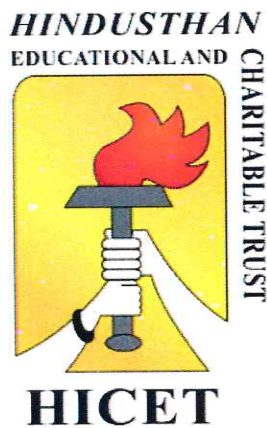


HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution, Affiliated to Anna University, Chennai
Approved by AICTE, New Delhi & Accredited by NAAC with 'A' Grade)
Coimbatore – 641 032

B.TECH. ARTIFICIAL INTELLIGENCE & MACHINE LEARNING



Curriculum & Syllabus

2021-2022

CHOICE BASED CREDIT SYSTEM

VISION AND MISSION OF THE INSTITUTION

VISION

To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values.

MISSION

IM1: To provide academic excellence in technical education through novel teaching methods.

IM2: To empower students with creative skills and leadership qualities.

IM3: To produce dedicated professionals with social responsibility.


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HiCET

VISION AND MISSION OF THE DEPARTMENT

VISION

To impart quality education for students in the field of Artificial Intelligence and human-machine partnership in the technological-embedded world and create competent professionals who serve the greater cause of society.

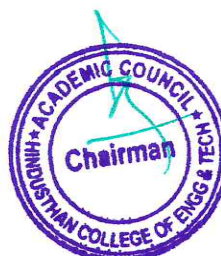
MISSION

DM1: To provide a student-centric learning environment to create competent professionals with knowledge in artificial intelligence, machine learning techniques, natural language processing, deep-learning and computer vision.

DM2: To facilitate the students to develop the necessary skills to sustain in today's globalised technological society, in pursuit of excellence by keeping high personal and professional values and ethics.

DM3: To nurture their skills in research and innovation that contributes to the development of society.


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HICET**

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1. Engineering Knowledge - Ability to apply knowledge of mathematics, science, mechanical engineering fundamentals and specialization to the solutions of complex engineering problems;

PO2. Problem Analysis - Ability to identify, formulate, conduct research literature and analyze complex engineering problems using principles of mathematics, natural sciences and mechanical engineering sciences;

PO3. Design/Development of Solutions - Ability to design mechanical solutions for complex engineering problems and systems, components or processes that meet specified needs;

PO4. Investigation - Ability to conduct investigation of complex problems using research based knowledge and research methods to provide valid conclusions;

PO5. Modern Tool Usage - Ability to develop and apply appropriate techniques, resources, and innovative engineering tools to complex mechanical engineering activities;

PO6. The Engineer and Society - Ability to apply contextual knowledge to assess societal, health, safety, legal and cultural issues with the awareness of the consequent responsibilities to professional mechanical engineering practice for the betterment of society;

PO7. Environment and Sustainability - Ability to understand the impact of professional mechanical engineering solutions in societal, economic and environmental contexts and demonstrate knowledge of and need for sustainable development;

PO8. Ethics - Ability to apply ethical principles and demonstrate commitment to professional ethics, responsibilities and norms of mechanical engineering practice;

PO9. Communication - Ability to communicate effectively on complex engineering activities with the engineering community and with society at large;


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PO10. Individual and Team Work - Ability to demonstrate knowledge and understanding of mechanical engineering and management principles and apply these effectively as an individual, a member or a leader in diverse teams and in multidisciplinary settings.

PO11. Life Long Learning - Ability to recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change in mechanical engineering practice.

PO12. Project Management and Finance - Ability to demonstrate knowledge and understanding of project management, finance principles, business development within the scope of mechanical engineering practices.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1	An ability to apply advanced core AI technologies, to extract information and provide knowledge to intelligent decision-making systems and human-AI collaboration
PSO2	An ability to develop a principled and thoughtful approach to the machine learning tools that can address complex cognitive tasks for the betterment of society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To acquire strong knowledge in the domain of artificial intelligence and machine learning theory and principles for identifying, analyzing and solving problems.

PEO2: To enable students to build intelligent machines, software, or applications with a cutting-edge combination of machine learning, analytics, and visualization technologies.

PEO 3: To improve students' ability to work effectively within a team and apply appropriate practices within a professional, legal and ethical framework for societal needs, and accomplish sustainable progress through lifelong learning and research.


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CURRICULUM



Hindusthan College of Engineering and Technology

(An Autonomous Institution, Affiliated to Anna University, Chennai Approved by AICTE, New Delhi & Accredited by NAAC with 'A' Grade)
Valley Campus, Pollachi Highways, Coimbatore, Tamil Nadu.



DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

REGULATION-2019

For the students admitted during the academic year 2021-2022 and onwards

SEMESTER I

S.No	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE1101	Technical English	HS	2	1	0	3	25	75	100
2	21MA1101	Calculus	BS	3	1	0	4	25	75	100
THEORY & LAB COMPONENT										
3	21PH1151	Applied Physics	BS	2	0	2	3	50	50	100
4	21CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
5	21CS1152	Object Oriented Programming using Python	IC	2	0	2	3	50	50	100
6	21EC1154	Basics of Electron devices and Electric Circuits	ES	2	0	2	3	50	50	100
PRACTICAL										
7	21HE1071	Language Competency Enhancement Course - I	HS	0	0	2	1	100	0	100
MANDATORY										
8	21MC1191	Induction Program	MC	0	0	0	0	0	0	0
9	21HE1072	Career Guidance Level - I	EEC	2	0	0	0	100	0	100
10	21HE1073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
Total Credits				16	2	10	20	550	350	900



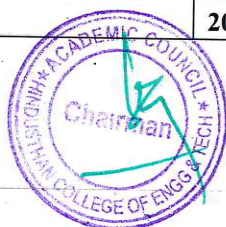
SEMESTER II

S.No	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE2101	Business English for Engineers	HS	2	1	0	3	25	75	100
2	21MA2104	Differential Equations And Linear Algebra	BS	3	1	0	4	25	75	100
THEORY & LAB COMPONENT										
3	21PH2151	Material Science	BS	2	0	2	3	50	50	100
4	21CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
5	21CS2153	Java Fundamentals	IC	2	0	2	3	50	50	100
6	21ME2154	Engineering Graphics	ES	1	0	4	3	50	50	100
PRACTICAL										
7	21ME2001	Engineering Practices	ES	0	0	4	2	50	50	100
8	21HE2071	Language Competency Enhancement Course - II	HS	0	0	2	1	100	0	100
MANDATORY										
9	21HE2072	Career Guidance Level - II	EEC	2	0	0	0	100	0	100
Total Credits				14	2	16	22	500	400	900

