware of eco-friendly materials and processes.

Outcomes: Student will be able to:

1.Apply concept of electrode potential in identifying feasibility of electrochemical reaction; illustrate electro analytical techniques and working of batteries.
2. Identify the mechanism of corrosion of materials on basis of electrochemical approach and devise corrosion control methods.
3. Estimate the physical & chemical parameters of quality of water and explain the process of water treatment
4.Analyze the influence of chemical structure on properties of materials and their choice in engineering applications.
5. Classify chemical fuels and grade them through qualitative analysis and relate the concept of green c chemistry to modify engineering processes and materials.

UNIT – I

Electrochemistry: Electrochemical cells, Electrolytic and Galvanic cells-notation, cell reaction and cell potentials. Types of electrodes, Calomel Quinhydrone and Glass electrodes. Determination of pH of a solution by using Quinhydrone electrode. Thermodynamics of emf of cells, Nernst equation and its derivation. Applications of Nernst equation to electrode potential and emf of cells. Numerical problems.

Battery Chemistry: Primary batteries: Zn - Carbon battery. Secondary batteries: Pb-Acid battery and Li-Ion battery, Applications. Flow batteries (Fuel cells): Methanol-Oxygen fuel cells, Construction, Applications.

UNIT – II

Water Chemistry: Hardness of Water-Types and units of hardness, estimation of temporary and permanent hardness of water by EDTA method. Alkalinity of water and its determination. Water softening by Ion exchange and Reverse Osmosis methods. Numerical problems. Specifications of potable water. Sterilization by Chlorination. Break Point Chlorination.

Corrosion: Causes and its effects. Types of Corrosion-Dry or Chemical corrosion and Wet or Electrochemical corrosion and their mechanism. Electrochemical corrosion –Waterline and Pitting Corrosion. Factors influencing rate of corrosion.

Corrosion control methods: Cathodic protection methods - Sacrificial anodic and impressed current methods.

Surface coating methods: Hot Dipping-Galvanizing.

UNIT – III

Engineering Materials: Polymers: Basics of terms polymers: Monomer and its functionality, Polymers and degree of polymerization. Classification of polymers - Thermoplastics & Thermosetting resins.

	Types of Polymerization-Addition, Condensation, Co-Polymerization. Mechanism of free radical polymerization.Preparation, Properties & Uses of the following polymers: Plastics - PVC and Bakelite, Fibres - Nylon 6:6, and Kevlar, Elastomers - Buna-S, Butyl and Silicone Rubbers. ***Conducting polymers***: Introduction, Classification and Mechanism of conduction in Poly-acetylene, Applications of conducting polymers. ***Biodegradable polymers:*** Introduction preparation, properties and applications of polylactic acid.
UNIT – IV	
	Chemical Fuels: Classification of fuels: Introduction, definition and classification of chemical fuels-Primary and secondary fuels. Solid, liquid and gaseous fuels. Requirements of a good fuel. Calorific Value – HCV and LCV. Theoretical calculations of calorific value by Dulong's formula – Numerical problems. ***Solid Fuels:*** Coal and its Ranking. Analysis of coal - Proximate and Ultimate analysis. ***Liquid Fuels:*** Fractionation of Petroleum. Composition and uses of Gasoline, Diesel and Kerosene. Cracking & its Significance- Catalytic cracking by moving bed method, Knocking. Fuel rating – Octane and Cetane numbers. ***Gaseous Fuels***: LPG, CNG -Composition and Uses. ***Combustion:*** Ignition temperature of a fuel, calculation of air quantities by weight and volume required for combustion of a fuel- Numerical problems.
UNIT – V	
	Green Chemistry: Concept, Principles of green chemistry – Atom Economy, Catalysis. and examples of clean technology. ***Biodiesel:*** Sources, Concept of Transesterification and carbon neutrality, Properties and significance ***Composites:*** Introduction to composites, composition and characteristic properties of composites. Classification of composites based on matrix, reinforcement and ply. Applications of composites.

Suggested Readings:

1	B.R. Puri, L.R. Sharma, Madan S. Pathania , -*Principles of Physical Chemistry*‖, S.N. Chand & Co. New Delhi,1987
2	P C Jain and M Jain ,—*Engineering Chemistry*‖, Dhanpat Rai & Sons , 15th Edition, New Delhi, 2004
3	J C Kuriacose and J Rajaram ,-*Chemistry in Engineering and Technology* –, Tata Mc Graw Hill, New Delhi, 2010
4	O G Palanna, -*Engineering Chemistry*‖, Tata Mc Graw Hill, New Delhi, 2009
5	S S Dara and SS Umare, -*Engineering Chemistry*‖, S.N. Chand & Co. New Delhi, 2004
6	Sashi Chawla, -*Engineering Chemistry*‖, Dhanpat Rai & Sons, New Delhi, 2017
7	Prasanta Rath, -*Engineering Chemistry*‖, Cengage Learning India Pvt. Ltd, 2015

For the academic years 2020-2024

PROGRAMMING FOR PROBLEM SOLVING

Duration of SEE: 3 hours
SEE: 70 marks

ES 302 CS
Instruction: 3+1 periods per week
CIE: 30 marks
Credits: 3

Objectives:

1. To introduce the concepts of Computing environment, number systems, flowcharts and algorithms
2. To familiarize the basic constructs of C language – data types, operators and expressions
3. To understand modular and structured programming constructs in C
4. To learn the usage of structured data types and memory management using pointers
5. To learn the concepts of data handling using pointers

Outcomes: Student will be able to:

1. Formulate simple algorithms and translate the algorithms to programs using C language.
2. Implement conditional branching, and iteration and arrays.
3. Apply the function concepts to implement searching and sorting algorithms
4. Analyse the usage of structures and pointer variables.

UNIT – I

Introduction to Programming: 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 – II

Control Structures: Arithmetic expressions and precedence, Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching.
Arrays: Arrays (1-D, 2-D), Character arrays and Strings.

UNIT – III

Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble and Selection), Finding roots of Equations.
Functions: Functions (including using built in libraries), Parameter passing in functions, call by value. Passing arrays to functions: idea of call by reference

UNIT – IV

Recursion: Recursion, Example programs, such as Finding Factorial, Fibonacci series
Structure: Structures, Defining structures and Array of Structures

UNIT – V

Pointers : Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation), Introduction to File Handling.

Suggested Readings:

1. Byron Gottfried, –*Theory and practice of Programming with C*", Schaum's Outline McGraw-Hill, 1996
2. A.K. Sharma, –*Computer Fundamentals and Programming in C*‖, Universities Press, 2nd Edition, 2018.
3. E. Balaguruswamy, –*Programming in ANSI C*‖, Tata McGraw-Hill Education, 2008
4. Brian W. Kernighan and Dennis M. Ritchie,‖*The C Programming Language*‖, Prentice Hall of India,1988.

For the academic years 2020-2024

CHEMISTRY LAB

ES 252 CH

Instruction:2 periods per week — *Duration of SEE: 3 hours*

CIE: 25 marks — *SEE: 50 marks*

Credits: 1.5

Objectives:

1.Conduct experiments, take measurements and analyse the data though hands-on experience in order to demonstrate understanding of the theoretical concepts of quantitative Analysis while working in small group.
2.Interpret the electro analytical principles with experimental results graphically
3.Demonstrate writing skills through clear laboratory reports

Outcomes: Student will be able to:

1.Apply the principles of Colourimetry and Electrochemistry in quantitative estimations.
2.Estimate the rate constants of reactions from concentration of reactants/ products as a function of time.
3. Synthesize small drug molecules.

List of Experiments:

1. Introduction to Chemical Analysis.
2. Techniques of Weighing. Volumetric Analysis:
3. Preparation of Standard Mohr's salt solution, Standardization of $KMnO_4$ and estimation ferrous ion.
4. Estimation Iron(II) by Dichromatometry
5. Water Analysis:
6. Preparation of Standard Magnesium sulphate solution, standardization of EDTA and Estimation of Total Hardness.
7. Preparation of Standard Sodium Carbonate Solution, Standardization of HCL and Estimation of Carbonate and Bicarbonate Alkalinity.
   Conductometry: Estimation of HCL
8. Estimation of CH_3COOH and mixture of Acids Potentiometry
9. Estimation of HCL
10. Estimation of Iron
    pH Metry:
11. Estimation of HCL
    Colorimetry:
12. Verification of Beer-Lambert's law and estimation of Manganese.
    Chemical Kinetics:
13. Determination of rate constant of acid catalysed hydrolysis of methyl acetate.
14. Drug Synthesis Preparation of Aspirin

Note: Minimum ten experiments should be conducted in the semester

Suggested Readings:

1	B.D. Khosla, A. Gulati and V. Garg , -*Senior Practical Physical Chemistry*‖, R. Chand & Co., Delhi, 2011.
2	K. K. Sharma and D.S. Sharma , -*An Introduction to Practical Chemistry*‖, Vikas publishers, New Delhi, 1982.

PROGRAMMING FOR PROBLEM SOLVING LAB

ES 351 CS

Instruction: 2 periods per week
CIE: 25 marks
Credits: 1

Duration of SEE: 3 hours
SEE: 50 marks

Objectives:

1. Understand the fundamentals of programming in C Language
2. Write, compile and debug programs in C
3. Formulate solution to problems and implement in C.
4. Effectively choose programming components to solve computing problems

Outcomes: Student will be able to:

1.Choose appropriate data type for implementing programs in C language
2.Design and implement modular programs involving input output operations, decision making and looping constructs.
3.Implement search and sort operations on arrays.
4.Apply the concept of pointers for implementing programs on dynamic memory management and string handling.
5.Design and implement programs to store data in structures and files.

List of Experiments:

1. Finding maximum and minimum of given set of numbers, finding roots of quadratic equation.
2. Sin x and Cos x values using series expansion.
3. Conversion of binary to decimal, octal, hexadecimal and vice versa.
4. Generating Pascal triangle, pyramid of numbers.
5. Recursion: factorial, Fibonacci, GCD.
6. Matrix addition and multiplication using arrays, linear search and binary search using recursive and non-recursive procedures.
7. Bubble sort and selection sort.
8. Programs on pointers: pointer to arrays, pointer to functions.
9. Functions for string manipulations.
10. Programs on structures and unions.
11. Finding the number of characters, words and lines of given text file.
12. File handling programs

Suggested Readings:

1	Byron Gottfried, –*Theory and practice of Programming with C"*, Schaum's Outline McGraw-Hill, 1996
2	A.K. Sharma, –*Computer Fundamentals and Programming in C*‖, Universities Press, 2nd Edition, 2018.
3	E. Balaguruswamy, –*Programming in ANSI C*‖, Tata McGraw-Hill Education, 2008
4	Brian W. Kernighan and Dennis M. Ritchie,‖*The C Programming Language*‖, Prentice Hall of India,1988.

For the academic years 2020-2024

WORKSHOP PRACTICE

ES 352 ME

Instruction:4 periods per week — *Duration of SEE: 3 hours*
CIE: 25 marks — *SEE: 50 marks*
Credits: 3

Objectives:

1.Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.
2.To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
3.To gain a good basic working knowledge required for the production of various engineering products.
4.To Study different hand operated power tools, uses and their demonstration.
5.Adopt safety practices while working with various tools

Outcomes: Student will be able to:

1. Demonstrate an understanding of and comply with workshop safety regulations.
2. Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
3. Study and practice on machine tools and their operations
4.Undertake jobs connected with Engineering Workshop trades including fitting, carpentry, sheet metal, house wiring, welding, smithy and foundry.
5.Apply basic electrical engineering knowledge for house wiring practice

List of Experiments:

A. TRADE FOR EXERCISES:

1. Carpentry
2. Fitting
3. House wiring
4. Sheet metal working
5. Smithy
6. Welding
7. Plumbing

B. TRADES FOR DEMONSTRATION AND EXPOSURE:

1. Machining (Lathe & Drilling)
2. Injection moulding
3. Mould making and casting
4. Basic Electronics lab instruments

C. PRESENTATIONS AND VIDEO LECTURES

1. Manufacturing Methods
2. Rapid Prototyping
3. Glass Cutting
4. 3D printing
5. CNC LATHE

D. IT WORKSHOP: Computer hardware, identification of parts, Disassembly, Assembly of computer to working condition, operating system installation.

Note: At least two exercises from each trade.

Suggested Readings:

1	Venugopal, K, "*Workshop Manual*", Anuradha Publications, Kumbakonam, TN, 2012
2	K.C. John, "*Mechanical Workshop*‖ 2nd Edn., PHI, 2010.
3	Hajra Choudary, "*Elements of Workshop Technology*‖ Vol. 1, Asian Publishers, Edn., 1993.
4	G.S. Sawhney, "*Mechanical Experiments and Workshop Practice*‖, I.K. International Publishing House, New Delhi, 2009.

FACULTY OF ENGINEERING

Scheme of Instruction & Examination

And

Syllabi

B.E. III and IV Semester

Of

Four Year Degree Programme

In

CSE (AI&ML)

(With effect from the academic year 2020-2021)

As approved in the faculty meeting held on 11.8.2021

Issued by

Dean, Faculty of Engineering
Osmania University, Hyderabad
2021

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SCHEME OF INSTRUCTION & EXAMINATION
B.E. - III SEMESTER
CSE (AI&ML)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P / D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	BS207MT	Mathematics – III (Probability & Statistics)	3	-	-	3	30	70	3	3
2	HS105CSM	Finance and Accounting	3	-	-	3	30	70	3	3
3	PC301CSM	Data Structures and Algorithms	3	-	-	3	30	70	3	3
4	ES302EC	Digital Electronics	3	-	-	3	30	70	3	3
5	ES303CSM	Python Programming	3	-	-	3	30	70	3	3
6	PC304CSM	Automata Languages and Computation	3	-	-	3	30	70	3	3
7	*MC306HS	Gender Sensitization	3	-	-	3	30	70	3	0
Practical/ Laboratory Courses										
8	PC 351 CSM	Data Structures and Algorithms Lab	-	-	2	2	25	50	3	1
9	PC 352 CSM	Python Programming Lab	-	-	2	2	25	50	3	1
			21	**-**	**4**	**25**	**260**	**590**	**-**	**20**

PC: Professional Course
HS: Humanities and social Science
L: Lecture **T**: Tutorial
CIE: Continuous Internal Evaluation,
PE: Professional Elective,
MC: Mandatory Course
P: Practical **D**: Drawing
SEE: Semester End Examination (Univ. Exam)

Note:
1. Each contact hour is a Clock Hour
2. The practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.

(Dr Abdul Rasool, Lords)

13/7/23
(Dr DVSS Subrahmanyam) KMEC

B.E III SEMESTER Syllabus

Computer Science and Engineering (AI & ML)

Course Code	Course Title						Core/Elective
BS207MT	**Mathematics – III (Probability & Statistics)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering
- To provide an overview of probability and statistics to engineers

Course Outcomes

After completing this course, the student will be able to:

1. Solve field problems in engineering involving PDEs.
2. They can also formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data.

UNIT-I: Introduction of Probability, Conditional probability, Theorem of Total probability, Baye's Theorem and its applications, Random variables, Types of random variables, Probability mass function and Probability density function, Mathematical expectations.

UNIT-II: Discrete probability distributions: Binomial and Poisson distributions, Mean, variance, moment generating function and evaluation of statistical parameters for these distributions, Moments, Skewness and Kurtosis.

UNIT-III: Continuous probability distributions, Uniform, Exponential and Normal distributions, Mean, variance, moment generating function and evaluation of statistical parameters for these distributions

UNIT-IV: Curve fitting by the method of least squares: Fitting of straight lines, second degree parabolas and more general curves, Correlation, regression and Rank correlation. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

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UNIT-V: Test for single mean, difference of means and correlation coefficients, test for ratio of variances, Chi-square test for goodness of fit and independence of attributes, -control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits – Acceptance sampling

Suggested Readings:

1. R.K.Jain & Iyengar, "Advanced Engineering Mathematics", Narosa Publications.
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.
3. P.Sivaramakrishna Das & C.Vijaya Kumar, "Engineering Mathematics" , Pearson India Education Services Pvt. Ltd.
4. N.P. Bali & M. Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications, 2010.
5. S.C.Gupta & V.K.Kapoor, "Fundamentals of Mathematical Statistics" , S.Chand Pub.
6. P. G. Hoel, S. C. Port & C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, 2003.
7. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, Wiley, 1968.

Course Code	Course Title						Core/ Elective
HS105CSM	**Finance and Accounting**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The course will introduce the students

- To provide basic understanding of Financial and Accounting aspects of a business unit
- To provide understanding of the accounting aspects of business
- To provide understanding of financial statements
- To provide the understanding of financial system
- To provide inputs necessary to evaluate the viability of projects
- To provide the skills necessary to analyse the financial statements

Course Outcomes

After successful completion of the course the students will be able to

1. Evaluate the financial performance of the business unit.
2. Take decisions on selection of projects.
3. Take decisions on procurement of finances.
4. Analyse the liquidity, solvency and profitability of the business unit.
5. Evaluate the overall financial functioning of an enterprise.

UNIT-I

Basics of Accounting: Financial Accounting–Definition- Accounting Cycle – Journal - Ledger and Trial Balance-Cash Book-Bank Reconciliation Statement (including Problems)

UNIT-II

Final Accounts: Trading Account-Concept of Gross Profit- Profit and Loss Account-Concept of Net Profit- Balance Sheet (including problems with minor adjustments)

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UNIT-III

Financial System and Markets: Financial System-Components-Role-Considerations of the investors and issuers- Role of Financial Intermediaries. Financial Markets-Players- Regulators and instruments - Money Markets Credit Market- Capital Market (Basics only)

UNIT-IV

Basics of Capital Budgeting techniques: Time Value of money- Compounding-Discounting- Future Value of single and multiple flows- Present Value of single and multiple Flows- Present Value of annuities- Financial Appraisal of Projects– Payback Period, ARR-NPV, Benefit Cost Ratio, IRR (simple ratios).

UNIT-V

Financial statement Analysis: Financial Statement Analysis- Importance-Users-Ratio Analysis-liquidity, solvency, turnover and profitability ratios.

Suggested Readings:

1. Satyanarayana. S.V. and Satish. D., Finance and Accounting for Engineering, Pearson Education
2. Rajasekharan, Financial Accounting, Pearson Education
3. Sharma. S.K. and Rachan Sareen, Financial Management, Sultan Chand
4. Jonathan Berk, Fundamentals of Corporate Finance, Pearson Education
5. Sharan, Fundamentals of Financial Management, Pearson Education

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Course Code	Course Title						Core / Elective
PC301CSM	**Data Structures and Algorithms**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Objectives:

1. To develop proficiency in the specification, representation, and implementation of abstract data types and data structures.
2. To discuss the linear and non-linear data structures and their applications
3. To introduce the creation, insertion and deletion operations on binary search trees and balanced binary search trees.
4. To introduce various internal sorting, searching techniques and their time complexities

Outcomes:

After completing this course, the student will be able to:

1. Understand the importance of abstract data type and implementing the concepts of data structureusing abstract data type.
2. Evaluate an algorithm by using algorithmic performance and measures.
3. Distinguish between linear and non-linear data structures and their representations in the memoryusing array and linked list.
4. Apply the suitable data structure for a real world problem and think critically for improvement insolutions.
5. Determine the suitability of the standard algorithms: Searching, Sorting and Traversals

UNIT – I
Algorithms: Introduction, Algorithm Specifications, Recursive Algorithms, Performance Analysis ofan algorithm- Time and Space Complexity, Asymptotic Notations. **Arrays:**Arrays-ADT,Polynomials,Sparsematrices,Strings-ADT,PatternMatching.
UNIT – II
StacksandQueues: Stacks, Stacks using Arrays, Stacksusingdynamicarrays,Evaluation ofExpressions –EvaluatingPostfixExpression,InfixtoPostfix. **Queues:** Queues ADT, operations, Circular Queues, Applications

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UNIT – III

Linked Lists: Singly Linked Lists and Chains, Linked Stacks and Queues,Polynomials, Operations forCircularly linked lists, Equivalence Classes,Sparsematrices,DoublyLinkedLists.

Hashing: Static Hashing, Hash Tables, Hash Functions, Overflow Handling, Theoretical Evaluation ofOverflow Techniques

UNIT – IV

Trees: Introduction, Binary Trees, Binary Tree Traversals, Heaps, BinarySearch trees (BST) : Definition, Searching an element, Insertion into a BST,Deletion from a BST.

Efficient Binary Search Trees: AVL Trees: Definition, Searching an element, Insertion into aAVL

UNIT – V

Graphs: Graph Abstract Data Type, Elementary Graph operations (DFS and BFS), Minimum CostSpanning Trees (Prim_s and Kruskal_s Algorithms).
Sorting and Searching: Insertion sort, Quick sort, Best computing time for Sorting, Merge sort, Heapsort, shell sort, Sorting on Several Keys, List and Table Sorts, Summary of Internal Sorting, Linear and
Binary Search algorithms.

SuggestedBooks:

1.Horowitz E, Sahni S and Susan Anderson-Freed, Fundamentals ofDatastructuresinC, 2nd Edition(2008),UniversitiesPress

ReferenceBooks:

1. Mark A Weiss, Data Structures and Algorithm Analysis In C, SecondEdition(2002),Pearson
2. Kushwaha D. S and Misra A.K, Data structures A ProgrammingApproachwithC,SecondEdition(2014),PHI.
3. Gilberg R. F and Forouzan B. A,Data structures: A PseudocodeApproachwithC,SecondEdition(2007),CengageLeaming
4. Tanenbaum A. M ,Langsam Y.Augenstein M. J,Data StructuresusingC,SecondEdition(2008),Pearson.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L Rivest, CliffordStein,IntroductiontoAlgorithms,ThirdEdition(2009),MITPress
6. YedidyahLangsam, MosheJ.Augenstein ,AaronM.Tenenbaum, Data Structures Using C and C++ , Second Edition(2009),PHI

Course Code	Course title						Core/ Elective
ES302EC	**Digital Electronics**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To learn the principles of digital hardware and support given by it to the software.
- To explain the operation and design of combinational and arithmetic logic circuits.
- To design hardware for real world problems.

Course Outcomes

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

1. Understand the design process of digital hardware, use Boolean algebra to minimize the logical expressions and optimize the implementation of logical functions.
2. Understand the number representation and design combinational circuits like adders, MUX etc.
3. Design Combinational circuits using PLDS and write VHDL code for basic gates and combinational circuits.
4. Analyse sequential circuits using flip-flops and design registers, counters.
5. Represent a sequential circuit using Finite State machine and apply state minimization techniques to design a FSM

UNIT – I

Design Concepts: Digital Hardware, Design process, Design of digital hardware. Introduction to logic circuits – Variables and functions, Logic gates and networks. Boolean algebra, Synthesis using gates, Design examples. Optimized implementation of logic functions using K-Map and Quine-McCluskey Tabular method

UNIT – II

Number representation: Addition and Subtraction of signed and unsigned numbers.

Combinational circuit building blocks: Half adder, Full adder, Multiplexers. Decoders. Encoders. Code converters, BCD to 7-segment converter, Arithmetic comparator circuits.

UNIT – III

Design of combinational circuits using Programmable Logic Devices (PLDs): General structure of a Programmable Array Logic (PAL), Programmable Logic Arrays(PLAs), Structure of CPLDs and FPGAs, 2- input and 3-input lookup tables (LUTs)

Introduction to Verilog HDL: Verilog code for basic logic gates, adders, decoders.

UNIT – IV

Sequential Circuits: Basic Latch, Gated SR Latch, gated D Latch, Master-Slave edge triggered flip-flops, T Flip-flop, JK Flip-flop, Excitation tables. Registers, Counters, Verilog code for flip-flops.

UNIT – V

Synchronous Sequential Circuits: Basic Design Steps, Finite State machine (FSM) representation using Moore and Mealy state models, State minimization, Design of FSM for Sequence Generation and Detection, Algorithmic State Machine charts.

Suggested Readings:

1. Morris Mano and Michael D CIletti, Digital Design, Pearson, fourth edition,2008
2. Zvi Kohavi, Switching and Finite Automata Theory, 3rd ed., Cambridge University Press-New Delhi, 2011.
3. R. P Jain, Modern Digital Electronics,4th ed., McGraw Hill Education (India) Private Limited, 2003
4. Ronald J.Tocci, Neal S. Widmer &Gregory L.Moss, "Digital Systems: Principles and Applications," PHI, 10/e, 2009.
   Samir Palnitkar, "Verilog HDL A Guide to Digital Design and Synthesis," 2nd Edition, Pearson Education, 2006.

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Course Code	Course title						Core/ Elective
ES303CSM	**PYTHON PROGRAMMING**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

To learn

- Learn Syntax and Semantics and create Functions in Python.
- Handle Strings and Files in Python.
- Understand Lists, Dictionaries and Regular expressions in Python.
- Implement Object Oriented Programming concepts in Python
- Build Web Services and introduction to Network and Database Programming in Python.

Course Outcomes

After learning the contents of this course the student is able to

- Examine Python syntax and semantics and be fluent in the use of Python flow control and functions. Demonstrate proficiency in handling Strings and File Systems.
- Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Implement exemplary applications related to Network Programming, Web Services and Databases in Python

UNIT – I: Python Basics, Objects- Python Objects, Standard Types, Other Built-in Types, Internal Types, Standard Type Operators, Standard Type Built-in Functions, Categorizing the Standard Types, Unsupported Types

Numbers - Introduction to Numbers, Integers, Floating Point Real Numbers, Complex Numbers, Operators, Built-in Functions, Related Modules (object, class, method creation, calling).**Sequences -** Strings, Lists, Tuples, Mapping and Set Types.

UNIT - II

FILES: File Objects, File Built-in Function [open()], File Built-in Methods, File Built-in Attributes, Standard Files, Command-line Arguments, File System, File Execution, Persistent Storage Modules, Related Modules

Exceptions: Exceptions in Python, Detecting and Handling Exceptions, Context Management, *Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions, *Creating Exceptions, Why Exceptions (Now)?, Why Exceptions at All?, Exceptions and the sys Module, Related Modules: Modules and Files, Namespaces, Importing Modules, Importing Module Attributes, Module Built-in Functions, Packages, Other Features of Modules.

UNIT - III

Regular Expressions: Introduction, Special Symbols and Characters, Res and Python

Multithreaded Programming: Introduction, Threads and Processes, Python, Threads, and the Global Interpreter Lock, Thread Module, Threading Module, Related Modules

UNIT - IV

Web Basics: HTTP protocol, HTML, URL Basics, Web server, Web Framework, Introduction to WSGI.

FLASK Basics: FLASK installation, Basic Structure of application, Routing, variable rules, URL building, HTTP methods, Template, static files.

FLASK Advance: Request object, Response object, sending form data to template, Redirect errors, message flashing, file uploading, define and access database.

UNIT - V

Database Programming: Introduction, Python Database Application Programmer's Interface (DB-API), Object Relational Managers (ORMs), Related Modules.

TEXT BOOKS:

1. Core Python Programming, Wesley J. Chun, Second Edition, Pearson. **(UNIT 1, UNIT 2, UNIT3, UNIT5)**
2. Flask Web Development, 2nd Edition, Miguel Grinberg, March 2018, O'Reilly Media, Inc., **(UNIT 4)**

REFERENCE BOOKS:

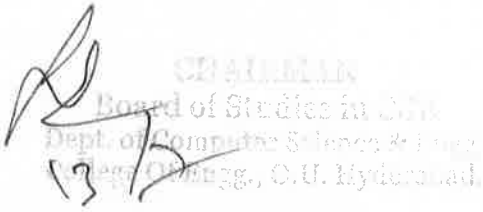
1. Think Python, Allen Downey, Green Tea Press

2. Introduction to Python, Kenneth A. Lambert, Cengage

3. Python Programming: A Modern Approach, Vamsi Kurama, Pearson

4. Learning Python, Mark Lutz, O'Reilly

5. Flask Framework Cookbook - Second Edition, Shalabh Aggarwal, July 2019, Packt Publishing.



Course Code	Course title						Core/ Elective
PC404CSM	**AUTOMATA LANGUAGES AND COMPUTATION**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	-	-	-	**30**	**70**	**3**

Course Objectives

- → Develop a formal notation for strings, languages and machines.
- → Design finite automata to accept a set of strings of a language.
- → Design context free grammars to generate strings from a context free language and Convert them into normal forms.
- → Identify the hierarchy of formal languages, grammars and machines.
- → Distinguish between computability and non-computability and Decidability and undecidability.

Course Outcomes :After learning the contents of this course the student is able to

1. Write a formal notation for strings, languages and machines, Design finite automata to accept a set of strings of a language.
2. Design context free grammars to generate strings of context free languages.
3. Determine equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars
4. Write the hierarchy of formal languages, grammars and machines.
5. Distinguish between computability and non-computability and Decidability and undecidability.

UNIT-I

Introduction: Finite state automata, Non-deterministic finite state automata, FA with ϵ-transitions, Regular expressions, Applications of FA, Properties of regular sets, Pumping Lemma, Closure properties,

Myhill-Nerode Theorem, Minimization of FA.

UNIT-II

Context Free Grammars and Languages: Derivations, Parse-trees, Ambiguity in Grammars and Languages. Pushdown Automata–Definitions, The languages of PDA, Equivalence of PDAs and CFGs, Deterministic Pushdown Automata.

UNIT-III

Properties of CFLs: Normal forms for CFGs, Pumping Lemma, Closure properties, Deterministic Context Free Languages, Decision properties.

UNIT-IV

Turing Machines: Introduction, Computational Languages and Functions, Techniques for construction of Turing machines. Modifications of TM, TM as enumerator, Restricted TM.

UNIT-V

Undecidability: Recursive and Recursively enumerable languages, UTM and undecidable problem, Rice Theorem, Post's correspondence problem. Chomsky's Hierarchy–Regular grammars, Unrestricted grammar, CSL, Relationship between classes of languages.

Suggested Books:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman,

Suggested Reference Books:

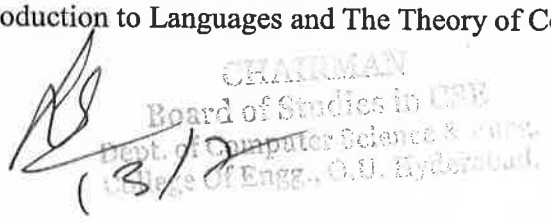
1. Zvi Kohavi, Switching and Finite Automata Theory, TMH, 1976

2. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.

3. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.

4. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.

5. John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill.



Course Code	Course Title						Core/ Elective
*MC406HS	GENDER SENSITIZATION						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	0

Course Objectives:

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Course Outcomes:

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and How to counter it.
- Students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.

UNIT – I

Understanding Gender: Why Should We Study It? Socialization: Making Women, Making Men: Introduction-Preparing for Womanhood-Growing up male-First lessons in caste-Different Masculinities; Just Relationships: Being Together as Equals: Mary Kom and Onler-Love and acid just do not mix-Love Letters-Mothers and Fathers-Further reading: Rosa Parks-The brave heart.

UNIT – II

Gender and Biology: Missing Women: Sex selection and Its Consequences – Declining sex ratio. Demographic Consequences; Gender

Spectrum: Beyond the Binary – Two or many – Struggles with discrimination; Our Bodies, Our Health.

UNIT - III

Gender and Labour: Housework: the Invisible Labour: "My mother doesn't work"- Share the Load"; Women's Work; Its Politics and Economics: Fact and fiction-Unrecognized and unaccounted work- Wages and conditions of work.

UNIT - IV

Issues of Violence: Sexual Harassment: Say No! : Sexual harassment – not eve-teasing-Coping with everyday harassment-"Chupulu"; Domestic Violence: Speaking Out: Is home a safe place? When women unite-Rebuilding lives-New forums for justice; thinking about Sexual Violence: Blaming the victim – "I fought for my life". The caste face of violence

UNIT - V

Gender Studies: Knowledge - Through the Lens of Gender - Point of view - Gender and the structure of knowledge – Unacknowledged women artists of Telangana: Who's History?

Questions for Historians and Others: Reclaiming a past-Writing other histories-Missing pages from modern Telangana history.

Suggested Readings:

1. A.Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, VasudhaNagarajAsmaRasheed, GoguShyamala, Deepa Srinivas and Susie Tharu, "Towards a World of Equals: A Bilingual Textbook on Gender" Telugu Akademi, Hyderabad, 1st Edition, 2015.
2. www.halfthesky.cgg.gov.in

Course Code	Course Title						Core/ Elective
PC351CSM	**Data Structures And Algorithms Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-		-	-	2	**25**	**50**	**1**

Objectives:

1. To develop skills to design and analyse simple linear and nonlinear data structures, suchas stacks, queues and lists and their applications.
2. To gain programming skills to implement sorting and searching algorithms
3. To Strengthen the ability to identify and apply the suitable data structures for the given real world problem
4. To Gain knowledge in practical applications of data structures

Outcomes:

After completing this course, the student will be able to:

1. Implement various data structures using arrays, linked lists
2. Develop ADT necessary for solving problems based on Stacks and Queues
3. Implement binary trees, general tree structures, advanced search trees, heaps, graphs.
4. Implement hash functions and handle collisions
5. Implement various kinds of sorting techniques and apply appropriate techniques for solving a given problem

List of Experiments (Using C programming Language):

1. Implementation of Stacks and Queues using Arrays.
2. Implementation of Circular Queue.
3. Implementation of Infix to Postfix Conversion,Postfix ExpressionEvaluation.
4. Implementation of SinglyLinkedList
5. Implementation of DoublyLinkedList.
6. Implementation of CircularLinkedList.
7. Implementation of Stacks,Queues using Linked Lists.
8. Implementation of BinarySearch and Hashing
9. Implementation of Operations on Binary Tree (Delete Entire Tree,Copy Entire Tree, Mirror Image, Level Order, Search for a Node etc.)
10. Implementation of Tree Traversals on Binary Trees.
11. Implementation of BinarySearch Tree. (Insertion, Deletion and Search operations)
12. Implementation of operations onAVL Trees.

13. Implementationof Traversal on Graphs.
14. Implementation of Prims and Kruskals Algorithm.
15. Implementation of Selection,Merge,Quick,Heap,and InsertionSort.

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Course Code	Course Title						Core/ Elective
PC352ES	**Python Programming Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-		-	-	**2**	**25**	**50**	**1**

Course Objectives:

- To be able to introduce core programming basics and program design with functions using Python programming language.
- To understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques.
- To understand the high-performance programs designed to strengthen the practical expertise.

Course Outcomes: After learning the contents of this course the student is able to

- Explore Basics of Python programming
- Understand the concepts of Decision Making and Functions in Python

List of Programs:

1. Write the following classes with class variables, instance variable and illustration the self variable
   i) Robot (to greet the world)
   ii) ATM (to deposit and withdraw amount from ATM machine)
2. Make a class called Restaurant. The __init__() method for Restaurant should store two attributes: a restaurant_name and a cuisine_type. Make a method called describe_restaurant() that prints these two pieces of information, and a method called open_restaurant() that prints a message indicating that the restaurant is open. Create three different instances from the class, print the two attributes individually, and then call both methods for each instance.
3. Write a program to check whether the given number is Consecutive Four Sum Number or not. Consecutive Four Sum Number: A positive integer is called a `Consecutive Four Sum (CFS) number' if that number can be expressed as the sum of four consecutive positive integers.
4. Given a positive integer 'x' (with even number of digits in it), compute the difference between the sum of the digits occurring in the alternate positions (starting from the first position) and the sum of the digits occurring in the alternate positions, starting from the last rightmost position of 'x'.