For the students admitted during the academic year 2020-2021 and onwards

SEMESTER III

S.No	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19AI3201	Data Structures and Algorithms	PC	3	0	0	3	25	75	100
2	19AI3202	Foundations of Artificial Intelligence	PC	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
3	19MA3152	Probability and Applied Statistics	BS	3	0	2	4	50	50	100
4	19AI3251	Digital Principles and System Design	PC	3	0	2	4	50	50	100
5	19AI3252	Clean Coding and Devops	IC	3	0	2	4	50	50	100
PRACTICAL										
6	19AI3001R	Data Structures and Algorithms Laboratory	PC	0	0	3	1.5	50	50	100
7	19AI3002	Artificial Intelligence Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY										
8	19MC3191	Indian Constitution	MC	2	0	0	0	0	0	0
9	19HE3072	Career Guidance Level III	EEC	2	0	0	0	100	0	100
10	19HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
Total Credits				20	0	12	21	500	400	900



SEMESTER IV

S.No	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19MA4105	Discrete Mathematical Structures	BS	2	1	0	3	25	75	100
2	19AI4201	Database Management System	PC	3	0	0	3	25	75	100
3	19AI4202	Data Visualization	IC	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
4	19AI4251	Operating Systems	PC	2	0	2	3	50	50	100
5	19AI4252	Introduction to Machine Learning	PC	3	0	2	4	50	50	100
PRACTICAL										
6	19AI4001R	Database Management System Laboratory	PC	0	0	3	1.5	50	50	100
7	19AI4002	Data Visualization Laboratory	IC	0	0	3	1.5	50	50	100
MANDATORY										
8	19MC4191	Essence of Indian Traditional Knowledge / Value Education	MC	2	0	0	0	0	0	0
9	19HE4072	Career Guidance Level IV: Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10	19HE4073	Ideation Skills	EEC	1	0	0	0	100	0	100
Total Credits				18	1	10	19	475	425	900

CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	21	19	24	24	21	14	165

* Student can earn extra credit 35 over and above the total credits


Chairman, Board of Studies


Dean - Academics


Principal

Chairman - BoS
AIML - HICET

Dean (Academics)
HICET

PRINCIPAL
Hindusthan College of Engineering & Tech
COIMBATORE - 641 032



SYLLABUS

Programme B.TECH.	Course Code 21HE1101	Name of the Course TECHNICAL ENGLISH	L 2	T 1	P 0	C 3
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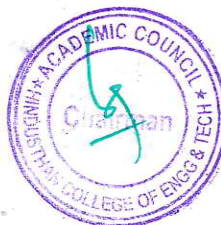
- Course Objective**
1. To facilitate students to communicate effectively with coherence.
 2. To train the learners in descriptive communication.
 3. To introduce professional communication.
 4. To enhance knowledge and to provide the information on corporate environment.
 5. To equip the trainers with the necessary skills on critical thinking.

Unit	Description	Instructional Hours
I	Listening and Speaking – Opening a conversation, maintaining coherence, turn taking, closing a conversation (excuse, general wishes, positive comments and thanks) Reading – Reading articles from newspaper, Reading comprehension Writing Chart analysis, process description, Writing instructions Grammar and Vocabulary - Tenses, Regular and irregular verb, technical vocabulary.	9
II	Listening and Speaking - listening to product description, equipment & work place (purpose, appearance, function) Reading - Reading technical articles Writing - Letter phrases, writing personal letters, Grammar and Vocabulary -articles, Cause & effect, Prepositions.	9
III	Listening and Speaking - - listening to announcements Reading - Reading about technical inventions, research and development Writing - Letter inviting a candidate for interview, Job application and resume preparation Grammar and Vocabulary - Homophones and Homonyms.	9
IV	Listening and Speaking - - Practice telephone skills and telephone etiquette (listening and responding, asking questions). Reading - Reading short texts and memos Writing - invitation letters, accepting an invitation and declining an invitation Grammar and Vocabulary - Modal verbs, Collocation, Conditionals, Subject verb agreement and Pronoun-Antecedent agreement.	9
V	Listening and Speaking - listening to technical group discussions and participating in GDs Reading - reading biographical writing - Writing - Proposal writing, Writing definitions, Grammar and Vocabulary - Abbreviation and Acronym, Prefixes & suffixes, phrasal verbs.	9
Total Instructional Hours		45

- Course Outcome**
- CO1- Trained to maintain coherence and communicate effectively.
 - CO2- Practiced to create and interpret descriptive communication.
 - CO3- Introduced to gain information of the professional world.
 - CO4- acquired various types of communication and etiquette.
 - CO5- Taught to improve interpersonal and intrapersonal skills.

TEXT BOOKS:

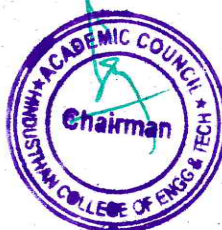
- T1- Norman Whitby, “Business Benchmark-Pre-intermediate to Intermediate”, Cambridge University Press, 2016.
T2- Raymond Murphy, “Essential English Grammar”, Cambridge University Press, 2019.

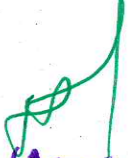


REFERENCE BOOKS :

- R1- Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice", Oxford University Press, 2009.
- R2- Raymond Murphy, "English Grammar in Use"- 4th edition Cambridge University Press, 2004.
- R3- Kamallesh Sadanan "A Foundation Course for the Speakers of Tamil-Part-I &II", Orient Blackswan, 2010.


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Programme B.TECH.	Course Code 21MA1101	Name of the Course CALCULUS	L 3	T 1	P 0	C 4
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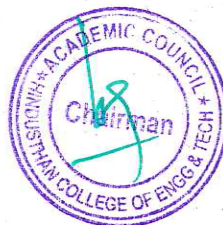
- Course Objective**
1. Understand the concept of differentiation
 2. Evaluate the functions of several variables which are needed in many branches of engineering.
 3. Understand the concept of double integrals.
 4. Understand the concept of triple integrals.
 5. Interpret in the area of infinite series and their convergence.