5. Given a number A which contains only digits 0's and 1's. Your task is to make all digits the same by just flipping one digit (i.e. 0 to 1 or 1 to 0) only. If it is possible to make all the digits the same by just flipping one digit then print 'YES' else print 'NO'.
6. Write a program to create a list of tuples from a given list having a number and its cube in each tuple.
7. A professor calls out student IDs of students one by one while marking attendance. He notices that the number of students recorded in the attendance sheet is far more than the number of students who are actually present in the classes. Hence, he decides to use a chitti, the robot which can record the students' voices and keep track of which students have responded to attendance calls. At the end of each session, the robot outputs the student IDs of the students who have responded to attendance calls. With this information, the professor needs your help to find out which students were absent. Write a program which takes an integer array denoting the student IDs recorded by the robot and print the list of student IDs of the students which were absent in increasing order.

   Input Format: The first line of input contains a single integer n denoting the number of students. The second line contains n space-separated integers a1,a2....and denoting the student IDs recorded by the robot. The students have IDs from 1 to n, inclusive.

   Output Format: Print a single line containing the student IDs of the students which were absent, space-separated and in increasing order.
8. Let us assume paper as the plane and a letter as a curve on the plane, then each letter divides the plane into regions. For example letters "A", "D", "O", "P", "R" divide the plane into two regions so we say these letters each have one hole. Similarly, the letter "B" has two holes and letters such as "C", "E", "F", "K" have no holes. We say that the number of holes in the text is equal to the total number of holes in the letters of the text. Write a program to determine how many holes are in a given text.
9. Write a program to print each line of a file in reverse order. Also compute the number of characters, words and lines in a file.
10. Write a function named collatz() that has one parameter named number. If the number is even, then collatz() should print number // 2 and return this value. If number is odd, then collatz() should print and return 3 * number + 1. Then write a program that lets the user type in an integer and that keeps calling collatz() on that number until the function returns the value 1. (Amazingly enough, this sequence actually works for any integer—sooner or later, using this sequence, you'll arrive at 1! Even mathematicians aren't sure why. Your program is exploring what's called the Collatz sequence, sometimes called "the simplest impossible math problem.")

    The input and output of this program could look something like this:

    Input=

    Enter number: 3

    Output=

    10 5 16 8 4 2 1

    Input Validation Add try and except statements to the previous project to detect whether the user types in a non-integer string. Normally, the int() function will raise a ValueError error if it is passed a non-integer string, as in int('puppy'). In the except clause, print a message to the user saying they must enter an integer.

11. Say you have the boring task of finding every phone number and email address in a long web page or document. Write a program to search for the phone numbers and email addresses from a given text file and store them in a separate text file.
12. Using Python flask, develop a Government "E-Seva E-Pass Portal" to support the COVID management team to provide travel passes for the citizens to travel from one location to another location.

TEXT BOOKS:

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning.

2. Think Python First Edition, by Allen B. Downey, Orielly publishing

REFERENCES:

1. Introduction to Computation and Programming Using Python. John V. Guttag, The MIT Press.

2. James Payne, Beginning Python using Python 2.6 and Python 3, Wrox publishing

3. Paul Gries, Practical Programming: An Introduction to Computer Science using Python 3,The Pragmatic Bookshelf, 2nd edition (4 Oct. 2013)

4. Charles Dierach, Introduction to Computer Science using Python

SCHEME OF INSTRUCTION & EXAMINATION
B.E. - IV SEMESTER

(AI&ML)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/W	CIE	SEE	Duration in Hrs	
Theory Courses										
1	HS104EG	Effective Technical Communication in English	3	-	-	3	30	70	3	3
2	PC401CSM	Design and Analysis of Algorithms	3	-	-	3	30	70	3	3
3	PC402CSM	Database Management Systems	3	-	-	3	30	70	3	3
4	PC403CSM	Software Engineering	3	-	-	3	30	70	3	3
5	PC404CSM	Introduction to Machine Learning	3	1	-	4	30	70	3	4
6	PC405CSM	Java Programming	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
7	PC451CSM	Database Management Systems Lab	-	-	2	2	25	50	3	1
8	PC452CSM	Machine Learning Lab	-	-	2	2	25	50	3	1
9	PC453CSM	Java Programming Lab	-	-	2	2	25	50	3	1
			18	**1**	**6**	**25**	**255**	**570**	-	**22**

(Dr Abdul Basood) CDRDs 13/7

13/7/23
(Dr DVSS Subrahmanyam) KMEC

13/7/23 (Dr. T. Prem Chander)

B.E IV SEMESTER Syllabus Computer Science and Engineering (AI & ML)

Course Code	Course Title						Core/Elective
HS104EG	**Effective Technical Communication in English**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

To expose the students to:

- Features of technical communication
- Types of professional correspondence
- Techniques of report writing
- Basics of manual writing
- Aspects of data transfer and presentations.

Course Outcomes

On successful completion of the course, the students would be able to:

1. Handle technical communication effectively
2. Use different types of professional correspondence
3. Use various techniques of report writing
4. Acquire adequate skills of manual writing
5. Enhance their skills of information transfer and presentations

UNIT-I

Definition and Features of Technical communication: Definition and features of technical communication (precision, relevance, format, style, use of visual aids), Differences between general writing and technical writing, Types of technical communication (oral and written)

UNIT-II

Technical Writing-I (Official correspondence): Emails, IOM, Business letters, Business proposals.

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UNIT-III

Technical writing-II (Reports): Project report, Feasibility report, Progress report, Evaluation report.

UNIT-IV

Technical writing- III (Manuals): Types of manuals, User manual, Product manual, Operations manual.

UNIT-V

Information Transfer and Presentations: Non-verbal (bar diagram, flow chart, pie chart, tree diagram) to verbal (writing), Verbal (written) to non-verbal, Important aspects of oral and visual presentations.

Suggested readings:

1. Raman, Meenakshi & Sharma, Sangeeta. (2015). *Technical Communication: Principles and Practice*
(3rd ed.). New Delhi, OUP.

2. Rizvi, Ashraf, M. (2017). *Effective Technical Communication* (2nd ed.). New Delhi, Tata McGraw Hill Education.

3. Sharma, R. C., & Mohan, Krishna. (2017). *Business Correspondence and Report Writing: A Practical Approach to Business & Technical Communication* (4th ed.). New Delhi, Tata McGraw Hill Education.

4. Tyagi, Kavita &Misra, Padma. (2011). *Advanced Technical Communication*. New Delhi, PHI Learning.

5. Jungk, Dale. (2004). *Applied Writing for Technicians*. New York, McGraw-Hill Higher Education.

Course Code	Course Title						Core/ Elective
PC401CSM	**Design And Analysis Of Algorithms**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Data Structures	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Analyze the asymptotic performance of algorithms
- Write rigorous correctness proofs for algorithms
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis
- Synthesize efficient algorithms in common engineering design situations.

Course Outcomes After learning the contents of this course the student is able to:

1. Analyze the performance of algorithms.
2. Choose appropriate algorithm design techniques for solving problems.
3. Apply the Dynamic programming to solve problems of the real world.
4. Solve problems Which use Graphs as their data structure.
5. Distinguishes NP class of problems.

UNIT I

Introduction: Algorithm definition, and specification, asymptotic analysis – best, average, and worst-case behavior; Performance measurements of Algorithms, Time and Space complexities, Analysis of recursive algorithms.

Basic Data Structures: Disjoint set operations, union and find algorithms, Dictionaries, Graphs, Trees.

UNIT II

Divide and Conquer: General method, Control abstraction, Merge sort, Quicksort – Worst, Best and average case. Binary search.

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Greedy method: General method, applications- Knapsack problem, Job sequencing with deadlines, Minimum cost spanning trees, Single source shortest path problem.

UNIT III

Dynamic Programming: General Method, applications- All pairs shortest path problem, Optimal binary search trees, 0/1 knapsack problem, Reliability design, Traveling salesperson problem.

Backtracking: General method, Recursive backtracking algorithm, Iterative backtracking method. 8-Queen problem, Hamiltonian Cycle, 0/1 Knapsack Problem.

Branch and Bound: Control abstractions for Least Cost Search, Bounding, FIFO branch and bound, LC branch and bound, 0/1 Knapsack problem – LC branch and bound and FIFO branch and bound solution, Traveling salesperson problem.

UNIT IV

Graph Algorithms: Graph Traversals DFS, BFS, Transitive Closure, Directed Acyclic Graphs - Topological Ordering, Network Flow algorithms.

Tries: Standard Tries, Compressed Tries, Suffix Tries, Search Engine Indexing. External Searching and B-Trees: (a, b) Trees, B-Trees

UNIT V

Computational Complexity: Non Deterministic algorithms, The classes: P, NP, NP Complete, NP Hard, Satisfiability problem, Proofs for NP Complete Problems: Clique, Vertex Cover.

Parallel Algorithms: Introduction, models for parallel computing, computing with complete binary tree.

REFERENCES

1. E. Horowitz, S. Sahni, Fundamentals of Computer Algorithms.

2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.

3. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.

4. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.

Course Code	Course Title						Core/ Elective
PC402CSM	**DATABASE MANAGEMENT SYSTEMS**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

• : To learn

- The basic concepts and the applications of database systems.
- To master the basics of SQL and construct queries using SQL.
- Topics include data models, database design, relational model, relational algebra, transaction control, concurrency control, storage structures and access techniques.

Course Outcomes:

After learning the contents of this course the student is able to

- Understand the basic concepts and the applications of database systems
- Design ER-models to represent simple database application scenarios.
- Master the basics of SQL and construct queries using SQL.
- Demonstrate creation and usage of Triggers, Views and Stored Procedures using SQL.
- Recognize and identify the use of normalization and functional dependency in database design.
- **Apply** and **relate** various advances SQL queries related to Transaction Processing & Locking using concept of Concurrency control.
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS

UNIT - I

Database System Applications: File Systems versus a DBMS, the Data Model, Levels of Abstraction in a DBMS, Data Independence, Structure of a DBMS, Advantages of DBMS

Introduction to Database Design: Database Design and ER Diagrams, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design With the ER Model

UNIT – II

Introduction to the Relational Model: Data Definition Language, Integrity constraint over relations, Types of Integrity Constraints Domain Constraint-String, character, Integer, date, Entity Integrity Constraint-, Primary Key, Referential Integrity Constraint-Foreign Key, Other Key Constraint – NULL,NOT NULL,CHECK and etc. querying relational data, logical data base design, introduction to views, destroying/altering tables and views.

UNIT - III

Introduction to SQL : Select Queries, Constraints: Data Manipulation Language –Insert ,Delete, Update, form of basic SQL query , UNION, INTERSECT, and EXCEPT, Nested Queries, Co-related Queries aggregation operators, NULL values, complex integrity constraints in SQL.

Concept of Joins: Join, Outer Join, Left Outer Join, Right Outer Join, Self Join

Schema Refinement : Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, FIRST, SECOND, THIRD normal forms, BCNF, lossless join decomposition, multi-valued dependencies, FOURTH normal form, FIFTH normal form.

UNIT - IV

Introduction to Transactions: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, Lock Based Protocols, Timestamp Based Protocols, Validation- Based Protocols, Multiple Granularity, Recovery and Atomicity, Log–Based Recovery, Recovery with Concurrent Transactions. TCL Commands – Save point Commit and Rollback

UNIT – V

Overview of Triggers,Stored Procedures:triggers-Row level table level and active databases, Stored Procedures IN, OUT parameters, Execution of Stored Procedure from Java.

DBA – Introduction to DBA, Creating Users, Grant/Revoke Permissions on tables using DML Commands.

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TEXT BOOKS:

1.DatabaseManagementSystems,RaghuramaKrishnan,JohannesGehrke,TataMcGrawHill,3rd Edition**(UNITS - I ,II,III).**

2. Database System Concepts, Silberschatz, Korth,McGrawHill,**(UNITS - IV ,V)**

REFERENCES:

1. Database Systems design, Implementation and Management, Peter Rob & Carlos Coronel 7th Edition.

2. Fundamentals of Database Systems, Elmasri Navrate, *Pearson Education*

3. Introduction to Database Systems, C. J. Date, *Pearson Education*

4. Oracle for Professionals, The X Team, S.Shah and V.Shah, *SPD.*

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Course Code	Course Title				Core/Elective		
PC403CSM	**SOFTWARE ENGINEERING**						**Core**
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	-	-	**30**	**70**	**3**

Course Objectives

- To introduce the basic concepts of software development- processes from defining a product to shipping and maintaining that product
- To impart knowledge on various phases, methodologies and practices of software development
- To understand importance of software modelling using UML.
- To understand the importance of testing in software development and study various testing strategies and software quality metrics.

Course Outcomes:

Students will be able to:

- Acquire knowledge about different software development processes and their usability in different problem domains.
- Understand the process of requirements collection, analysing, and modelling requirements for effective understanding and communication with stakeholders.
- Design and develop the architecture of real world problems towards developing a blueprint for implementation.
- Use the UML language to design various models during software development life cycle.
- Understand the concepts of software quality, testing and maintenance.

UNIT-I:

Introduction to Software Engineering: A generic view of Process: Software Engineering, Process Framework, CMM Process Patterns, and Process Assessment.

Process Models: Prescriptive Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, the Unified Models, Personal and Team Process Models, Process Technology, Product and Process.

An Agile View of Process: Introduction to Agility and Agile Process, Agile Process Models.

UNIT-II:

Requirements Engineering: A Bridge to Design and Construction, Requirements Engineering Tasks, Initiating Requirements Engineering Process,

Eliciting Requirements, Developing Use- Cases, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

Building the Analysis Model: Requirements Analysis Modelling Approaches, Data Modelling Concepts, Object-Oriented Analysis, Scenario-based Modelling, Flow-oriented Modelling, Class-based Modelling, Creating a Behavioural Model.

UNIT-III:

Design Engineering: Design within the context of SE, Design Process and Design Quality, Design Concepts, The Design Model, Pattern-based Software Design.

Creating an Architectural Design: Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design, Assessing Alternative Architectural Designs, Mapping Data Flow into Software Architecture.

UNIT-IV:

Introduction to UML: Importance of Modelling, Principles of Modelling, Conceptual model of the UML, Basic Building Blocks of UML Basic Structural Modelling: Classes, Relationships, Common Mechanisms and Diagrams, Class Diagrams. Modelling techniques for Class Diagrams Basic Behavioural Modelling: Interactions, Interaction diagrams, Use cases, Use case Diagrams, Activity Diagrams, State chart diagrams Architectural Modelling: Component Diagrams and Deployment Diagrams.

UNIT-V:

Software Quality Assurance: Basic Elements, Tasks, Goals and Metrics, Formal Approaches, Statistical Software Quality Assurance, Software Reliability, ISO 9000 Quality Standards, SQA Plan.

Testing Strategies: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for O-O Software, Validation Testing, System Testing, The Art of Debugging.

Testing Tactics: Software Testing Fundamentals, Black-box and White-box Testing, Basis Path Testing, Control Structure Testing.

Suggested Reading:

1. Roger S.Pressman, Software Engineering: A Practitioners Approach, Seventh Edition, McGrawHill, 2009.
2. Grady Booch, James Rumbaugh, Ivor Jacobson, "The Unified Modelling Language-User Guide (Covering UML 2.0)", Second Edition, Pearson Education, India, 2007
3. Ali Behforoz and Frederic J.Hadson, Software Engineering Fundamentals, Oxford University Press, 1996.
4. Pankaj Jalote "An Integrated Approach to Software Engineering, Third Edition, Narosa Publishing house, 2008.

Course Code	Course Title						Core/ Elective
PC403CM	**INTRODUCTION TO MACHINE LEARNING**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives:

- To introduce students to the basic concepts of Data Science and techniques of Machine Learning.
- To develop skills of using recent machine learning software for solving practical problems.
- To gain experience of doing independent study and research.

Course Outcomes: After learning the contents of this course the student is able to

1. Design and implement machine learning solutions of classification, regression problems.
2. Evaluate and interpret the results of the machine learning algorithms.
3. Evaluate exploratory data analysis and Data preparation and preprocessing on different datasets.
4. Calculate Statistical measurements of the given data.
5. Analyze and identify the best algorithm matches for a given dataset.

UNIT – I

Introduction: What is Machine Learning, Use Machine Learning, and Types of Machine Learning Systems: supervised, unsupervised, semi-supervised, Reinforcement Learning, Batch and Online Learning, Main Challenges of Machine Learning.

UNIT – II

Descriptive Statistics: Data representation, types of data- nominal, ordinal, interval and continuous, central tendency- calculating mean mode median, mean vs median, variability, variance, standard deviation, Mean Absolute Deviation using sample dataset, finding the

percentile, interquartile range, Box Plot, Outlier, whisker, calculating correlation, covariance, causation.

Exploratory data analysis, Data preparation and preprocessing, Data visualization.

UNIT – III

Regression: Introduction to Regression analysis, measure of linear relationship, Regression with stats models, Determining coefficient, meaning and significance of coefficients, coefficient calculation with least square method, Types of regression, Simple Linear Regression, Using Multiple features, Polynomial Regression, Metrics for Regression: MSE, RMSE, MAE.

UNIT – IV

Classification: Classification problem, Probability based approach, Logistic Regression- log-odd, sigmoid transformation, Metrics: Confusion Matrix, Accuracy, Error Rate, Precision, Recall, ROC curve, F1 score, and introduction to gradient descent.

UNIT – V

Non Parametric & SVM classification: About Non parametric classification, Decision Trees: Entropy, Gain ratio, Information Gain, Splitting criteria, .

Ensemble Method: Introduction to Random Forest, Accuracy measure & performance

Instance based learning- Introduction, KNN algorithm, Distance measures, model building, locally weighted regression, radial basis functions, SVM classifier, hyper-plane, slack variables, geometric transformation kernel trick, kernel transformation.

TEXT BOOKS / REFERENCES:

1. Booz, Allen, Hamilton, The Field Guide to Data Science
2. AurélienGéron, Hands-On Machine Learning with Scikit-Learn and TensorFlow,O'Reilly Media, 2017-03-10
3. Peter Harrington, Machine Learning in Action, Manning Publications
4. Python For Data Analysis by wes McKinny 2nd edition,O'REILLY publications.
5. Jason Brownlee data analysis for machine learning.

Course Code	Course Title						Core/ Elective
PC401CM	**JAVA PROGRAMMING**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

• : To learn

- The object oriented programming concepts,
- To understand object oriented programming concepts, and apply them in solving problems,
- To introduce the principles of inheritance and polymorphism; and demonstrate how they relate
- To design abstract classes and to introduce the implementation of packages and interfaces,
- To introduce the concepts of exception handling and multithreading.

Course Outcomes:

After learning the contents of this course the student is able to

- Use concepts of OOPs such as data abstraction, inheritance, polymorphism, encapsulation and method overloading principles in structuring computer applications for solving problems.
- Choose appropriate collections to solve programming problems.
- Utilize the concepts of I/O streams and exception handling in a given real time problem.
- Build java applications to utilize advanced mechanisms like multi-threading, database connectivity, etc.
- Apply the concepts and principles of the programming language to the real-world problems and solve the problems through project-based learning

UNIT- I

Object Oriented Programming: Principles, Benefits of Object Oriented Programming.

Introduction to Java: Java buzzwords, bytecode, Java Programming Fundamentals: Applet and Application program using simple java program, data types, variables, arrays, operators, expressions, control statements, type conversion and casting, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, introducing access control, static, final, nested and inner classes, exploring string class, using command-line arguments.

Inheritance: Inheritance concept, types of inheritance, Member access rules, use of super and final. Polymorphism - dynamic binding, method overriding, abstract classes and methods.

UNIT - II

Interfaces: Defining an interface, implementing interfaces, extending interface.

Packages: Defining, Creating and Accessing a Package, importing packages

Exception handling: Benefits of exception handling, classification, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, rethrowing exceptions, built in exceptions, creating own exception sub classes

Multithreading: Java Thread Model, The Main Thread, creating a Thread, creating multiple threads, using is Alive() and join(), thread priorities, synchronization, inter thread communication, deadlock

UNIT- III

Collections: Overview of Java Collection frame work, commonly used Collection classes – Array List, Linked List, Hash Set, Tree Set, Collection Interfaces – Collection, List, Set. Accessing Collection via iterate, working with Map. Legacy classes and interfaces – Vector, Hashtable, Stack, Dictionary, Enumeration interface.

Other Utility classes: String Tokenizer, Date, Calendar, Gregorian Calendar, Scanner

Java Input/Output: exploring java.io, Java I/O classes and interfaces, File, Stream classes, byte stream, character stream, serialization.

UNIT- IV

GUI Programming with java: The AWT class hierarchy, MVC architecture. Applet Revisited: Basics, architecture and skeleton, simple applet program.

Event Handling: Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces. Handling mouse and keyboard events, Adapter classes.

Database Programming using JDBC: Introduction to JDBC, JDBC Drivers & Architecture, CURD operation Using JDBC, Connecting to non-conventional Databases.

UNIT- V

Exploring Swing: JLabel, ImageIcon, JTextField, the Swing buttons, JTabbedpane, JScrollPane, JList, JComboBox.

Servlet: Life cycle, using tomcat, simple servlet, servlet API, javax.servlet package, reading servlet parameters, javax.servlet.http package, handling HTTP requests and responses

Suggested Readings:

1. Herbert Scheldt, "The Complete Reference Java, 7th Edition, Tata McGraw Hill, 2006.
2. James M Slack, Programming and Problem Solving with JAVA, Thomson Learning, 2002.
3. C Thomas Wu, An Introduction to Object Oriented Programming with Java 5th Edition, McGraw Hill Publishing, 2010.
4. H. M. Dietel and P. J. Dietel, Java How to Program, Sixth Edition, Pearson Education /.

Course Code	Course Title						Core/ Elective
PC451CSM	**DATABASE MANAGEMENT SYSTEMS LAB**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**2**	**25**	**50**	**1**

Course Outcomes:

- Design database schema for a given application and apply normalization
- Gather skills in using SQL commands for data definition and data manipulation.
- Develop solutions for database applications using procedures, cursors and triggers

LIST OF EXPERIMENTS

Scenario 1:

Product-Sales database **: SouthWind**

Southwind database is a sample database used by Organization. The database contains the sales data for SouthWind Traders, a foods export-import company. Using this schema to demonstrate how customers can choose and order products, how orders are placed and how those products get delivered to the customer.

Products: This Entity will have all the product details where suppliers will supply products based on customers demand.

Supplies: This Entity will supply the products demanded by the customers. Shippers: This Entity will take the orders from suppliers and deliver to customers. Employees : Employees will monitor the orders placed by customers.

Invoices: This Entity will take care of the billing process based on customer order. Etc..identify some more entities and find out the relationship between them.

A product-sales the above process involves many steps like

1. Analyzing the problem and identifying the Entities and Relationships,
2. E-R Model
3. Relational Model
4. Normalization
5. Creating the database
6. Querying.

Experiment 1: E-R Model

Analyze and come up with the entities in it. Identify what data has to be persisted in the database. This contains the entities, attributes etc.

Identify the primary keys for all the entities. Identify the other keys like Foreign Key and constraints like NULL, NOT NULL, CHECK etc.

Example to create for **products, customers, suppliers, orders, , employees, order details, categories**, among others.

Students should submit E-R diagrams using the above tables.

Experiment 2: Installation & DDL

Installation of Mysql and practicing DDL commands.

Creating databases, How to create tables, altering the database or tables, dropping tables and databases if not required. You will also try truncate, rename commands etc.

Data Definition Language (DDL) : create , alter, drop.

Experiment 3: DML

Data Manipulation Language Commands (DML) commands are used to for managing data within schema objects.

Exercising the commands using **DML :** insert, delete, update on the following tables : products, customers, suppliers, orders, , employees, order details, categories.

- INSERT – insert data into a table.
- UPDATE – updates existing data within a table.
- DELETE – deletes single or all records from a table.

Data Query Language – Select

Populate all the tables designed in experiment : 2 with appropriate data.

Experiment 4: Querying

Practice queries on **Aggregate functions** like count, max , min ,avg ,sum Practice queries like nested queries/co-related queries using ANY, ALL, IN,

Exists, NOT EXISTS, UNION, INTERSECT, groupby
,having etc.

Joins: Join , Left Outer Join, Right Outer Join, Self Join

Experiment 5 : Querying(continued...)

Some example to practice the queries:

- Display all the order details given to a customer.
- Display all the products.
- Get the highest sold product from given supplier ID
- List all products grouped by category
- List the products, whose product unit price is greater than all the products on average.
- List Details of order and customer of each order
- List the products which were sold in year 1997
- Display the total amount for each order
- Display Order Details for given an order ID

Order Details: product name and unit price for

given order ID Exercising Simple to complex Queries

using joins, nested and correlated queries.

Experiment 6 : Stored Procedures :

Create a stored procedure, Alter and Drop a procedure, IN, OUT, IN & OUT parameters

- Create a Procedure to display order details of given customer ID like ordered, order Date , Required Date, Shipped Date
- Create a procedure to accept a customer ID and display the customer order history(product name and how much quantity ordered for that particular product)
  Ex: product name, Total quantity he/she ordered.

- Create a procedure to display Ten Most Expensive Products Columns should be displayed Product name & Unit price

Experiment 7: Views

Create a view to display the current product list which are available(not discontinued)

Create a view to display the products by category

Display product name, quantity Per Unit, units In Stock, Discontinued

Create a view as "Invoices" to display all the information from order, customer, shipper for each "Order Details"

Experiment 8: Triggers

Demonstrate Create Trigger, Alter Trigger, Drop Trigger, Row Level , Table Level triggers, Before Insert ,After Insert, Before Update, After Update, Before Delete, After Delete

Experiment 9 :

Demonstrate the role of DBA using DCL commands

TEXT BOOKS:

1. Raghurama Krishnan, Johannes Gehrke, "Database Management Systems", Tata McGraw Hill, 3rd Edition, 2008.
2. Silberschatz, Korth, "Database System Concepts", McGraw Hill, V edition, 2005.

REFERENCES BOOKS:

1. Rick F. Vander Lans, "Introduction to SQL", Pearson education, 2007.
2. B. Rosenzweig and E. Silvestrova, "Oracle PL/SQL", Pearson education, 2004.
3. Dr. P. S. Deshpande, "SQL & PL/SQL for Oracle 10g", Black Book, Dream Tech, 2006.
4. M. Mc Laughlin, "Oracle Database 11g PL/SQL Programming", TMH, 2017

Course Code	Course Title						Core/ Elective
PC452CSM	MACHINE LEARNING LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	25	50	1

Course Objectives: The objective of this lab is to get an overview of the various machine learning techniques and can able to demonstrate them using python.

- To introduce students to the basic concepts of Data Science and techniques of Machine Learning.
- To develop skills of using recent machine learning software for solving practical problems.
- To gain experience of doing independent study and research.

Course Outcomes:

After the completion of the course the student can able to:

- After learning the contents of this paper the student must be able to design and implement machine learning solutions to classification, regression problems.
- Understand complexity of Machine Learning algorithms and their limitations
- Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own;
- Be capable of performing experiments in Machine Learning using real-world data.
- Able to evaluate and interpret the results of the algorithms.

LIST OF EXPERIMENTS

1. Write a program to demonstrate the following

a) Operation of data types in Python.
b) Different Arithmetic Operations on numbers in Python.
c) Create, concatenate and print a string and access substring from a given string.
d) Append, and remove lists in python.
e) Demonstrate working with tuples in python.
f) Demonstrate working with dictionaries in python.

2. Using python write a NumPy program to compute the

a) Expected Value
b) Mean
c) Standard deviation
d) Variance
e) Covariance
f) Covariance Matrix of two given arrays.

3. For a given set of training data examples stored in a .CSV file, demonstrate Data Preprocessing in Machine learning with the following steps

a) Getting the dataset.
b) Importing libraries.
c) Importing datasets.
d) Finding Missing Data.
e) Encoding Categorical Data.
f) Splitting dataset into training and test set.
g) Feature scaling.

4. Build a linear regression model using python for a particular data set by

a) Splitting Training data and Test data.
b) Evaluate the model (intercept and slope).
c) Visualize the training set and testing set
d) predicting the test set result
e) compare actual output values with predicted values

5. The dataset contains information of users from a company's database. It contains information about UserID, Gender, Age, EstimatedSalary, and Purchased. Use this dataset for predicting that a user will purchase the company's newly launched product or not by Logistic Regression model.

User ID	Gender	Age	EstimatedSalary	Purchased
15624510	Male	19	19000	0
15810944	Male	35	20000	0
15668575	Female	26	43000	0
15603246	Female	27	57000	0
15804002	Male	19	76000	0
15728773	Male	27	58000	0
15598044	Female	27	84000	0
15694829	Female	32	150000	1
15600575	Male	25	33000	0
15727311	Female	35	65000	0
15570769	Female	26	80000	0
15606274	Female	26	52000	0
15746139	Male	20	86000	0
15704987	Male	32	18000	0
15628972	Male	18	82000	0
15697686	Male	29	80000	0
15733883	Male	47	25000	1
15617482	Male	45	26000	1
15704583	Male	46	28000	1

6. a) The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is the probability that a student is absent given that today is Friday? Apply Bayes rule in python to get the result. (Ans: 15%)

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

7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the detection of diabetic patients using standard diabetic Disease Data Set. use Python ML library classes.

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

9. Implement k-nearest neighbor's classification to classify the iris data set using python.

10. Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k-means clustering with 3 means (i.e., 3 centroids)

VAR1	VAR2	CLASS
1.713	1.586	0
0.180	1.786	1
0.353	1.240	1
0.940	1.566	0
1.486	0.759	1
1.266	1.106	0
1.540	0.419	1
0.459	1.799	1
0.773	0.186	1

11. Evaluate the metrics for all types of machine learning algorithms using sample data.

12. Implement an algorithm to demonstrate the significance of SVM.

TEXT BOOKS / REFERENCES:

1. Booz, Allen, Hamilton, The Field Guide to Data Science
2. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn and TensorFlow,O'Reilly Media, 2017-03-10
3. Peter Harrington, Machine Learning in Action, Manning Publications

course Code	Course Title						Core/Elective
PC453CSM	**JAVA Programming Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**2**	**25**	**50**	**1**

Course Objectives

- To build software development skills using java programming for real world applications.
- To implement frontend and backend of an application
- To implement classical problems using java programming.

Course Outcomes

After completing this course, the student will be able to:

1. Develop Java applications using the concepts of Inheritance, interfaces, packages, access control specifiers.
2. Implement the concepts of Exception Handling in java Applications.
3. Read and write data using different Java I/O streams.
4. Create graphical user interfaces and Applets by applying the knowledge of Event Handling.
5. Create robust applications using Java standard class libraries and retrieve data from a database with JDBC.
6. Ability to solve real-world problems by designing user friendly GUI with befitting backend through the APIs of Java.

List of Experiments

1) Write a Java program to illustrate the concept of class with method overloading
2) Write a Java Program that reads a line of integers, and then displays each integer, and the sum of all the integers (Use String Tokenizer class of java. util)
3) Write a Java program to illustrate the concept of Single level and Multi level Inheritance.
4) Write a Java program to demonstrate the Interfaces & Abstract Classes.
5) Write a Java program to implement the concept of exception handling.
6) Write a Java program to illustrate the concept of threading using Thread Class and runnable Interface.
7) Write a Java program to illustrate the concept of Thread synchronization.
8) Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication.
9) Write a Java program to illustrate collection classes like Array List, Linked List, Tree map and Hash map.
10) Write a Java program to illustrate Legacy classes like Vector, Hashtable, Dictionary & Enumeration interface
11) Write a Java program to implement iteration over Collection using Iterator interface and List Iterator interface
12) Write a Java program that reads a file name from the user, and then displays

information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.

13) Write a Java program to illustrate the concept of I/O Streams
14) Write a Java program to implement serialization concept
15) Write a Java applet program to implement Colour and Graphics class
16) Write a Java applet program for handling mouse & key events
17) Write a Java applet program to implement Adapter classes
18) Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result.
19) Write an example for JDBC prepared statement with Result Set
20) Program to get primary key value (auto-generated keys) from inserted queries using JDBC
21) Program to create a simple JList
22) java Program to create a simple checkbox using JCheckBox
23) Program to create a checkbox and ItemListener to it.
24) 1. Write Servlet application to print current date & time
    2. Html & Servlet Communication
    3. Auto refresh a page
    4. Demonstrate session tracking
    5. Select record from database
    6. Application for login page
    7. Insert record into database
    8. Count the visits on web page
    9. Insert teacher record in Database

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FACULTY OF ENGINEERING

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(AICTE Model Curriculum)

and

Syllabi

B.E. V and VI Semesters

Of

Four Year Degree Programme

in

B.E. *CSE (AI&ML)*

Issued by

Dean, Faculty of Engineering

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2022

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SCHEME OF INSTRUCTION & EXAMINATION
B.E. - V SEMESTER
CSE (AI&ML)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact hrs/wk	CIE	SEE	Duration in hrs	
Theory Courses										
1	PC501CSM	Compiler Design	3	-	-	3	30	70	3	3
2	PC502CSM	Artificial Intelligence	3	1	-	4	30	70	3	4
3	PC503CSM	Operating Systems	3	-	-	3	30	70	3	3
4	PC504CSM	Web and Internet Technologies	3	-	-	3	30	70	3	3
5	PC505CSM	Speech and Natural Language Processing	3	-	-	3	30	70	3	3
6	PE-I	Professional Elective-1	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
7	PC551CSM	Artificial Intelligence Lab	-	-	2	2	25	50	3	1
8	PC552CSM	Operating Systems Lab	-	-	2	2	25	50	3	1
9	PW533CSM	Mini Project	-	-	2	2	25	50	3	1
			18	**1**	**6**	**25**	**255**	**570**	**-**	**22**

PROFESSIONAL ELECTIVE -1	
COURSE CODE	COURSE TITLE
PE511	EMBEDDED SYSTEMS
PE512	COMPUTER GRAPHICS
PE513	OBJECT ORIENTED ANALYSIS AND DESIGN
PE514	MACHINE LEARNING FOR DATA SCIENCE
PE515	BLOCK CHAIN TECHNOLOGY

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COMPILER DESIGN

PC 501 CSM
Contact Hours per Week L 3 CIE 30 SEE 70
Credits 3

Course Objectives

1. To understand and list the different stages in the process of compilation.
2. Identify different methods of lexical analysis
3. Design top-down and bottom-up parsers
4. Identify synthesized and inherited attributes
5. Develop syntax directed translation schemes
6. Develop algorithms to generate code for a target machine

Course Outcomes

1. Upon completion of the course, the students will be able to:
2. For a given grammar specification, develop the lexical analyzer.
3. For a given parser specification, design top-down and bottom-up parsers.
4. Develop syntax directed translation schemes.
5. Develop algorithms to generate code for target machine.