Unit	Description	Instructional Hours
	DIFFERENTIAL CALCULUS	
I	Rolle's Theorem – Lagrange's Mean Value Theorem- Maxima and Minima –Taylor's and Maclaurin's Theorem	12
	MULTIVARIATE CALCULUS (DIFFERENTIATION)	
II	Total derivatives - Jacobians – Maxima, Minima and Saddle points - Lagrange's method of undetermined multipliers – Gradient, divergence, curl and derivatives.	12
	DOUBLE INTEGRATION	
III	Double integrals in Cartesian coordinates – Area enclosed by the plane curves (excluding surface area) – Green's Theorem (Simple Application) - Stoke's Theorem – Simple Application involving cubes and rectangular parelloiped.	12
	TRIPLE INTEGRATION	
IV	Triple integrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates. Gauss Divergence Theorem – Simple Application involving cubes and rectangular parelloiped.	12
	SEQUENCES & SERIES	
V	Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test and D'Alembert's ratio test – Alternating series – Leibnitz's test — Absolute and conditional convergence.	12
Total Instructional Hours		60

- Course Outcome**
- CO1: Apply the concept of differentiation in any curve.
CO2: Identify the maximum and minimum values of surfaces.
CO3: Apply double integrals to compute area of plane curves.
CO4: Evaluation of triple integrals to compute volume of solids.
CO5: Evaluation of infinite series approximations for problems arising in mathematical modeling.

TEXT BOOKS:


- T1 - Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018.
T2 - Veerarajan T, "Engineering Mathematics ", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016.




REFERENCE BOOKS :

- R1- Thomas & Finney “ Calculus and Analytic Geometry” , Sixth Edition,,Narosa Publishing House, New Delhi.
R2 - Weir,M.D and Joel Hass, ‘ Thomas Calculus” 12th Edition,Pearson India 2016..
R3 - Grewal B.S, “Higher Engineering Mathematics”, 42nd Edition, Khanna Publications, Delhi, 2012.




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Programme B.TECH.	Course Code 21PH1151	Name of the Course APPLIED PHYSICS	L 2	T 0	P 2	C 3
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The student should be able to

Course Objective

1. Enhance the fundamental knowledge in properties of matter
2. Analysis the oscillatory motions of particles
3. Extend the knowledge about wave optics
4. Gain knowledge about laser and their applications
5. Conversant with principles of optical fiber, types and applications of optical fiber

Unit	Description	Instructional Hours
I	PROPERTIES OF MATTER Elasticity – Hooke's law – Stress-strain diagram - Poisson's ratio – Bending moment – Depression of a cantilever – Derivation of Young's modulus of the material of the beam by Uniform bending theory and experiment. Determination of Young's modulus by uniform bending method.	6+3=9
II	OSCILLATIONS Translation motion –Vibration motion – Simple Harmonic motion – Differential Equation of SHM and its solution – Damped harmonic oscillation - Torsion stress and deformations – Torsion pendulum: theory and experiment. Determination of Rigidity modulus – Torsion pendulum.	6+3=9
III	WAVE OPTICS Conditions for sustained Interference – air wedge and it's applications - Diffraction of light – Fresnel and Fraunhofer diffraction at single slit –Diffraction grating – Rayleigh's criterion of resolution power - resolving power of grating. Determination of wavelength of mercury spectrum – spectrometer grating. Determination of thickness of a thin wire – Air wedge method.	6+6=12
IV	LASER AND APPLICATIONS Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein's coefficients (A&B) – Type of lasers – Nd:YAG laser and CO ₂ laser- Laser Applications – Holography – Construction and reconstruction of images. Determination of Wavelength and particle size using Laser.	6+3=9
V	FIBER OPTICS AND APPLICATIONS Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index, modes and materials) – Fiber optical communication link – Fiber optic sensors – Temperature and displacement sensors.	6

Total Instructional Hours

45



After completion of the course the learner will be able to

- Course Outcome**
- CO1: Illustrate the fundamental properties of matter
 - CO2: Discuss the Oscillatory motions of particles
 - CO3: Analyze the wavelength of different colors
 - CO4: Understand the advanced technology of LASER in the field of Engineering
 - CO5: Develop the technology of fiber optical communication in engineering field

TEXT BOOKS:

- T1** - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

REFERENCE BOOKS:

- R1** - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015
R2 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi 2016
R3 - Dr. G. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2016


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Programme	Course Code	Name of the Course	L	T	P	C
BE/B.Tech	21CY1151	CHEMISTRY FOR ENGINEERS (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective

1. The boiler feed water requirements, related problems and water treatment techniques.
2. The principles of polymer chemistry and engineering applications of polymers and composites.
3. The principles of electrochemistry and with the mechanism of corrosion and its control.
4. The principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
5. The important concepts of spectroscopy and its applications.

Unit	Description	Instructional Hours
I	WATER TECHNOLOGY Hard water and soft water- Disadvantages of hard water- Hardness: types of hardness, simple calculations, estimation of hardness of water – EDTA method – Boiler troubles - Conditioning methods of hard water – External conditioning - demineralization process - desalination: definition, reverse osmosis – Potable water treatment – breakpoint chlorination. Estimation of total, permanent and temporary hardness of water by EDTA.	6+3=9
II	POLYMER & COMPOSITES Polymerization – types of polymerization – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, properties and uses of commercial plastics – PVC, Bakelite – moulding of plastics (extrusion and compression); Composites: definition, types of composites – polymer matrix composites (PMC) –FRP	6
III	ELECTROCHEMISTRY AND CORROSION Electrochemical cells – reversible and irreversible cells - EMF- Single electrode potential – Nernst equation (derivation only) – Conductometric titrations. Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types –galvanic corrosion – differential aeration corrosion – corrosion control – sacrificial anode and impressed cathodic current methods - protective coatings – paints – constituents and functions. Conductometric titration of strong acid vs strong base (HCl vs NaOH). Conductometric precipitation titration using BaCl₂ and Na₂SO₄. Estimation of Ferrous iron by Potentiometry.	6+9=15
IV	ENERGY SOURCES AND STORAGE DEVICES Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- lithium battery- fuel cell H ₂ -O ₂ fuel cell applications.	6
V	ANALYTICAL TECHNIQUES Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principle – instrumentation (block diagram only) – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy. Determination of iron content of the water sample using spectrophotometer.(1,10 phenanthroline / thiocyanate method).	6+3
Total Instructional Hours		45

Course Outcome

- CO1: Differentiate hard and soft water and to solve the related problems on water purification and its significance in industries and daily life
- CO2: Acquire the basic knowledge of polymers, composites and FRP and their significance.
- CO3: Develop knowledge on the basic principles of electrochemistry and understand the causes of corrosion, its consequences to minimize corrosion to improve industrial design.
- CO4: Develop knowledge about the renewable energy resources and batteries along with the need of new materials to improve energy storage capabilities.
- CO5: Identify the structure and characteristics of unknown/new compound with the help of spectroscopy.