UNIT-I

Introduction: The Structure of a Compiler, Phases of Compilation, The Translation Process, Major Data Structures in a Compiler, Bootstrapping and Porting.
Lexical Analysis (Scanner): The Role of the Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, The Lexical Analyzer Generator Lex.

UNIT-II

Syntax Analysis (Parser): The Role of the Parser, Syntax Error Handling and Recovery, Top-Down Parsing, Bottom-Up Parsing, Simple LR Parsing, More Powerful LR Parsing, Using Ambiguous Grammars, Parser Generator Yaac.

UNIT-III

Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's Applications of Syntax-Directed Translation.

Symbol Table: Structure, Operations, Implementation and Management.

UNIT-IV

Intermediate Code Generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Backpatching, Switch-statements, Intermediate Code for Procedures.

Run-time environment: Storage Organization, Stack Allocation of Space, Access to Nonlocal Data on the Stack, Parameter passing, Heap Management and Garbage Collection.

UNIT-V

Code Generation: Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow graphs, Optimization of Basic Blocks, Peephole Optimization, Register Allocation and Assignment.

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Machine-Independent Optimizations: The Principal Sources of Optimizations, Introduction to Data-Flow Analysis.

Suggested Books:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, & Jeffrey D. Ullman , ***Compilers: Principles, Techniques and Tools***, Pearson Education
2. Kenneth C. Louden, ***Compiler Construction: Principles and Practice***, *Thomson Learning Inc., 1997.*

Suggested Reference Books:

1. P.Trembley and P.S.Sorenson, ***The Theory and Practice of Compiler Writing***, TMH-1985.

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ARTIFICIAL INTELLIGENCE

PC 502 CSM

Contact Hours per week L 3 T 1 CIE 30 SEE 70

Credits 4

Course Objectives

1. Understand the importance of the field of AI by discussing its history and various applications.
2. Learn about one of the basic applications of A.I, search state formulations.
3. Learn methods of expressing knowledge by a machine with appropriate reasoning and different mathematics involved behind it
4. Learn how to reason when an agent has only uncertain information about its task.
5. Know various supervised and unsupervised learning algorithms

Course Outcomes

The students will be able to:

1. Formalize a problem in the language/framework of different AI methods
2. Illustrate basic principles of AI in solutions that require problem solving, search, inference
3. Represent natural language/English using Predicate Logic to build knowledge through various representation mechanisms
4. Demonstrate understanding of steps involved in building of intelligent agents, expert systems, Bayesian networks
5. Differentiate between learning paradigms to be applied for an application

UNIT – I

Problem Solving & Search: Introduction- introduction to intelligence Foundations of artificial intelligence (AI). History of AI, Structure of Agents.
Problem Solving - Formulating problems, problem types, states and operators, state space.
Search Strategies. - Informed Search Strategies- Best first search, A* algorithm, heuristic functions, Iterative deepening A*.
Adversarial Search/ Game playing - Perfect decision game, imperfect decision game, evaluation function, alpha-beta pruning.

UNIT – II

Knowledge, Reasoning &Planning: Reasoning - Knowledge based agent, Propositional Logic, Inference, Predicate logic (first order logic),Resolution
Structured Knowledge Representation – Frames, Semantic Nets
Planning - A Simple Planning Agent, Form Problem Solving to Planning, Basic representation of plans, partial order planning, hierarchical planning.

UNIT – III

Expert Systems, Reasoning with Uncertainty: Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System Architecture, Applications. **Uncertainty** - Basic probability, Bayes rule, Belief networks, Inference in Bayesian Networks, Fuzzy sets, and fuzzy logic: Fuzzy logic system architecture, membership function.
Decision Making- Utility theory, utility functions.

UNIT – IV

Learning: Machine-Learning Paradigms: Introduction, Machine Learning Systems, Supervised and Unsupervised Learning, Inductive Learning, Learning Decision Trees
Artificial Neural Networks: Introduction, Artificial Neural Networks, Single-Layer Feed-Forward Networks, Multi-Layer Feed-Forward Networks
Reinforcement learning: Learning from rewards, Passive and Active reinforcement learning, Applications.

UNIT – V

Communicating & Perceiving: Introduction to NLP- Progress & applications of NLP, Components of NLP, Grammars, Parsing.

Automatic Speech Recognition (ASR) – Speech Processing, Ex: DRAGON, HARPY,

Machine Vision – Applications, Basic Principles of Vision, Machine vision techniques: Low, Middle and High-level vision.

AI Today & Tomorrow - Achievements, ubiquitous AI.

Suggested Readings:

a. Stuart Russell and Peter Norvig. *Artificial Intelligence – A Modern Approach*, 3rd Edition, Pearson Education Press, 2009.
b. Kevin Knight, Elaine Rich, B. Nair, *Artificial Intelligence*, 3rd Edition, McGraw Hill, 2008.
c. Nils J. Nilsson, *The Quest for Artificial Intelligence*, Cambridge University Press, 2009.

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OPERATING SYSTEMS

PC 503 CSM

Contact Hours Per Week L 3 CIE 30 SEE 70

Credits 3

Course Objectives

1. To learn the fundamentals of Operating Systems.
2. To learn the mechanisms of OS to handle processes and threads and their communication
3. To learn the mechanisms involved in memory management in contemporary OS
4. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection
5. To know the components and management aspects of concurrency management

Course Outcomes

1. Identify System calls and evaluate process scheduling criteria of OS.
2. Develop procedures for process synchronization of an OS.
3. Demonstrate the concepts of memory management and of disk management
4. Solve issues related to file system interface and implementation, I/O systems
5. Describe System model for deadlock, Methods for handling deadlocks.

UNIT-I

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine.

UNIT-II

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling Criteria, Scheduling algorithms, multiprocessor scheduling

UNIT-III

Process Synchronization: Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Peterson's Solution, classical problems of synchronization: The Bounded buffer problem, Producer\Consumer Problem, reader's & writer problem, Dinning philosopher's problem. Semaphores, Event Counters, Monitors, Message Passing,

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Methods for Handling: Deadlocks: Deadlock prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

UNIT-IV

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation, fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, structure of page table, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms, Trashing

UNIT-V

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software,

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods, Free-space management, directory implementation, efficiency and performance.

Secondary-Storage Structure: Disk structure, Disk scheduling algorithms, Disk Management, RAID structure

Suggested books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

Suggested reference books:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

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Course Code	Course Title						Core/ Elective
PC 504 CSM	WEB & INTERNET TECHNOLOGIES						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
C, C++, Java, DC	3	-	-	-	30	70	3

Course Objectives

1. Learn various client side technologies for developing web based applications.
2. Learn the concepts of JavaScript and Angular JS for adding rich GUI.
3. To Know about XML applications with DTD and Schema.
4. To familiarize the concepts about Servlets and JSPs in dynamic web applications.
5. To learn how to establish database connectivity in web applications.

Course Outcomes

1. Understand the concepts of HTML and CSS.
2. Acquire the knowledge to build AJAX based applications using Javascript.
3. Understand and apply the concepts of servlet framework
4. Implement JSP to build interactive web applications
5. Acquire the knowledge of database connectivity in web applications

UNIT-I

A Brief Introduction to Internet, The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, MIME, HTTP

HTML5: Evolution of HTML and XHTML, Basic Syntax, Document Structure, Links, Images, Multimedia, Lists, Tables, Creating Forms. Cascading Style sheets.

UNIT-II

JavaScript: Overview, Object Orientation and JavaScript, Syntactic Characteristics, Primitives, Operators, Expressions, Input and Output, Control Statements, Objects Creation and modification, Arrays, Functions, Constructors, Pattern Matching. Manipulating DOM, HTML DOM Events, Basics of AJAX with example.

UNIT-III

XML: Introduction to XML, Syntax, XML document structure, Document Type Definition, Name spaces, XML Schemas, Display in raw XML documents, Displaying XML documents with CSS, XPath Basics, XSLT, XML Processors.

J2EE: Exploring Enterprise architecture styles, Features of EE platform, Web servers and application servers.

Database programming with JDBC: JDBC Drivers, Exploring JDBC Processes with the java.sql Package.

UNIT-IV

Servlets Technology: Exploring the Features of Java Servlet, Exploring the Servlet API, Explaining the Servlet Life Cycle, Creating a Sample Servlet, Working with ServletConfig and ServletContext Objects, Implementing Servlet Collaboration, Exploring the Session Tracking Mechanisms.

UNIT-V

JSP Technology: Advantages of JSP over Java Servlet, Architecture of a JSP Page, Life Cycle of a JSP Page, Working with JSP Basic Tags and Implicit Objects, Working with Action Tags in JSP, Exploring EL, Exploring the Elements of Tag Extensions, Tag Extension API, Working with Simple Tag Handlers Accessing Database from Servlet and JSP.

Suggested books:

1. Robert W.Sebesta: Programming the World Wide Web, 4th Edition, Pearson Education, 2009
2. Java Server Programming Java EE7 (J2EE 1.7): Black Book, (2014), Dreamtech Press
3. Porter Scobey, PawanLingras: Web Programming and Internet Technologies an E-Commerce Approach, 2nd Edition, Jones & Bartlett Learning
4. Bryan Basham, Kathy Sierra, Bert Bates: Head first Servlets & JSP, 2nd edition, OREILLY, 2008.

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Course Code	Course Title						Core/ Elective
PC 505 CSM	**SPEECH AND NATURAL LANGUAGE PROCESSING**						**CORE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

1. Teach students the leading trends and systems in natural language processing.
2. Make them understand the concepts of morphology, syntax and semantics of the language and that they are able to give the appropriate examples that will illustrate the above mentioned concepts.
3. Teach them to recognize the significance of pragmatics for natural language understanding.
4. Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic and semantic processing.

Course Outcomes

1. To tag a given text with basic Language features
2. To design an innovative application using NLP components
3. To implement a rule based system to tackle morphology/syntax of a language
4. To design a tag set to be used for statistical processing for real-time applications
5. To compare and contrast the use of different statistical approaches for different types of NLP applications.
6. Perform various language phonetic analysis

UNIT I

Introduction of NLP: Origins and challenges of NLP, Language Modeling: Grammar-based LM,Statistical LM – Regular Expressions, Automata , Morphologyand Finite State Transducers, Tokenization, stemming, Normalization,Detecting and Correcting Spelling Errors, Minimum EditDistance.

UNIT II

WORD LEVEL ANALYSIS: N-grams, Evaluating N-grams, Smoothing,Word Classes,Part-of-SpeechTagging, Rule-based, Stochastic and Transformation-basedtagging, Issuesin PoS tagging – Entropy, Hidden Markov and Maximum Entropy models, ; Named Entities

UNIT-III

SYNTACTIC ANALYSIS: Context free rules and trees – The noun Phrase – Co-ordination – Verbphrase – context free grammars – Parsing with context free grammars, Shallow parsing – Probabilistic CFG , Dependency Grammar , SemanticAnalysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.

UNIT_IV

Speech Fundamentals: Phonetics – speech sounds and phonetic transcription –articulatory phonetics – phonological categories and pronunciation variation– acoustic phonetics and signals –phonetic resources – articulatory and gesturalphonology.

UNIT-V

Speech synthesis – text normalization – phonetic analysis – prosodic analysis – diphonewaveformsynthesis – unit selection waveform synthesis – evaluation.

Text Books:

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to NaturalLanguage Processing, Computational Linguistics andSpeech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processingwith Python, FirstEdition, OReilly Media, 2009.

References:

1. Breck Baldwin, —Language Processing with Java and LingPipeCookbook,Atlantic Publisher,2015.
2. Richard M Reese, —Natural Language Processing with Java, OReilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural LanguageProcessing, SecondEdition, Chapman and Hall/CRC Press,2010.
4. Tanveer Siddiqui, U.S. Tiwary, —Natural Language ProcessingandInformation Retrieval,Oxford University Press, 2008.
5. Ikrami Eldirawy, Wesam Ashour, —Visual Speech Recognition, Wiley publications , 2011
6. Himanshu Chaurasiya, —Soft Computing Implementation of AutomaticSpeech Recognition,LAP Lambert Academic Publishing,2010.
7. Kai-Fu Lee, —Automatic Speech Recognition, The Springer International Seriesin Engineeringand Computer Science, 1999.

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Course Code	Course Title						Core/ Elective
PE 511 CSM	**EMBEDDED SYSTEMS**						**ELECTIVE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

1. To provide an overview of Design Principles of Embedded System.
2. Understand the fundamentals of Microcontroller based systems, basic hardware components, selection methods and attributes of an embedded system.
3. To introduce and discuss Interfacing of various real world devices with 8051 microcontroller
4. Comprehend the real time operating system used for the embedded system
5. To expose students to the recent trends in embedded system design.

Course Outcomes

1. Demonstrate the role of individual components involved in a typical embedded system.
2. Describe the architectural features and instructions of Intel 8051 Microcontroller
3. Apply the knowledge gained for Programming ARM for different applications.
4. Expected to visualize the role of Real time Operating Systems in Embedded Systems
5. Interpret the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.

UNIT – I

Introduction to embedded systems: Embedded systems, Processor embedded into a system, Embedded hardware units and device in a system, Embedded software in a system, Examples of embedded systems, Design process in embedded system, Formalization of system design, Design process and design examples, Classification of embedded systems, skills required for an embedded system designer.

UNIT – II

Devices and communication buses for devices network: IO types and application with Keyboards , Serial communication devices, Parallel device ports, Sophisticated interfacing features in device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock, Networked embedded systems, Serial bus communication protocols, Parallel bus device protocols-parallel communication internet using ISA, PCI, PCI-X and advanced buses, Internet enabled systems network protocols, Wireless and mobile system protocols.

UNIT – III

Device drivers and interrupts and service mechanism: Programming-I/O busy-wait approach without interrupt service mechanism, ISR concept, Interrupt sources, Interrupt servicing (Handling) Mechanism, Multiple interrupts, Context and the periods for context

switching, interrupt latency and deadline, Classification of processors interrupt service mechanism from Context-saving angle, Direct memory access, Device driver programming.

UNIT – IV

Inter process communication and synchronization of processes, Threads and tasks: Multiple process in an application, Multiple threads in an application, Tasks, Task states, Task and Data, Clear-cut distinction between functions. ISRS and tasks by their characteristics, concept and semaphores, Shared data, Interprocess communication, Signal function, Semaphore functions, Message Queue functions, Mailbox functions, Pipe functions, Socket functions, RPC functions.

Unit –V

Real-time operating systems: OS Services, Process management, Timer functions, Event functions, Memory management, Device, file and IO subsystems management, Interrupt routines in RTOS environment and handling of interrupt source calls, Real-time operating systems, Basic design using an RTOS, RTOS task scheduling models, interrupt latency and response of the tasks as performance metrics, OS security issues. Introduction to embedded software development process and tools, Host and target machines, Linking and location software.

Suggested Readings:

1. Microcontroller and Embedded Systems Using Assembly and C (Second Edition), - Muhammed Ali Mazidi ,Janice Gillispie Mazidi, Rolin D. McKinlay ;2008;Pearson Publication ; ISBM : 978-81-317-1026-5 .
2. Raj Kamal, "Embedded Systems", 2nd edition, Tata McGraw Hill, 2009.
3. Peter Barry and Patric Crowley, Intel architecture for Embedded system.
4. Wayne Wolf, "Computers as Components-principles of Embedded Computer systemDesign", 1st edition, Elseveir, 2009.
5. Tammy Noergaard, "Embedded System Architecture, A comprehensive Guide for Engineers and Programmers", Elsevier, 2006.

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Course Code	Course Title	Core/ Elective
PE 512 CSM	**COMPUTER GRAPHICS**	**ELECTIVE**

Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
Mathematics, Engg.Drawing	3	-	-	-	30	70	3

Course Objectives

1. To introduce the concept of synthetic camera model , programmable pipeline and OpenGL API
2. To study different interaction modes and data structures that store 2-D and 3-D geometric objects
3. To understand different transformations in 2-D and 3-D
4. To study different rasterization and rendering algorithms

Course Outcomes

After completing this course, the student will be able to:-

1. Describe the steps in graphics programming pipeline
2. Write interactive graphics applications using OpenGL geometric primitives
3. Apply affine transformations for viewing and projections
4. create realistic images of 3-d objects that involve lighting shading aspects

UNIT-I

Graphics Systems and Models: Graphics system, Images, Physical and Synthetic, Imaging system, Synthetic camera model, Programming interface, Graphics architectures, Programmable pipelines.

Graphics Programming: Programming two-dimensional applications, OpenGL API, Primitives and attributes, Color, Viewing and Control functions.

UNIT-II

Input and Interaction: Input devices, Display lists & modeling, Programming event-driven input, Picking, Building interactive models, Animating interactive programs, Logic operations.

Geometric Objects: Three-dimensional primitives, Coordinate systems and frames, Frames in OpenGL, Modeling colored cube.

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UNIT-III

Transformations: Affine transformations, Transformations in homogeneous coordinates, Concatenation of transformations, OpenGL transformation matrices.

Viewing: Classical and Computer views, Viewing with a computer, Positioning of camera, Simple projections, Projections in OpenGL, Hidden surface removal, Parallel-projection matrices, Perspective-projection matrices.

UNIT-IV

Lighting and Shading: Light sources, The Phong lighting model, Computational vectors, Polygonal shading, Light sources in OpenGL, Specification of matrices in OpenGL, Global illumination.

From Vertices to Frames: Basic implementation strategies, Line-segment clipping, Polygon clipping, Clipping in three dimensions, Rasterization, Anti-aliasing.