TEXT BOOKS

- T1 -P. N. Madudeswaran and B.Jeyagowri, "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, Chennai (2019).
T2 - P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2018).

REFERENCE BOOKS

- R1 - B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2012).
R2 - S.S.Dara "A Text book of Engineering Chemistry" S.Chand & Co. Ltd., New Delhi (2017).

(Signature)
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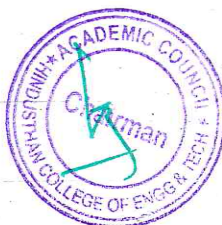
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**Dean (Academics)
HiCET**

Programme B.TECH.	Course Code 21CS1152	Name of the Course OBJECT ORIENTED PROGRAMMING USING PYTHON	L 2	T 0	P 2	C 3
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- Course Objective**
1. To read and write simple Python programs.
 2. To develop Python programs with conditionals and loops
 3. To define Python functions and call them
 4. To understand OOP concepts and write programs using classes and objects
 5. To do input/output with files in Python

Unit	Description	Instructional Hours												
	INTRODUCTION TO PYTHON What is Python - Advantages and Disadvantages, Benefits and Limitation- Downloading and Python-installation-Python Versions-Running Python Scripts, Executing scripts with python launcher-Using interpreter interactively- Using variables-String types: normal, raw and Unicode-String operations and functions- Math operator and functions. <i>Illustrative program: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.</i>	7+2(P)												
I	DATA TYPES, STATEMENTS, CONTROL FLOW Data Types (List, Tuple, string, dictionary, set)-Operators and precedence of operators, expressions, statements, comments; Conditionals: Boolean values and operators, conditional (if), alternative (if -else), chained conditional (if -elif-else); Iteration: state, while, for, break, continue, pass. <i>Illustrative programs: Find the square root of a number, To find the given number is Prime or not, Write a Python program which accepts a sequence of comma-separated numbers from user, generate a list and find the sum and average of the numbers.</i>	5+4(P)												
II	PYTHON FUNCTIONS Introduction to functions-Global and local variable in python-Decorators in python- Python lamda functions-Exception handling in python. <i>Illustrative programs: Square root, GCD, exponentiation, linear search, binary search, Write a menu driven program to perform the following task: a) A function Sum_DigN() to find the sum of the digits of a given number, b) A recursive function Sum_DigR() to find the same.</i>	5+4(P)												
III	PYTHON OOPS Introduction to oops concept-Python class and objects-Constructor in python- Inheritance-Types of inheritance-Encapsulation in python-Polymorphism in python. <i>Illustrative programs: Illustrative programs: Write a Python program using class for the calculation of telephone bill. The charges for the calls are fixed as follows:</i>	5+4(P)												
IV	<table border="1"> <tr> <td>Unit Call</td> <td>Cost/unit</td> </tr> <tr> <td>Below 100 calls</td> <td>No Charge, only rental amount Rs. 250</td> </tr> <tr> <td>100-150 calls</td> <td>Rs. 1.00</td> </tr> <tr> <td>151-300 calls</td> <td>Rs. 2.50</td> </tr> <tr> <td>301-600 calls</td> <td>Rs. 4.50</td> </tr> <tr> <td>Above 600</td> <td>Rs. 6.00.</td> </tr> </table>	Unit Call	Cost/unit	Below 100 calls	No Charge, only rental amount Rs. 250	100-150 calls	Rs. 1.00	151-300 calls	Rs. 2.50	301-600 calls	Rs. 4.50	Above 600	Rs. 6.00.	
Unit Call	Cost/unit													
Below 100 calls	No Charge, only rental amount Rs. 250													
100-150 calls	Rs. 1.00													
151-300 calls	Rs. 2.50													
301-600 calls	Rs. 4.50													
Above 600	Rs. 6.00.													
V	FILES, PACKAGES File handling in python-Open a file in python-How to read from a file in python- writing to file in python-Python numpy-Python pandas. <i>Illustrative programs: How to display the contents of text file in reverse order? Write the code for the same, not exceeding 10 lines of code, Creating Modules and Packages for arithmetic Operations.</i>	5+4(P)												

Total Instructional Hours (27 + 18) 45




Course Outcome	CO1:	Understanding the basic concepts to read, write and execute simple python programs.
	CO2:	Apply the conditional and looping concepts for solving problems
	CO3:	Apply functions to decompose larger complex programs
	CO4:	Understanding the OOPS concepts and writing programs using classes and objects
	CO5:	Understand to read and write data from/to files in Python Programs.

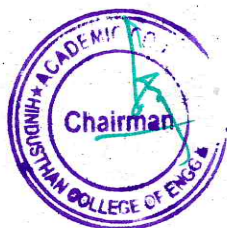
TEXT BOOKS:

- T1: Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCE BOOKS:

- R1: Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
R2: Timothy A. Budd, —Exploring Python1, Mc-Graw Hill Education (India) Private Ltd., 2015
R3: Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016


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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21EC1154	BASICS OF ELECTRON DEVICES AND ELECTRIC CIRCUITS	2	0	2	3

- Course Objective**
1. To introduce the fundamental concepts of electrical circuits and theorems.
 2. To introduce the concept of circuit transients and resonance.
 3. To understand the basics theory, operational characteristics of diodes and transistors.
 4. To study the operating principles of special semiconductor devices..
 5. To create awareness on the methods for electrical safety and protection.

Unit	Description	Instructional Hours
I	UNIT I : ELECTRICAL CIRCUITS AND ANALYSIS Ohm's law, DC and AC circuits fundamentals, Kirchhoff's laws, Mesh and Nodal analysis-Theorems and simple problems: Superposition, Maximum power transfer theorem - Experimental study -Verification of superposition theorem.	6+3
II	UNIT II : CIRCUIT TRANSIENTS AND RESONANCES Basic RL, RC and RLC circuits and their responses to DC and sinusoidal inputs – frequency response – Parallel and series resonances – Q factor. Experimental verification of series resonance. Experimental study-Determination of Resonance Frequency of Series RLC Circuits	6+3
III	UNIT III : DIODE AND TRANSISTOR Characteristics of PN Junction Diode – Zener Diode and its Characteristics – Zener Effect– Zener Voltage Regulator.Bipolar Junction Transistor (BJT) Construction – CB, CE, CC Configurations and Characteristics- Experimental study-PN Junction Diode Characteristics,Zener Diode Characteristics	6+3
IV	UNIT IV : SPECIAL SEMICONDUCTOR DEVICES Construction, Characteristics and Applications of FET - UJT – SCR, Photo diode, Photo Transistor - LED and LCD- Implementation of Photo diode application. Experimental study- FET Characteristics	6+3
V	UNIT V : BASICS OF POWER SUPPLY AND ELECTRICAL WIRING Introduction to Power supply circuits: Half wave, Full wave Rectifier –SMPS - UPS (online & offline).Cable and wire types and applications – Two way and three way control- Experimental study- Implementation of simple wiring circuit for a Computer network.	6+3

Total Instructional Hours 45

- Course Outcome**
- CO1: Apply network theorems for AC and DC Circuits.
 - CO2: Understand the concept of transient response of circuits.
 - CO3: Ability to explain the theory, construction, and operation of diodes and BJT.
 - CO4: Ability to explain the theory, construction, and operation of FET and special semiconductor diodes.
 - CO5: Ability to apply the methods to ensure electrical safety.



TEXT BOOKS:

- T1 - W David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5Th Edition,(2008).
- T2 - Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis",Tata McGraw Hill, (2007).

REFERENCES BOOKS:

- R1 - M.Robert T. Paynter, "Introducing Electronics Devices and Circuits", PearsonEducation, 7thEducation, (2006).
- R2 - J. Millman&Halkins, SatyebrantaJit, "Electronic Devices &Circuits",Tata McGraw Hill, 2nd Edition, 2008
- R3 - William H. Hayt, J.V. Jack, E. Kemmebly and steven M. Durbin, "Engineering Circuit Analysis",Tata McGraw Hill, 6th Edition, 2002.
- R4 - Robert Boylestad and Louis Nashelsky, "Electron Devices and Circuit Theory" Prentice Hall, 10th edition, July 2008


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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	21HE1071	LANGUAGE COMPETENCY ENHANCEMENT COURSE-I (COMMON TO ALL BRANCHES)	0	0	2	1

Course Objective	
	✓ To enhance student language competency
	✓ To identify individual students level of communication skills
	✓ To develop English Vocabulary and spoken communication skills.
	✓ To revive the fundamentals of English Grammar.

Unit	Description	Instructional Hours
I	Listening Language of Communication- English listening- Hearing Vs Listening- Verbal and Non-verbal communication – Listening strategies-Sounds of English.	3
III	Reading English Language Enhancement – Indianism in English – Role of Reading in effective communication – Techniques for good reading (skimming and scanning) Reading articles from newspaper, magazine. Reading and interpreting a passage.	3
III	Speaking Common errors in Pronunciation – Signposts in English (Role play) – Public Speaking skills – Social Phobia – Eliminating fear – Common etiquette of speaking - Debate and Discuss.	3
IV	Writing Writing genre – Enhancement of basic English Vocabulary; Parts of Speech, Noun, Verbs, and Tenses – combining sentences, sentence formation and completion.	3
V	Art of Communication Communication process – Word building and roleplay – Exercise on English Language for various situations through online and offline activities.	3
Total Instructional Hours		15

Course Outcome	
	CO1- Trained to maintain coherence and communicate effectively.
	CO2- Practiced to create and interpret descriptive communication.
	CO3- Introduced to gain information of the professional world.
	CO4- acquired various types of communication and etiquette.
	CO5- Taught to improve interpersonal and intrapersonal skills.

REFERENCE BOOKS :

1. Verbal Ability and Reading Comprehension by Arun Sharma, 9th edition, Tata Mc Graw Hill
2. Word Power Made Easy by Norman Lewis, – Print, 1 June 2011.
3. High School English Grammar by Wren and Martin, S.CHAND Publications, 1 January 2017.
4. Practical course in Spoken English by J.K. Gangal, PHI Learning , Second edition, 1 January 2018.


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Programme B.TECH.	Course Code 21HE1072	Name of the Course CAREER GUIDANCE LEVEL - I Personality, Aptitude and Career Guidance	L 2	T 0	P 0	C 0
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- Course Objective**
1. To develop and nurture the soft skills of the students through instruction, knowledge acquisition, demonstration and practice
 2. To enhance the students ability to deal with numerical and quantitative skills.
 3. To identify the core skills associated with critical thinking.
 4. To develop and integrate the use of English language skills

Unit	Description	Instructional Hours
	LESSONS ON EXCELLENCE	
I	Skill introspection, Skill acquisition, consistent practice	2
	LOGICAL REASONING	
II	Problem Solving - Critical Thinking- Lateral Thinking - Coding and Decoding – Series – Analogy – Odd Man Out - Visual Reasoning - Sudoku puzzles -Attention to detail	11
	QUANTITATIVE APTITUDE	
III	Addition and Subtraction of bigger numbers - Square and square roots - Cubes and cube roots – Vedic maths techniques - Multiplication Shortcuts - Multiplication of 3 and higher digit numbers – Simplifications - Comparing fractions - Shortcuts to find HCF and LCM - Divisibility tests shortcuts - Algebra and functions	11
	RECRUITMENT ESSENTIALS	
IV	Resume Building - Impression Management	2
	VERBAL ABILITY	
V	Nouns and Pronouns – Verbs - Subject-Verb Agreement - Pronoun-Antecedent – Agreement – Punctuations	4
Total Instructional Hours		30

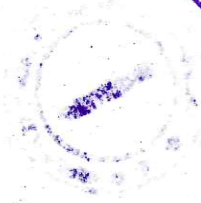
- Course Outcome**
- CO1: Students will analyze interpersonal communication skills. public speaking skills.
CO2: Students will exemplify tautology, contradiction and contingency by logical thinking
CO3: Students will be able to develop an appropriate integral form to solve all sorts of quantitative problems.
CO4: Students can produce a resume that describes their education, skills, experiences and measurable achievements with proper grammar, format and brevity.
CO5: Students will be developed to acquire the ability to use English language with an error while making optimum use of grammar.