UNIT-V

Modeling & Hierarchy: Hierarchal models, Trees and traversal, Use of tree data structure, Animation, Graphical objects, Scene graphs, Simple scene graph API, Open Scene graph, Other tree structures.

Suggested Reading

1. Edward Angel, Interactive Computer Graphics: A Top-Down Approach Using OpenGL, Pearson Education, 5th edition, 2009
2. Francis S Hill Jr., Stephen M Kelley, Computer Graphics using OpenGL, Prentice-Hall Inc., 3rd Edition, 2007
3. Jim X. Chen, Foundations of 3D Graphics Programming using JOGL and Java3D, Springer Verlag, 2006
4. Hearn Donald, Pauline M Baker, Computer Graphics, 2nd edition, 1995

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Course Code	Course Title	Core/ Elective
PE 515 CSM	**BLOCK CHAIN TECHNOLOGY**	**ELECTIVE**

Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

1. Understand how block chain systems (mainly Bitcoin and Ethereum) work,
2. To securely interact with them,
3. Design, build, and deploy smart contracts and distributed applications,
4. Integrate ideas from block chain technology into their own projects.

Course Outcomes: Upon completion of the course, the students will be able to:

1. Explain design principles of Bitcoin and Ethereum.
2. Explain Nakamoto consensus.
3. Explain the Simplified Payment Verification protocol.
4. List and describe differences between proof-of-work and proof-of-stakeconsensus.
5. Interact with a block chain system by sending and reading transactions.
6. Design, build, and deploy a distributed application.
7. Evaluate security, privacy, and efficiency of a given block chain system.

UNIT - I

Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete.

Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

UNIT - II

Blockchain: Introduction, Advantage over conventional distributed database, Block chain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Block chain application, Soft & Hard Fork, Private and Public block chain.

UNIT - III

Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

UNIT - IV

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum -Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin

UNIT – V

Cryptocurrency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects-Cryptocurrency Exchange, Black Market and Global Economy.

Applications: Internet of Things, Medical Record Management System, Domain NameService and future of Block chain.

Case study : *Naive Blockchain construction, Memory Hard algorithm - Hashcash implementation, Direct Acyclic Graph, Play with Go-ethereum, Smart Contract Construction,Toy application using Blockchain, Mining puzzles*

Suggested Readings:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction,Princeton University Press, 2016.
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
4. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks onEthereum smart contracts

CourseCode	Course Title	Core/Elective
PE513CSM	OBJECT ORIENTED ANALYSIS AND DESIGN	ELECTIVE

Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives:

1. To introduce the basic concepts of Unified Modeling Language from defining Unified process and Core workflows
2. To impart knowledge on various UML diagrams for the software development
3. To understand the importance of each diagram in software development and understand rules to develop each diagram

Course Outcomes

Student will able to

1. Understand the activities in the different phases of the object-oriented development life cycle.
2. Model a real-world application by using a UML diagram.
3. Provide a snapshot of the detailed state of a system at appoint in time using object diagram.
4. Recognize when to use generalization, aggregation, and composition relationships. Specify different types of business rules in a class diagram.

UNIT – I

Object-Oriented Analysis and Design: Introduction to UML
Iterative, Evolutionary, and Agile: Introduction to Unified Process, Agile Modeling, Agile Unified Process.
Inception& Use cases: Introduction, Evolutionary Requirements, Use Cases, Use case Diagrams, Activity Diagrams.

UNIT – II

Elaboration & Domain Models: Iteration Requirements and Emphasis: Core OOAD Skills, Domain Models, Class Diagrams, System Sequence Diagrams, Requirements to Design,
Package Diagram and UML Tools: Logical Architecture, Software Architecture, Package Diagrams, On to Object Design, UML CASE Tools, UML Class Diagrams.

UNIT – III

UML Class Diagrams, UML Interaction Diagrams, UML Activity Diagram and Modelling, Mapping Design to Code, UML State Machine Diagram and Modelling, Test Driven Development and Agile Concepts, Documenting Architecture, Case Studies.

UNIT – IV

UML Deployment and Component Diagram, GoF Design Patterns and Iterative Planning Introduction to GRASP – Methodological approach to OO Design, Architectural analysis andUML Package Design.

UNIT – V

Test Driven Development and Agile Concepts, Documenting Architecture, Case Studies.

***Suggested Readings*:**

1. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", 3rd edition, Pearson 2008
2. Grady Booch, James Rumbaugh, Ivar Jacobson (2009), The Unified Modeling Language User guide, 2nd edition, Pearson Education, New Delhi, India.
3. Cay Horstmann), Object-Oriented Design and Patterns, Wiley India edition, New Delhi, India.
4. Meilir Page-Jones (2000), Fundamentals of Object Oriented Design in UML, Pearson Education and NewYork.
5. John W. Satzinger, Robert B Jackson, Stephen D Burd (2004), Object-OrientedAnalysis and Design with theUnified Process, Cengage learning, India.

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Course Code	Course Title						Core/ Elective
PE514CSM	**MACHINE LEARNING FOR DATA SCIENCE**						**ELECTIVE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

The students will be able to derive practical solutions using predictive analytics. They will also understandthe importance of various algorithms in Data Science.

Course Outcomes After completion of course, students would be able to:

1. Apply practical solutions using predictive analytics.
2. Understand the importance of various algorithms in Data Science.
3. Create competitive advantage from both structured and unstructured data.
4. Predict outcomes with supervised machine learning techniques.
5. Unearth patterns in customer behavior with unsupervised techniques.

UNIT- I

Introduction: Algorithms and Machine Learning, Introduction to algorithms, Tools to analyze algorithms, Algorithmic techniques: Divide and Conquer, examples, Randomization, Applications.

UNIT - II

Algorithms: Graphs, maps, Map searching, Application of algorithms: stable marriages example, Dictionaries and hashing, search trees, Dynamic programming.

UNIT - III

Application to Personal Genomics: Linear Programming, NP completeness, Introduction to personal Genomics, Massive Raw data in Genomics, Data science on Personal Genomes, Interconnectedness on Personal Genomes, Case studies.

UNIT - IV

Machine Learning Introduction: Classification, Linear Classification, Ensemble Classifiers, Model Selection, Cross Validation, Holdout.

UNIT - V

Machine Learning Applications: Probabilistic modelling, Topic modelling, Probabilistic Inference, Application: prediction of preterm birth, Data description and preparation, Relationship between machine learning and statistics.

Suggested books:

1. Introduction to Machine Learning, Jeeva Jose, Khanna Book Publishing House.
2. Machine Learning, Rajiv Chopra, Khanna Book Publishing House.
3. Data Science and Machine Learning: Mathematical and Statistical Methods Machine Learning & Pattern Recognition, by Dirk P. Kroese, Zdravko Botev, Thomas Taimre, Radislav Vaisman, Chapman & Hall/Crc, 2019.
4. Hands-On Data Science and Python Machine Learning, Frank Kane, Packt Publishers, 2017.
5. https://www.edx.org/course/machine-learning-for-data-science-and-analytics

Course Code	Course Title	Core/Elective
PC551CSM	**ARTIFICIAL INTELLIGENCE LAB**	Core

Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Python Programming	-	-	-	2	25	50	1

Course Objectives:

1. To apply programming skills to formulate the solutions for computational problems.
2. To study implementation first order predicate calculus using Prolog
3. To familiarize with basic implementation of NLP with the help of Python libraries NLTK
4. To understand python library scikit-learn for building machine learning models
5. To enrich knowledge to select and apply relevant AI tools for the given problem

Course Outcomes:

1. Design and develop solutions for informed and uninformed search problems in AI.
2. Demonstrate reasoning in first order logic using Prolog
3. Utilize advanced package like NLTK for implementing natural language processing.
4. Demonstrate and enrich knowledge to select and apply python libraries to synthesize information and develop supervised learning models
5. Develop a case study in multidisciplinary areas to demonstrate use of AI.

Prerequisite: Basics of programming in Python

1. Write a program to implement Uninformed search techniques:
a. BFS
b. DFS

2. Write a program to implement Informed search techniques
a. Greedy Best first search
b. A* algorithm

3. Study of Prolog, its facts, and rules.
a. Write simple facts for the statements and querying it.
b. Write a program for Family-tree.

4. Write a program to train and validate the following classifiers for given data (scikit-learn):
a. Decision Tree
b. Multi-layer Feed Forward neural network

5. Text processing using NLTK
a. Remove stop words
b. Implement stemming
c. POS (Parts of Speech) tagging

In addition to the above programs, students should be encouraged to study implementations of one of the following

- Game bot (Tic Tac toe, 7 puzzle)
- Expert system (Simple Medical Diagnosis • Text classification
- Chat bot

Course Code	Course Title						Core/ Elective
PC 552 CSM	**OPERATING SYSTEMS LAB**						**CORE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	25	50	1

Course Objectives

1. Learn different types of CPU scheduling algorithms
2. Demonstrate the usage of semaphores for solving synchronization problem
3. Understand memory management techniques and different types of fragmentation that occur in them and various page replacement policies
4. Understand Banker's algorithm used for deadlock avoidance
5. Learn various disk scheduling algorithms.

Course Outcomes

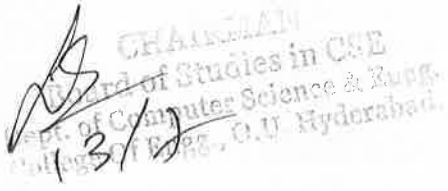
1. Evaluate the performance of different types of CPU scheduling algorithms
2. Implement producer-consumer problem, reader-writers problem, Dining philosopher's problem
3. Simulate Banker's algorithm for deadlock avoidance
4. Implement paging replacement and disk scheduling techniques
5. Use different system calls for writing application programs.

I. CASE STUDY

Perform a case study by installing and exploring various types of operating systemson a physicalor logical (virtual) machine

II. List of Experiments (preferred programming language is C)

1. Write a C programs to implement UNIX system calls and file management
2. Write C programs to demonstrate various process related concepts.
3. Write C programs to demonstrate various thread related concepts.
4. Write C programs to simulate CPU scheduling algorithms: FCFS, SJF, Round Robin
5. Write C programs to simulate Intra & Inter-Process Communication (IPC)techniques: Pipes,Messages Queues, Shared Memory.
6. Write C programs to simulate solutions to Classical Process SynchronizationProblems: DiningPhilosophers, Producer-Consumer, Readers-Writers
7. Write a C program to simulate Bankers Algorithm for Deadlock Avoidance.
8. Write C programs to simulate Page Replacement Algorithms: FIFO, LRU
9. Write C programs to simulate implementation of Disk Scheduling Algorithms:FCFS, SSTF



Course Code	Course Title						Core/ Elective
PW 533 CS	**MINI PROJECT**						**CORE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	50	-	1

Course Objectives: To prepare the students

1. To enhance practical and professional skills.
2. To familiarize tools and techniques of systematic literature survey and documentation
3. To expose the students to industry practices and team work.
4. To encourage students to work with innovative and entrepreneurial ideas

Course Outcomes

1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
2. Evaluate different solutions based on economic and technical feasibility
3. Effectively plan a project and confidently perform all aspects of project management
4. Demonstrate effective coding, written, presentation and oral communication skills

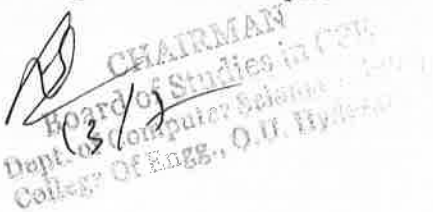
The students are required to carry out mini projects in any of the areas such as Data Structures, Microprocessors and Interfacing, Database Management Systems, Operating Systems, Design and Analysis of Algorithms, Software Engineering, Data Communications, Web Programming & Services, Computer Networks, Compiler Construction, and Object Oriented System Development.

Problems Statements are suggested to be taken can also be taken from Smart India Hackathon (SIH) Portal invited from the Ministries / PSUs / MNCs / NGOs to be worked out through.

The project could be classified as hardware, software, modeling, simulation etc. The project should involve one or many elements of techniques such as analysis, design, and synthesis.

The department will appoint a project coordinator who will coordinate the following:

1. Grouping of students (maximum of 3 students in a group)
2. Allotment of projects and project guides.
3. All projects allotment is to be completed by the 4th week of the semester so that the students get sufficient time for completion of the project.
4. Disseminate guidelines given by monitoring committee comprising of senior faculty members to the students and their guides.
5. Three periods of contact load will also be assigned to each project guide for project guidance andmonitoring at regular intervals.
6. Sessional marks are to be awarded by the monitoring committee.
7. Common norms will be established for the final presentation and documentation of the project report bythe respective departments.
8. Students are required to submit a presentation and report on the mini project at the end of the semester.



SCHEME OF INSTRUCTION & EXAMINATION
B.E. - VI SEMESTER
CSE (AI&ML)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duratin in Hrs	
Theory Courses										
1	PC601CSM	Deep Learning Techniques	3	-	-	3	30	70	3	3
2	PC602CSM	Computer Networks	3	-	-	3	30	70	3	3
3	PC603CSM	Advanced Machine Learning	3	1	-	4	30	70	3	4
4	PC604CSM	Soft Computing	3	-	-	3	30	70	3	3
5	PE-II	Professional Elective-2	3	-	-	3	30	70	3	3
6	OE-I	Open Elective-1	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
7	PC651CSM	Deep Learning Techniques Lab	-	-	2	2	25	50	3	1
8	PC652CSM	Computer Networks Lab	-	-	2	2	25	50	3	1
9	PC653CSM	Advanced Machine Learning Lab	-	-	2	2	25	50	3	1
10	PC671CSM	Summer Internship(To be evaluated during VII Semester)	-	-	-	-	-	-	-	-
			18	**1**	**6**	**25**	**255**	**570**	**-**	**22**

PROFESSIONAL ELECTIVE -2	
COURSE CODE	COURSE TITLE
PE621	QUANTUM COMPUTING
PE622	ADVANCED COMPUTER ARCHITECTURE
PE623	IMAGE PROCESSING
PE624	SOFTWARE QUALITY AND TESTING
PE625	DATA MINING
PE626	MOBILE COMPUTING

Open Elective- I

Code	Name of Subject
OE601 EE	Electrical Energy Conservation and Safety (Not for EEE & EIE Students)
OE602 EE	Reliability Engineering (Not for EEE & EIE Students)
OE611 AE	Automobile Engineering (Not for Auto. Engg. students)
OE611 ME	Entrepreneurship (Not for Mech Engg& Prod. Engg. students)
OE601 EG	Soft Skills & Interpersonal Skills
OE602 MB	Human Resource Development and Organizational Behaviour
OE601 LW	Cyber Law and Ethics
OE601 CS	Operating Systems (Not for CSE Students)
OE602 CS	OOP using Java (Not for CSE Students)
OE601 IT	Database Systems (Not for IT Students)
OE602 IT	Data Structures (Not for IT Students)

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OE601 CE Disaster Mitigation (Not for Civil Engg. Students)
OE601 CSM Principles of Machine Learning(Not for AI&ML students)

13/7/23
(Dr ~~A Rama~~ Barad MD)

13/7/23

13/7/23
(Dr DVSS Subrahmanyam)
KMEC

13/7/23 (Dr. T. Premchander) (NGIT)

Course Code	Course Title	Core/Elective
PC 601 CSM	**DEEP LEARNING TECHNIQUES**	Core

Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

1. Understand the concept of neural networks, convolutional neural networks, and recurrent neural networks.
2. Implement deep learning algorithms, and learn how to train deep networks.
3. Gain in-depth knowledge of TensorFlow along with its functions, operations, and the execution pipeline.
4. Understanding the major Architectures of Neural Networks and getting into the Convolutional neural Networks.
5. Understand the applications of implementing deep learning such as image processing, natural language processing, speech recognition, deep face - facial recognition system, etc.

Course Outcomes:

After completing this course, students will be able to:

1. To understand the fundamentals of deep learning.
2. To be able to understand deep learning algorithms and design neural network.
3. To be able to train and implement a neural network.
4. To be able to have knowledge about convolutional neural networks.
5. To be able to apply neural networks in various fields.

UNIT – I

What is deep learning? Artificial intelligence, Machine learning, and Deep learning - Artificial intelligence -Machine learning - Learningrepresentations from data - The "deep" in deep learning -Understanding how deep learning works, in three figures -What deep learning has achieved so far- The promise of AI

UNIT – II

Getting started with neural networks - Anatomy of a neural network - Layers: the building blocks of deep learning - Models:networks of layers - Loss functions and optimizers: keysto configuring the learning process

The Neural Network-Building Intelligent Machines, The Limits of Traditional Computer Programs, The Mechanics of Machine Learning, The Neuron, Expressing Linear Perceptrons as Neurons, Feed-Forward Neural Networks, Linear Neurons and Their Limitations, Sigmoid, Tanh

UNIT – III

Training Feed-Forward Neural Networks - The Fast-Food Problem - Gradient Descent - The Delta Rule and Learning Rates - Gradient Descent with Sigmoidal Neurons - The Backpropagation Algorithm - Stochastic and Minibatch Gradient Descent - Test Sets, Validation Sets, and Overfitting - Preventing Overfitting in Deep Neural Networks

Implementing Neural Networks in TensorFlow - What is TensorFlow? - How Does TensorFlow Compare to Alternatives?- Installing TensorFlow - Creating and Manipulating TensorFlow Variables - TensorFlow Operations - Placeholder Tensors - Sessions in TensorFlow - Navigating Variable Scopes and Sharing Variables - Managing Models over the CPU and GPU - Specifying the Logistic Regression Model in TensorFlow - Logging and

Training the Logistic Regression Model - Leveraging TensorBoard to Visualize Computation Graphs and Learning -Building a Multilayer Model for MNIST in TensorFlow

UNIT – IV

Introduction to Major Architectures of Deep Networks–Unsupervised Pretrained Networks (UPNs), Convolutional Neural Networks (CNNs), Recurrent Neural Networks, Recursive Neural Networks

Convolutional Neural Networks -Neurons in Human Vision - The Shortcomings of Feature Selection - Vanilla Deep Neural Networks Don't Scale - Filters and Feature Maps - Full Description of the Convolutional Layer - Max Pooling - Full Architectural Description of Convolution Networks - Closing the Loop on MNIST with Convolutional Networks - Accelerating Training with Batch Normalization.

UNIT –V

Deep Learning Applications - Large Scale Deep Learning - Computer Vision - Speech Recognition - Natural Language Processing - Other Applications

Suggested Reading:

1. Nikhil Buduma and Nicholas Locascio - Fundamentals of Deep Learning : Designing Next-Generation Machine Intelligence Algorithms – First Edition - O'Reilly , 2017
2. Francois Chollet-Deep Learning with Python-Second Edition,Manning Publications, 2017.
3. Josh Patterson and Adam Gibson- Deep Learning: A Practitioner's Approach - First Edition - O'Reilly , 2017
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville - Deep Learning – Second Edition-MIT Press , 2016

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Course Code	Course Title						Core/ Elective
PC 602 CSM	COMPUTER NETWORKS						CORE
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

1. To develop an understanding of communication in modern network architectures from a design and performance perspective.
2. To understand Data Transmission standards and MAC protocols.
3. To introduce the protocols functionalities in Network Layer and Transport Layer.
4. To understand DNS and supportive application protocols.
5. To provide basic concepts of Cryptography.

Course Outcomes

After completing this course, the student will be able to:

1. Explain the functions of the different layer of the OSI and TCP/IP Protocol.
2. Understand wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
3. Illustrate network layer and transport layer protocols. For a given problem related TCP/IP protocol developed the network programming.
4. Configure DNS , EMAIL, SNMP, Bluetooth, Firewalls using open source available software and tools.
5. Identify the types of encryption techniques.

UNIT – I

Data communication Components: Representation of data and itsfllow Networks,Layered architecture, OSI and TCP/IP model, Transmission Media.

Techniques for Bandwidth utilization: Line configuration, Multiplexing - Frequency division, Timedivision and Wave division, Asynchronous and Synchronous transmission, XDSL, wireless LAN

UNIT - II

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction -Fundamentals, Block coding, Hamming Distance, CRC;

Flow Control and Error control protocols: Stop and Wait, Go back – N ARQ, SelectiveRepeat ARQ,Sliding Window, and Piggybacking.

Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA

UNIT - III

Network Layer: Switching techniques (circuit and packet) , Logical addressing – IPV4, IPV6, sub nettingconcepts.

Inter-networking: Tunnelling, Fragmentation, congestion control, Internet control

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protocols:ARP,RARP, BOOTP and DHCP.
Delivery, Forwarding and Unicast Routing protocols, Gateway protocols.

UNIT - IV

Transport Layer: Process to Process Communication, Elements of transportprotocol, IntroductionSocket Programing.
Internet Transport Protocols: UDP, TCP, SCTP; Quality of Service, QoS improvingtechniques: LeakyBucket and Token Bucket algorithm.

UNIT - V

Application Layer: Domain Name Space (DNS), EMAIL, SNMP, Bluetooth, VOIP.
Basic concepts of Cryptography: Network Security Attacks, firewalls, symmetric encryption, Data encryption Standards, public key Encryption (RSA), Hash function,Message authentication, Digital Signature.

Suggested books

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGrawHill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson PrenticeHallIndia.

Suggested reference books

1. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson NewInternationalEdition.
2. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice HallofIndia.
3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

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Course Code	Course Title						Core / Elective
PC 603 CSM	**Advanced Machine Learning**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives

1. To introduce advanced concepts and methods of Machine learning.
2. To develop an understanding of the role of machine learning in massive scale automation.
3. To design and implement various machine learning algorithms in the range of real world applications.

Course Outcomes

After completing this course, the student will be able to

1. Understand advanced concepts of machine learning.
2. Design various machine learning algorithms.
3. Implement machine learning algorithms in the range of real world applications.

UNIT I

Artificial neural network: Introduction to ANN, Perceptron,Cost function,Gradient checking, Multi layer perceptron andback propagation algorithm.

UNIT II

Bayesian learning: Probability theory and Bayes rule.Naive Bayes learning algorithm,Bayes Nets.

UNIT III

Decision trees: Representing concepts as Decision trees, Recursive induction of Decision trees, Best splitting attribute:Entropy and Information gain, Searching for simple trees and Computational complexity, Overfitting, noisy data and pruning.

UNIT IV

Reinforcement Learning : Reinforcement Learning through feedback network, function approximation.

UNIT V

Ensemble methods : Bagging,Boosting and learning with ensembles. Random forests.

Suggested Readings:

1. Tom Mitchel, Machine learning Mc Graw Hill,1997.
2. Jeeva Jose,Introduction to Machine learning,Khanna book publishing,2020
3. Rajiv chopra,Machine Learning,Khanna book publishing,2021.
4. Uma N Dulhare,Khaleel Ahmad,Khairol AmaliBin Ahmad, Machine Learning and Big Data Concepts,Algorithms,Tools and Applications,Scrivener Publishing,Wiley,2020.
5. Ethem Apaydin, Introduction to Machine learning, 2e, the MIT press, 2010.

Course Code	Course Title						Core/ Elective
PC 604 CSM	**SOFT COMPUTING**						**Core**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

Objectives of the course

1. Classify the various soft computing frame works
2. Be familiar with the design of neural networks, fuzzy logic and fuzzy systems
3. Learn mathematical background for optimized genetic programming

Course Outcomes

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

1. Learn about soft computing techniques and their applications.
2. Learn about fuzzy logic, various fuzzy systems and their functions.
3. Use fuzzy rules and reasoning to develop decision making and expert system
4. Choose and design suitable neural network for real time problems
5. Understand the genetic algorithm concepts and their applications

UNIT-I

Introduction to Soft Computing: Soft computing constituents, characteristics of neuro-computing and soft computing, difference between hard computing and soft computing, some applications of soft computing techniques, concepts of learning and adaptation.

UNIT-II

Fuzzy logic: Introduction to classical/crisp sets and fuzzy sets, classical/crisp relations and fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets.

Membership functions: fuzzification, methods of membership value assignments, defuzzification, lambda cuts for fuzzy sets and fuzzy relations, defuzzification methods.

UNIT-III

Fuzzy arithmetic and fuzzy measures: Fuzzy rule base and approximate reasoning, truth values and tables in fuzzy logic, fuzzy propositions, formation of rules, decomposition and aggregation of rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making, fuzzy logic control systems, fuzzy expert systems.

UNIT-IV

Introduction Neural Network: Fundamental concept, evolution of neural networks, models of artificial neural networks, important technologies, applications, McCulloch, Pitts Neuron, linear separability, Hebb network.

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Supervised learning network: Perception networks, adaptive linear neuron, multiple adaptive linear neurons, back propagation network, radial basis function network.

Unsupervised learning networks: Kohonenself-organizing feature maps, learning vector quantization, counter propagation networks, adaptive resonance theory network.

UNIT-V

Genetic Algorithm: Difference between traditional algorithms and GA, genetic algorithm and search space, general genetic algorithm, operators, generational cycle, in genetic algorithm, stopping condition for genetic algorithm flow, constraints in genetic algorithm, schema theorem, classification of genetic algorithm, genetic programming, multilevel optimization.

Suggested Readings:

1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", Pearson Education 2004.
2. S.N.Sivanandam, S.N.Deepa "Principles of Soft Computing" Second Edition, Wiley Publication.
3. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill,1997.
4. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y.
5. S.Rajasekaran and G.A.VijayalakshmiPai "Neural Networks, Fuzzy Logic and Genetic Algorithms" PHI Learning.

Course Code	Course Title	Core/ Elective
PC 651 CSM	DEEP LEARNING TECHNIQUES LAB	CORE

Prerequisite	Contact Hours Per Week					
	L	T	D	P	CIE	SEE	Credits
	-	-	-	2	25	50	1

Course Objectives

1. Understand the concepts of Artificial Neural Networks and Deep Learning concepts.
2. Implement ANN and DL algorithms with Tensorflow and Keras.
3. Gain knowledge on Sequence learning with RNN.
4. Gain knowledge on Image processing and analysis with CNN
5. Get information on advanced concepts of computer vision.

Course Outcomes

After learning the concepts of this course, the student is able to

1. Develop ANN without using Machine Learning/Deep learning librarie
2. Understand the Training ANN model with back propagation
3. Develop model for sequence learning using RNN
4. Develop image classification model using ANN and CNN.
5. Generate a new image with auto-encoder and GAN.

List of Programs

1. Create Tensors and perform basic operations with tensors
2. Create Tensors and apply split & merge operations and statistics operations.
3. Design single unit perceptron for classification of iris dataset without using predefined models
4. Design, train and test the MLP for tabular data and verify various activation functions and optimizers tensor flow.
5. Design and implement to classify 32x32 images using MLP using tensorflow/keras and check the accuracy.
6. Design and implement a simple RNN model with tensorflow / keras and check accuracy.
7. Design and implement LSTM model with tensorflow / keras and check accuracy.
8. Design and implement GRU model with tensorflow / keras and check accuracy.
9. Design and implement a CNN model to classify multi category JPG images with tensorflow / keras and check accuracy. Predict labels for new images.
10. Design and implement a CNN model to classify multi category tiff images with tensorflow / keras and check the accuracy. Check whether your model is overfit / underfit / perfect fit and apply the techniques to avoid overfit and underfit like regulizers, dropouts etc.
11. Implement a CNN architectures (LeNet, Alexnet, VGG, etc) model to classify multi category Satellite images with tensorflow / keras and check the accuracy. Check whether your model is overfit / underfit / perfect fit and apply the techniques to avoid overfit and underfit.
12. Implement an Auto encoder to de-noise image.
13. Implement a GAN application to convert images.

Text Books:

1. Data Science for Beginners- Comprehensive Guide to Most Important Basics in Data Science, Alex Campbell.
2. Artificial Intelligence Technologies, Applications, and Challenges- Lavanya Sharma, Amity University , Pradeep Kumar Garg, IIT Roorkee, India.
3. Artificial Intelligence Fundamentals and Applications- Cherry Bhargava and Pardeep Kumar Sharma, CRC Press.

CourseCode	Course Title					Core/ Elective
PC 652 CSM	**COMPUTER NETWORKS LAB**					**CORE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
DC	-	-	-	2	30	70	1

Course Objectives

1. Learn to communicate between two desktop computers.
2. Learn to implement the different protocols
3. Be familiar with socket programming.
4. Be familiar with the various routing algorithms
5. Be familiar with simulation tools.
6. To use simulation tools to analyze the performance of various network protocols

Course Outcomes

After completing this course, the student will be able to:

1. Implement various protocols using TCP and UDP.
2. Program using sockets.
3. Use simulation tools to analyze the performance of various network protocols.
4. Implement and Analyze various routing algorithms.

1. Running and using services/commands like tcpdump, netstat, ifconfig, nslookup, FTP, TELNET andtraceroute. Capture ping and trace route PDUs using a network protocol analyzer and examine.
2. Configuration of router, switch . (using real devices or simulators)
3. Socket programming using UDP and TCP (e.g., simple DNS, data & time client/server, echoclient/server, iterative & concurrent servers)
4. Network packet analysis using tools like Wireshark, tcpdump, etc.
5. Network simulation using tools like Cisco Packet Tracer, NetSim, OMNeT++, NS2, NS3, etc.
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.Performance evaluation of Routing protocols using Simulation tools.
7. Programming using raw sockets
8. Programming using RPC

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justifiedmanner.

LABORATORY REQUIREMENTS

HARDWARE:

1. Standalone desktops

SOFTWARE:

1. C / C++ / Java / Python / Equivalent Compiler
2. Network simulator like NS2/NS3/OPNET/ CISCO Packet Tracer / Equivalent

Course Code	Course Title					Core/ Elective
PC 653 CSM	ADVANCED MACHINE LEARNING LAB					CORE
Prerequisite	Contact Hours Per Week			CIE	SEE	Credits
	L	T	D	P		
	-	-	-	2	30	70	1

Course Objectives

Implement the machine learning concepts and algorithms in any suitable languageof choice

1. To implement classification algorithms.
2. To implement regression algorithms.
3. To implement clustering techniques.
4. To implement neural networks.
5. Learn to implement the different protocols
6. Implement Decision trees.

Course Outcomes

After completing this course, the student will be able to:

1. Implement various protocols using classification and regression techniques.
2. Implement clustering mechanisms
3. Implement Decision trees.
4. Implement and Analyze various random forest techniques.

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

1. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
2. Build an Artificial Neural Network by implementing the Backpropagationalgorithm *and test the same using appropriate data sets.*
3. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
4. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
5. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
6. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
7. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data setfor clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML libraryclasses/API in the program.
8. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

Course Code	Course Title	Core/Elective
SI 671CSM	SUMMER INTERNSHIP	Core

Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	-			-

Course Objectives

1. To train and provide hands-on experience in analysis, design, and programming ofinformation systems by means of case studies and projects.
2. To expose the students to industry practices and team work.
3. To provide training in soft skills and also train them in presenting seminars and technicalreport¬ writing

Course Outcomes

After completing this course, the student will be able to

1. Get Practical experience of software design and development, and coding practiceswithin Industrial/R&D Environments.
2. Gain working practices within Industrial/R&D Environments.
3. Prepare reports and other relevant documentation.

Summer Internship is introduced as part of the curricula of encouraging students to work on problems of interest to industries. A batch of three students will be attached to a person from the Government or Private Organisations/Computer Industry/Software Companies/R&D Organization for a period of 4-6 weeks.

This will be during the summer vacation following the completion of the III-year Course. One faculty coordinator will also be attached to the group of 3 students to monitor the progress and to interact with the industry coordinate (person from industry).

The course schedule will depend on the specific internship/training experience. The typical time per topic will vary depending on the internship

- Overview of company/project
- Safety training
- Discussions with project teams
- Background research, review of documents, white papers, and scientific papers
- Planning, designing, and reviewing the planned work
- Executing the plans
- Documenting progress, experiments, and other technical documentation
- Further team discussions to discuss results
- Final report writing and presentation

After the completion of the project, each student will be required to:

1. Submit a brief technical report on the project executed and
2. Present the work through a seminar talk (to be organized by the Department)

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Note: Students have to undergo summer internship of 4-6 weeks at the end of semester VI and credits will be awarded after evaluation in VII semester.

Course Code	Course Title	Core/Elective
PE 621CSM	QUANTUM COMPUTING	ELECTIVE

Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives:

1. The objective of this course is to impart necessary knowledge to the learner so that he/she candevelop and implement algorithm and write programs using these algorithms.

Course Outcomes:

After completing this course, students will be able to:

1. Explain the working of a Quantum Computing program, its architecture and program model
2. Develop quantum logic gate circuits
3. Develop quantum algorithm
4. Program quantum algorithm on major toolkits

UNIT-I

Introduction to Quantum Computing: Motivation for studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.) Origin of Quantum Computing, Overview of major concepts in Quantum Computing Qubits and multi-qubits states, Bra-ket notation: Bloch Sphere representation, Quantum Superposition, Quantum Entanglement

UNIT-II

Math Foundation for Quantum Computing: Matrix Algebra: basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen vectors.

UNIT-III

Building Blocks for Quantum Program: Architecture of a Quantum Computing platform, Details of q-bit system of information representation: Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from quantum algorithmic perceptive e.g. Bell State, Operation on qubits: Measuring and transforming using gates. Quantum Logic gates and Circuit: Pauli, Hadamard, phase shift, controlled gates.

UNIT-IV

Programming model for a Quantum Computing Program: Steps performed on classical computer, Steps performed on Quantum Computer, Moving data between bits and qubits.

UNIT-V

Quantum Algorithms: Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum Walks

Suggested Readings:

1. Michael A. Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press. October 2000.
2. David McMahon, "Quantum Computing Explained", Wiley 2007
3. IBM Experience: https://quantumexperience,ng,bluemix.net
4. Microsoft Quantum Development Kit https://www.microsoft.com/en-us/quantum/development-kit
   Forest SDK PyQuil: https://pyquil.readthedocs.io/en/stable/

Course Code	Course Title					Core/ Elective
PE 622 CSM	DATA MINING					ELECTIVE
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

1. To introduce the basic concepts of data Mining and its applications
2. To understand different data mining like classification, clustering and Frequent Pattern mining
3. To introduce current trends in data mining
4. To understand, pre-process and analyze the basic concepts of Data Attributes
5. To explore the various data mining techniques (Association Analysis, Classification, Clustering) adapted on data as per the requirement

Course Outcomes

1. Organize and Prepare the data needed for data mining using preprocessing techniques
2. Implement the appropriate data mining methods like classification, clustering or Frequent Pattern mining on a given data set
3. Define and apply metrics to measure the performance of various data mining algorithms
4. Understanding the importance of data mining application and using the most appropriate approach or trend for the realistic strategy

UNIT-I

INTRODUCTION: What is Data Mining? The process of knowledge discovery in databases, predictive and descriptive data mining techniques, supervised and unsupervised learning techniques. Major issues in Data Mining. Getting to know your data: Data objects and attributed types. Basic statistical descriptions of data. Data visualization, Measuring data similarity and dissimilarity.