REFERENCE BOOKS:

- R1: Quantitative Aptitude – Dr. R S Agarwal
R2: Speed Mathematics: Secret Skills for Quick Calculation - Bill Handley
R3: Verbal and Non – Verbal Reasoning – Dr. R S Agarwal
R4: Objective General English – S.P.Bakshi

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Programme B.TECH.	Course Code 21HE1073	Name of the Course ENTREPRENEURSHIP & INNOVATION	L 1	T 0	P 0	C 0
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- Course Objective**
1. To acquire the knowledge and skills needed to manage the development of innovation.
 2. To recognize and evaluate potential opportunities to monetize these innovations.
 3. To plan specific and detailed method to exploit these opportunities.
 4. To acquire the resources necessary to implement these plans.
 5. To make students understand organizational performance and its importance

Unit	Description
1	Entrepreneurial Thinking
2	Innovation Management
3	Design Thinking
4	Opportunity Spotting / Opportunity Evaluation
5	Industry and Market Research
6	Innovation Strategy and Business Models
7	Financial Forecasting
8	Business Plans/ Business Model Canvas
9	Entrepreneurial Finance
10	Pitching to Resources Providers / Pitch Deck
11	Negotiating Deals
12	New Venture Creation
13	Lean Start-ups
14	Entrepreneurial Ecosystem
15	Velocity Venture

- Course Outcome**
- CO1: Understand the nature of business opportunities, resources, and industries in critical and creative aspects.
- CO2: Understand the processes by which innovation is fostered, managed, and commercialized.
- CO3: Remember effectively and efficiently the potential of new business opportunities.
- CO4: Assess the market potential for a new venture, including customer need, competitors, and industry attractiveness.
- CO5: Develop a business model for a new venture, including revenue. Margins, operations, working capital, and investment.

TEXT BOOKS:

- T1: Arya Kumar “Entrepreneurship – Creating and leading an Entrepreneurial Organization”, Pearson, Second Edition (2012)
- T2: Emrah Yayici “Design Thinking Methodology”, Artbiztech, First Edition (2016).

REFERENCE BOOKS:

- R1: Christopher Golis “Enterprise & Venture Capital”, Allen & Unwin Publication, Fourth Edition (2007).
- R2: Thomas Lock Wood & Edger Papke “Innovation by Design”, Career Press.com, Second Edition (2017).
- R3: Jonathan Wilson “Essentials of Business Research”, Sage Publication, First Edition (2010)



WEB RESOURCES:

W1: <https://blof.forgeforward.in/tagged/startup-lessons>

W2: <https://blof.forgeforward.in/tagged/entrepreneurship>

W3: <https://blof.forgeforward.in/tagged/minimum-viable-product>

W4: <https://blof.forgeforward.in/tagged/minimum-viable-product>

W5: <https://blof.forgeforward.in/tagged/innovation>

W6: <https://www.youtube.com/watch?v=8vEyL7uKXs&list=PLmP9QrmTNPqBEvKbMSXvwIwn7fdnXe6Lw>


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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21HE2101	BUSINESS ENGLISH FOR ENGINEERS	2	1	0	3

- Course Objective**
1. To introduce to business communication.
 2. To train the students to react to different professional situations.
 3. To make the learner familiar with the managerial skills
 4. To empower the trainee in business writing skills.
 5. To learn to interpret and expertise different content.

Unit	Description	Instructional Hours
I	Listening and Speaking – listening and discussing about programme and conference arrangement Reading –reading auto biographies of successful personalities Writing Formal & informal email writing, Recommendations Grammar and Vocabulary - Business vocabulary, Adjectives & adverbs.	9
II	Listening and Speaking - listening to TED talks Reading - Making and interpretation of posters Writing - Business letters: letters giving good and bad news, Thank you letter, Congratulating someone on a success” Grammar and Vocabulary - Active & passive voice, Spotting errors (Tenses, Preposition, Articles).	9
III	Listening and Speaking -travel arrangements and experience Reading - travel reviews Writing - Business letters (Placing an order, making clarification & complaint letters). Grammar and Vocabulary - Direct and Indirect speech.	9
IV	Listening and Speaking - Role play - Reading - Sequencing of sentence Writing - Business report writing (marketing, investigating) Grammar and Vocabulary - Connectors, Gerund & infinitive.	9
V	Listening and Speaking - Listen to Interviews & mock interview Reading - Reading short stories, reading profile of a company - Writing - Descriptive writing (describing one’s own experience) Grammar and Vocabulary - Editing a passage(punctuation, spelling & number rules).	9
Total Instructional Hours		45

- Course Outcome**
- CO1- Introduced to different modes and types of business communication.
 - CO2- Practiced to face and react to various professional situations efficiently.
 - CO3- learnt to practice managerial skills.
 - CO4- Familiarized with proper guidance to business writing.
 - CO5- Trained to analyze and respond to different types of communication.

TEXT BOOKS:

T1 - Norman Whitby, “Business Benchmark-Pre-intermediate to Intermediate”, Cambridge University Press, 2016.

T2- Ian Wood and Anne Willams. “Pass Cambridge BEC Preliminary”, Cengage Learning press 2015.

REFERENCE BOOKS :

R1 - Michael Mc Carthy, “Grammar for Business”, Cambridge University Press, 2009.

R2- Bill Mascull, “Business Vocabulary in use: Advanced 2nd Edition”, Cambridge University Press, 2009.

R3- Frederick T. Wood, “Remedial English Grammar For Foreign Students”, Macmillan publishers, 2001.