UNIT-II

MINING FREQUENT PATTERNS, ASSOCIATIONS AND CORRELATIONS: Basic Concepts and methods, Frequent Item set Mining Methods, Sequential Pattern Mining conceptsand Pattern evaluation methods.

UNIT-III

CLASSIFICATION: Basic concepts, Decision tree, Decision rules, Bayes classification methods, Advance methods, Bayesian Belief Network, K-Nearest Neighbor (KNN) classifier, Classification byback propagation, Support vector machine.

UNIT-IV

CLUSTER ANALYSIS: Concepts and Methods: Type of data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of clustering.

UNIT-V

DATA MINING TRENDS AND RESEARCH FRONTIERS: Mining Complex Data Types, Other Methodologies of Data Mining, Data Mining Applications, Data Mining and Society, Data Mining trends.

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Suggested Readings:

1. Jiawei Han, Micheline Kamber, Jin Pei, Data Mining: Concepts & Techniques, 3rd Edition.,Morgon Koffman ,2011
2. Vikram Pudi, P. Radha Krishna, Data Mining, Oxford University Press, 1st Edition, 2009.
3. Pang-Ning Tan, Michael Steinbach, A Karpatne, and Vipin Kumar, Introduction to DataMining, 2nd Ed., Pearson Education, 2018.
4. J Zaki Mohammed and Wagner Meira, Data Mining and Analysis: Fundamental Conceptsand Algorithms, Cambridge University Press, 2014

References:

1. Vipin Kumar, Pang-Ning Tan, Michael Steinbach, *Introduction to Data Mining*, AddisonWesley, 2006.
2. G Dong, J Pei, Sequence Data Mining, Springer, 2007.

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Course Code	Course Title	Core/ Elective
PE 623 CSM	**ADVANCED COMPUTER ARCHITECTURE**	**ELECTIVE**

Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
--	3	-	-	-	30	70	3

Course Objectives

1. An overview of computer architecture, which stresses the underlying design principles and the impact of these principles on computer performance. General topics include design methodology, processor design, control design, memory organization, system organization, and parallel processing.

Course Outcomes

After completing this course, the student will be able to:

1. Know the classes of computers, and new trends and developments in computer architecture
2. Understand pipelining, instruction set architectures, memory addressing.
3. Understand the performance metrics of microprocessors, memory, networks, and disks
4. Understand the performance and efficiency in advanced multiple-issue processors.
5. Understand symmetric shared-memory architectures and their performance.

UNIT-I

Introduction - What is computer architecture? Software-hardware interface. Performanceand Power. Performance metrics. Performance measurement. Benchmark programs.

UNIT-II

Instructions- Instruction Set. Operations. Operands and addressing modes. Role of compilers and system software. Understanding implementation of function calls and returns, array references, pointers.

UNIT-III

Computer Arithmetic- Signed integers. Floating point. Rounding and accuracy. Addition and Subtraction. Multiplication. Division

Processor - Data path elements. Data path control.

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UNIT-IV

Pipelining - Speedup. Pipeline hazards. Stalling. Forwarding. Branch prediction. Exceptions. Speculation. Multiple issue.

Dynamic scheduling; Cache memory- Locality of reference. Cache organization and access. Multilevel caches. Performance. Cache coherence.

UNIT-V

Virtual Memory- Hardware support for address translation, page fault handling. Translation look aside buffer, Hardware-software interface.

Input/Output- Hard disk. Flash memory. I/O interfacing. Memory mapped I/O. Interrupt driven I/O. Direct memory access. Redundant arrays of inexpensive disks; Introduction to Multi-core architecture, Multi-processors. Clusters.

Suggested Readings:

1. David A. Patterson and John L. Hennessy, *Computer Organization and Design: The Hardware and Software Interface,* Morgan Kaufmann Publishers, 4th Edition.(2009)
2. John L. Hennessy and David A. Patterson, Computer Architecture: *A Quantitative Approach*, Morgan Kaufmann Publishers (2007)

Course Code	Course Title	Core / Elective
PE 624 CSM	**Mobile Computing**	**ELECTIVE**

Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

1. To introduce basics of wireless voice and data communication technologies
2. To build working knowledge on various telephone and satellite networks
3. To study the working principles of wireless LANs and standards
4. To study principles of adhoc networks and routing
5. To gain knowledge on integration of mobile networks into Internet
6. To build skills in working with wireless application protocols to develop mobile applications.

Course Outcomes

After completing this course, the student will be able to

1. Understand and apply various techniques involved in planning and construction stages.
2. Implement Adhoc Network Routing protocols.
3. Mini based project based on tracking, localization and routing in wireless networks.
4. Implement file transfer, access and authentication based applications for mobile computing.

UNIT-I

Introduction – Wireless transmission – Frequencies for radio transmission – Signals – Antennas – Signal Propagation – Multiplexing – Modulations – Spread spectrum – MAC – SDMA – FDMA – TDMA – CDMA – Cellular Wireless Networks.

UNIT-II

Telecommunication systems – GSM – GPRS – DECT – UMTS – IMT-2000 – Satellite Networks - Basics – Parameters and Configurations – Capacity Allocation – FAMA and DAMA – Broadcast Systems – DAB - DVB.

UNIT-III

Wireless LAN – IEEE 802.11 - Architecture – services – MAC – Physical layer – IEEE 802.11a - 802.11b standards – HIPERLAN – Blue Tooth.

UNIT-IV

Mobile IP, Dynamic Host Configuration Protocol, Routing in MANETs: DSDV, DSR, AODV and ZRP. MANETS vs VANETs

UNIT-V

Traditional TCP – classical TCP improvements – WAP, and WAP 2.0.
Mobile Transaction models, File Systems and Mobility Management

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Suggested Readings:

1. Jochen H. Schiller, *Mobile Communications*, Addison Wesley, Second Edition, 2003.
2. William Stallings, *Wireless Communications and Networks*, PHI/Pearson Education, 2002.
3. Kaveh Pahlavan, Prasanth Krishnamurthy, *Principles of Wireless Networks*, Prentice Hall, 2003.
4. Uwe Hansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, *Principles of MobileComputing*, Springer, 2003.
5. Krzysztof Wesolowski, *Mobile Communication Systems*, John Wiley and Sons Ltd, 2002.

Course Code	Course Title				Core / Elective		
PE 625 CSM	**Image Processing**				**ELECTIVE**		
Prerequisites	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

1. To introduce basics of visual perception, sampling, quantization and representation of digital images
2. To introduce spatial domain and frequency domain filtering techniques necessary for image processing operations.
3. To learn advanced image analysis techniques such as image compression, image segmentation, and object recognition
4. To learn techniques of colour image processing, multi resolution methods, wavelets and morphological processing

Course Outcomes

After completing this course, the student will be able to

1. Analyse images in the frequency domain using various transforms
2. Design and implement algorithms that perform image processing operations such as histogram equalization, enhancement, restoration, filtering and denoising
3. Explain colour spaces, restoration and enhancement of colour images
4. Develop simple object recognition systems

UNIT-I

Image Processing: Introduction, Examples, Fundamental steps, Components, Elements of visual perception, Light and Electromagnetic Spectrum, Image sensing and Acquisition, Image Sampling and Quantization, Basic relationships between pixels.

Intensity Transformations and Spatial Filtering: Background, some basic intensity transformation functions, Histogram processing, Fundamentals of Spatial filtering, smoothing spatial filters, sharpening spatial filters, Combining Spatial Enhancement Methods.

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UNIT-II

Filtering in the Frequency Domain: Background, Preliminary concepts, Sampling and Fourier Transformof Sampled Functions, Discrete Fourier Transform (DFT) of one variable, Extension to functions of two variables, Some Properties of the 2-D Discrete Fourier Transform, Basics of Filtering in the Frequency Domain, Image Smoothing, Image Sharpening, Homomorphic Filtering.

Image Restoration: Noise Models, Restoration in the presence of noise Only-Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering.

Linear Degradation, Position-invariant Degradation, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error Filtering, Constrained Least Squares Filtering, Geometric Mean Filter.

UNIT-III

Colour Image Processing: Colour fundamentals, Colour models, Pseudocolour Image Processing, Basics of Full-colour Image Processing, Colour Transformations, Smoothing and Sharpening, Colour-based Image Segmentation, Noise in Colour Images, Colour Image Compression.

Wavelets and Multi resolution Processing: Background, Multiresolution Expansions, Wavelet Transforms in One Dimension, The Fast Wavelet Transform, Wavelet Transforms in Two Dimensions, Wavelet Packets.

UNIT-IV

Image Compression: Fundamentals, Image Compression Models, Elements of Information Theory, Error-free Compression, Lossy Compression, Image Compression Standards, Some Basic Compression Methods.
Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms, Some Basic Gray-Scale Morphological Algorithms.

UNIT-V

Image Segmentation: Fundamentals, Point, Line and Edge Detection, Thresholding, Region-based Segmentation, Segmentation using Morphological Watersheds, The use of Motion in Segmentation.
Object Recognition: Patterns and Pattern Classes, Recognition based on Decision-theoretic Methods, Structural Methods.

Suggested Readings:

1. Rafael C. Gonzalez and Richard E. Woods, *Digital Image Processing,* PHI Learning Pvt. Limited,3rd Edition, 2008.
2. William K. Pratt, *Digital Image Processing*, John Wiley & Sons, Inc., 3rd Edition, 2001.

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Course Code	Course Title					Core / Elective
PE 626 CSM	**Software Quality and Testing**					**ELECTIVE**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

1. To understand the challenges of Software Quality and the need for integration of quality activities in project life cycle
2. To introduce supporting software quality devices
3. To introduce software quality metrics and Quality Assurance models
4. To understand the steps in software testing process and taxonomy of testing tools

Course Outcomes

After completing this course, the student will be able to

1. Describe the role of quality assurance activities in the software process
2. Compare several process improvement models such as CMM, CMMI, PCMM, and ISO9000
3. Describe several process metrics for assessing and controlling a project
4. Describe how available static and dynamic test tools can be integrated into the software development environment

UNIT - I

The Software Quality Challenge, Introduction Software Quality Factors, The Components of the Software Quality Assurance System – Overview, Development and Quality Plans.

UNIT - II

Integrating Quality Activities in the Project Life Cycle, Assuring the Quality of Software Maintenance Components, CASE Tools and their effect on Software Quality, Procedure and Work Instructions, Supporting Quality Devices, Configuration Management, Documentation Control, Project Progress Control.

UNIT - III

Software Quality Metrics, Costs of Software Quality, Quality Management Standards - ISO 9000 and Companion ISO Standards, CMM, CMMI, PCMM, Malcom Balridge, 3 Sigma, 6 Sigma, SQA Project Process Standards – IEEE Software Engineering Standards.

UNIT - IV

Building a Software Testing Strategy, establishing a Software Testing Methodology, Determining Your Software Testing Techniques, eleven – Step Software Testing Process Overview, Assess Project Management Development Estimate and Status, Develop Test Plan, Requirements Phase Testing, Design Phase Testing, Program Phase Testing, Execute Test and Record Results, Acceptance Test, Report Test Results, Test Software Changes, Evaluate Test Effectiveness.

UNIT - V

Testing Client / Server Systems, Testing the Adequacy of System Documentation, Testing Web-based Systems, Testing Off – the – Shelf Software, testing in a Multiplatform Environment, Testing Security, testing a Data Warehouse, Creating Test Documentation, Software Testing Tools, Taxonomy of Testing Tools, Methodology to Evaluate Automated Testing Tools, Load Runner, Win Runner and Rational Testing Tools, Java Testing Tools, JMetra, JUNIT and Cactus.

Suggested Readings:

1. Daniel Galin, *Software Quality Assurance–From Theory to Implementation*, Pearson Education.2004
2. Mordechai Ben Menachem / Garry S. Marliss, *Software Quality–Producing Practical, ConsistentSoftware*,BS Publications, 2014
3. William E. Perry, *Effective Methods for Software Testing*, 2nd Edition, Wiley.
4. Srinivasan Desikan, Gopalaswamy Ramesh, *Software Testing, Principles and Practices*, 2006.PearsonEducation.
5. K.V.K.K. Prasad, *Software Testing Tool*, Wiley Publishers

Web Resources:

1. http://www.sei.cmu.edu/cmmi/
2. www.ibm.com/software/awdtools/tester/functional/index.html
3. www.ibm.com/software/awdtools/test/manager/
4. *java-source.net/open-source/testing-tools*
5. www.junit.org
6. *java-source.net/open-source/web-testing-tools*

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Course Code	Course Title	Core/ Elective
OE 601 CSM	PRINCIPLES OF MACHINE LEARNING	OPEN ELECTIVE -1

Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	30	70	3

Course Objectives:

1. To introduce students to the basic concepts of Data Science and techniques of Machine Learning.
2. To develop skills of using recent machine learning software for solving practical problems.
3. To gain experience of doing independent study and research.

***Course Outcomes*:** After learning the contents of this course the student is able to

1. Design and implement machine learning solutions of classification, regression problems.
2. Evaluate and interpret the results of the machine learning algorithms.
3. Evaluate exploratory data analysis and Data preparation and preprocessing on different datasets.
4. Calculate Statistical measurements of the given data.
5. Analyze and identify the best algorithm matches for a given dataset.

UNIT – I

Introduction: What is Machine Learning, Use Machine Learning, and Types of Machine Learning Systems: supervised, unsupervised, semi-supervised, Reinforcement Learning, Batch and Online Learning, Main Challenges of Machine Learning.

UNIT – II

Descriptive Statistics: Data representation, types of data- nominal, ordinal, interval and continuous, central tendency- calculating mean mode median, mean vs median, variability, variance, standard deviation, Mean Absolute Deviation using sample dataset, finding the percentile, interquartile range, Box Plot, Outlier, whisker, calculating correlation, covariance, causation.

Exploratory data analysis, Data preparation and preprocessing, Data visualization.

UNIT – III

Regression: Introduction to Regression analysis, measure of linear relationship, Regression with stats models, Determining coefficient, meaning and significance of coefficients, coefficient calculation with least square method, Types of regression, Simple Linear Regression, Using Multiple features, Polynomial Regression, Metrics for Regression: MSE, RMSE, MAE.

UNIT – IV

Classification: Classification problem, Probability based approach, Logistic Regression- log-odd, sigmoid transformation, Metrics: Confusion Matrix, Accuracy, Error Rate, Precision, Recall, ROC curve, F1 score, and introduction to gradient descent.

UNIT – V

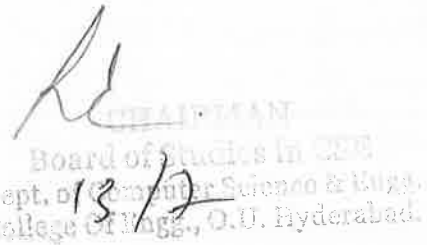
Non Parametric & SVM classification: About Non parametric classification, Decision Trees: Entropy, Gain ratio, Information Gain, Splitting criteria,

Ensemble Method: Introduction to Random Forest, Accuracy measure & performance

Instance based learning- Introduction, KNN algorithm, Distance measures, model building, locally weighted regression, radial basis functions, SVM classifier, hyper-plane, slack variables, geometric transformation kernel trick, kernel transformation.

***TEXT BOOKS / REFERENCES*:**

1. Booz, Allen, Hamilton, The Field Guide to Data Science
2. AurélienGéron, Hands-On Machine Learning with Scikit-Learn and TensorFlow,O'Reilly Media, 2017-03-10
3. Peter Harrington, Machine Learning in Action, Manning Publications
4. Python For Data Analysis by wes McKinny 2nd edition,O'REILLY publications.
5. Jason Brownlee data analysis for machine learning.



Soft Skills and Interpersonal Skills

OE 601EG
Instruction: 3 periods per week
Duration of SEE: 3 Hrs
CIE 30 Marks
SEE: 70 Marks
Credits 3

Objectives:

1. To train the students in effective listening skills required for Professional Communication.
2. To enable the students to develop the required speaking skills for Professional Communication
3. To equip the students with appropriate reading strategies required professionally
4. To develop professional Writing skills among students
5. To equip the students with the right attitude and coping techniques required professionally

Outcomes

By the end of the course students will be able to:
1. Listen to a variety of speakers and texts and will be able to comprehend and perform the required tasks.
2. Speak and respond appropriately as per the task requirement.
3. Read a variety of texts, comprehend, summarize them and perform the required tasks
4. Write and publish a variety of documents such as Letters, Memos, Emails , Blogs, Reports, Cover Letters and Resume
5. Demonstrate the right attitude and skills to cope with organizing and

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Suggested Reading

1. Andrea J. Rutherford. *Basic Communication Skills for Technology* Pearson Education, Inc.New Delhi, 2001.
2. Anne Dannellon. *Team Talk: The Power of Language in Team Dynamics* Harvard Business School Press, Boston, Massachusetts, 1996.
3. Antony Jay and Ros Jay. *Effective Presentation: How to be a Top Class Presenter* Universities Press (India) Limited, 1999.
4. Ashraf M. Rizvi, *Effective Technical Communication*. Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2005
5. Daniel Goldman. *Emotional Intelligence*. New York, Bantam Books, 1995.
6. Fnedrike Klippel. *Keep Talking*. Cambridge University Press, London, 1984.
7. K.K. Sinha *Business Communication* Galgotia Publishing Company GPC, New Delhi, 1999.
8. Lewis.Hedwig *Body Language: A Guide for Professionals.*Response Books (a division of Sage Publications India, Pvt. Ltd.,) New Delhi., 1998.
9. Hari Mohan Prasad and Rajnish Mohan. *How to prepare for Group Discussion and Interview.* 2nd Edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2005
10. Mitra, Barun. Personality Development and Soft Skills
11. Goodheart and Willcox. Soft Skills at Workplace

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