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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21MA2104	DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA	3	1	0	4

Course Objective

1. Develop the skill to use matrix algebra techniques that is needed by engineers for practical applications
2. Extend the knowledge of vector spaces
3. Describe some methods to solve different types of first order differential equations.
4. Solve ordinary differential equations of certain types using Wronskian technique.
5. Use the effective mathematical tools for the solutions of partial differential equations

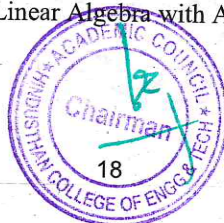
Unit	Description	Instructional Hours
	MATRICES	
I	Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (without proof) Cayley - Hamilton Theorem (excluding proof) - Orthogonal matrices – Definition – Reduction of a quadratic form to canonical form by orthogonal transformation.	12
	VECTOR SPACES	
II	Complex matrices – Conjugate of the matrix – Hermitian and Skew Hermitian matrices – Properties (without proof) – Unitary matrix – Properties (without proof) - Inner product spaces – Gram – Schmidt orthogonalization.	12
	FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS	
III	Equations of the first order and of the first degree – Homogeneous equations – Exact differential equations – Linear equations – Equations reducible to the linear form – Benoulli's equation.	12
	ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER	
IV	Second order linear differential equations with constant and variable co-efficients – Cauchy – Euler equations – Cauchy – Legendre equation – Method of variation of paramers.	12
	PARTIAL DIFFERENTIAL EQUATIONS	
V	Formation of partial differential equations by the elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations of the form $f(p,q)=0$, Clairaut's type : $z = px+qy +f(p,q)$ – Lagrange's linear equation.	12
Total Instructional Hours		60

Course Outcome

- CO1: Calculate Eigen values and Eigen vectors for a matrix which are used to determine the natural frequencies
- CO2: Infer the knowledge of vector spaces
- CO3: Apply few methods to solve different types of first order differential equations.
- CO4: Develop sound knowledge of techniques in solving ordinary differential equations.
- CO5: Solve Partial Differential Equations using various methods.

TEXT BOOKS:

- T1- Grewal B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2018.
- T2- Howard Anton, Chris Rorres, Elements of Linear Algebra with Applications, Wiley, New Delhi, 2nd Edition, 2015.

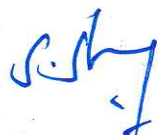


REFERENCE BOOKS :

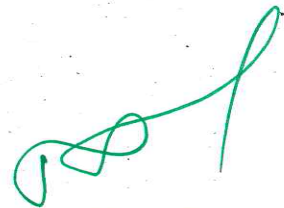
R1-E. A. Coddington, An Introduction to ordinary Differential Equations, Prentice Hall India, 1995.

R2 - G.F.Simmons and S. G. Krantz, Differential Equations, Tata McGraw Hill, 2007.

R3 - Veerarajan T, "Engineering Mathematics", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016



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Programme B.TECH.	Course Code 21PH2151	Name of the Course MATERIAL SCIENCE	L 2	T 0	P 2	C 3
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The student should be able to

Course Objective

1. Acquire fundamental knowledge of semiconducting materials which is related to the engineering program
2. Extend the knowledge about the magnetic materials
3. Explore the behavior of super conducting materials
4. Gain knowledge about Crystal systems
5. Understand the importance of ultrasonic waves

Unit	Description	Instructional Hours
I	SEMICONDUCTING MATERIALS Introduction – Intrinsic semiconductor – Compound and elemental semiconductor - direct and indirect band gap of semiconductors. Carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination. Optical properties of semiconductor – Light through optical fiber(Qualitative). Determination of band gap of a semiconductor. Determination of acceptance angle and numerical aperture in an optical fiber	6+(6)
II	MAGNETIC MATERIALS Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites and its applications. B – H curve by Magnetic hysteresis experiment.	6+(3)
III	SUPERCONDUCTING MATERIALS Superconductivity : properties(Messiner effect, effect of magnetic field, effect of current and isotope effects) – Type I and Type II superconductors – High Tc superconductors – Applications of superconductors –Cryotron and magnetic levitation.	6
IV	CRYSTAL PHYSICS Crystal systems - Bravais lattice - Lattice planes - Miller indices - Interplanar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC and FCC crystal structures.	6
V	ULTRASONICS Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Cavitations – Viscous force – co-efficient of viscosity. Industrial applications – Drilling and welding – Non destructive testing – Ultrasonic pulse echo system. Determination of velocity of sound and compressibility of liquid – Ultrasonic wave. Determination of Coefficient of viscosity of a liquid –Poiseuille’s method.	6+(6)
Total Instructional Hours		45

Course Outcome

After completion of the course the learner will be able to

- CO1: Understand the purpose of acceptor or donor levels and the band gap of a semiconductor
- CO2: Interpret the basic idea behind the process of magnetism and its applications in everyday
- CO3: Discuss the behavior of super conducting materials
- CO4: Illustrate the types and importance of crystal systems
- CO5: Evaluate the production of ultrasonics and its applications in NDT



TEXT BOOKS:

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.

T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

REFERENCE BOOKS:

R1 - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015

R2 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi 2016.

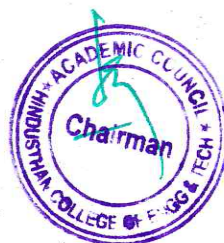
R3 - Dr. G. Senthilkumar "Engineering Physics – II" VRB publishers Pvt Ltd., 2016



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Programme B.TECH.	Course Code 21CY2151	Name of the Course ENVIRONMENTAL STUDIES	L 2	T 0	P 2	C 3
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The student should be conversant with

Course Objective

1. The natural resources, exploitation and its conservation
2. The importance of environmental education, ecosystem and biodiversity.
3. The knowledge about environmental pollution – sources, effects and control measures of environmental pollution.
4. Scientific, technological, economic and political solutions to environmental problems.
5. An awareness of the national and international concern for environment and its protection.

Unit	Description	Instructional Hours
I	NATURAL RESOURCES Renewable and Non renewable resources - Forest resources: Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forests and tribal people - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – Energy resources: Renewable and non renewable energy sources – Solar energy and wind energy - role of an individual in conservation of natural resources.	6
II	ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem - energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the forest and ponds ecosystem – Introduction to biodiversity definition: types and value of biodiversity – hot-spots of biodiversity – threats to biodiversity– endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.	6
III	ENVIRONMENTAL POLLUTION Definition – causes, effects and control measures of: Air pollution- Water pollution – Water quality parameters- Soil pollution - Noise pollution- Nuclear hazards – role of an individual in prevention of pollution. Determination of Dissolved Oxygen in sewage water by Winkler’s method. Estimation of alkalinity of water sample by indicator method. Determination of chloride content of water sample by argentometric method.	6+9=15
IV	SOCIAL ISSUES AND THE ENVIRONMENT From unsustainable to sustainable development – urban problems related to energy-environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- Municipal solid waste management. Global issues – Climatic change, acid rain, greenhouse effect and ozone layer depletion – Disaster Management – Tsunami and cyclones. Determination of pH in beverages.	6+3=9
V	HUMAN POPULATION AND THE ENVIRONMENT Population growth, variation among nations – population explosion – family welfare programme – environment and human health – effect of heavy metals – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- GIS-remote sensing-role of information technology in environment and human health. Estimation of heavy metal ion (copper) in effluents by EDTA.	6+3=9
Total Instructional Hours		45



After the completion of the course, the learner will be able to

Course Outcome

CO1: Develop an understanding of different natural resources including renewable resources.
CO2: Realise the importance of ecosystem and biodiversity for maintaining ecological balance.
CO3: Understand the causes of environmental pollution and hazards due to manmade activities.
CO4: Demonstrate an appreciation for need for sustainable development and understand the various social issues and solutions to solve the issues.
CO5: Gain knowledge about the importance of women and child education and know about the existing technology to protect environment.

TEXT BOOKS:

T1 - Anubha Kaushik and C. P. Kaushik, "Perspectives in Environmental studies", Sixth edition, New Age International Publishers, New Delhi, 2019.


T2 - S. Annadurai and P.N. Magudeswaran, "Environmental studies", Cengage Learning India Pvt.Ltd, Delhi, 2018

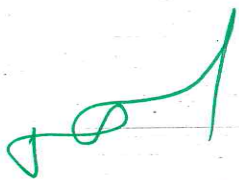
REFERENCES:

R1 - Erach Bharucha, "Textbook of environmental studies" University Press (I) Pvt.ltd, Hyderabad, 2015

R2 - G. Tyler Miller, Jr and Scott E. Spoolman "Environmental Science" Thirteenth Edition, Cengage Learning, 2010.

R3 - Gilbert M. Masters and Wendell P. Ela "Introduction to Environmental Engineering and Science", 3rd edition, Pearson Education, 2013.


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Programme B.TECH.	Course Code 21CS2153	Name of the Course JAVA FUNDAMENTALS	L 2	T 0	P 2	C 3
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- Course Objective**
1. To Understand the Basics of java Programming
 2. To discuss the packages and interfaces in java programming.
 3. To learn IO streams and multithreading in java.
 4. To learn generics and collections framework in java
 5. To understand event handling and swing in java.

Unit	Description	Instructional Hours
	INTRODUCTION TO JAVA	
I	JAVA-History of JAVA-Features of JAVA-Hello worlds java program-Setting path JDK, JRV and JVM-JAVA variables-JAVA data types-Keywords-Operators. <i>Illustrative Programs: Java program to swap two numbers using bitwise operator, Java program to find the smallest three numbers using ternary operator..</i>	5+2(P)
	CONTROL STATEMENTS	
II	Introduction to control statements in programming-If-else-switch-for loop-while loop-do while loop-Break-continue-JAVA comments. <i>Illustrative programs: Find the square root of a number, To determine leap year or not, Java program to find the factorial of number using recursion, Create Generic number calculator using Java..</i>	5+6(P)
	JAVA POLYMORPHISM	
III	Introduction to polymorphism concepts-Method overloading-Method overriding-Covariant return type-Super keyword-Instance Initializer block-final keyword- Runtime polymorphism-Dynamic binding-Instance of operator-Abstract class-interface-abstract Vs interface. <i>Illustrative programs: Method overriding, Abstract classes.</i>	7+2(P)
	ENCAPSUALATION, ARRAY	
IV	Java encapsulation-package-access modifier-Encapsulation-Object cloning- call by value-Java array concepts-Single dimension array-Multi dimension array. <i>Illustrative programs: Java program to check the whether the input character is vowels or not.</i>	7+2(P)
	FILES, PACKAGES	
V	File handling in python-Open a file in JAVA-How to read from a file in JAVA writing to file in JAVA-Exception handling-Java swing-java applet-Java AWT and events-Java collection. <i>Illustrative programs: Find the most frequent words in a text read from a file, Linked List implementation using collections, Program that handles all mouse events, Program using swing.</i>	5+4(P)
Total Instructional Hours		45(29+16)

- Course Outcome**
- CO1:** Understanding the OOPS and basic concepts of Java.
- CO2:** Understand how to program using user defined packages and interfaces.
- CO3:** Apply multithreading concepts based on appropriate problems.
- CO4:** Understand generics and collections framework in java.
- CO5:** Apply event handling classes and swing concepts to create different applications in java.

TEXT BOOKS:

T1: Herbert Schildt, "The complete reference java 2", 11th edition, McGraw – Hill 2019.

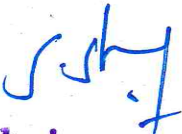
T2: "Core Java 2", Vol 2, Advanced Features, Cay S Horstmann and Gary Cornell, Seventh Edition, Pearson Education.



REFERENCE BOOKS:

R1: E.Balagurusamy, "Programming with java A Primer", fifth edition, McGraw – Hill 2014.

R2: H.M.Deitel, P.J.Deitel, "Java: how to program", Eleventh edition, Prentice Hall of India private limited, 2017.


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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21ME2154	ENGINEERING GRAPHICS	1	0	4	3

- Course Objective**
1. To gain the knowledge of Engineer's language of expressing complete details about objects and construction of conics and special curves.
 2. To learn about the orthogonal projections of straight lines and planes.
 3. To acquire the knowledge of projections of simple solid objects in plan and elevation.
 4. To learn about the projection of sections of solids and development of surfaces.
 5. To study the isometric projections of different objects.

Unit	Description	Instructional Hours
	PLANE CURVES	
I	Importance of engineering drawing; drafting instruments; drawing sheets – layout and folding; Lettering and dimensioning, BIS standards, scales. Geometrical constructions, Engineering Curves Conic sections – Construction of ellipse, parabola and hyperbola by eccentricity method. Construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves.	12
	PROJECTIONS OF POINTS, LINES AND PLANE SURFACES	
II	Introduction to Orthographic projections- Projection of points. Projection of straight lines inclined to both the planes, Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method (First angle projections only).	12
	PROJECTIONS OF SOLIDS	
III	Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane by rotating object method.	12
	SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES	
IV	Sectioning of simple solids with their axis in vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinder and cone. Development of lateral surfaces of truncated solids.	12
	ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS	
V	Isometric views and projections simple and truncated solids such as - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions. Free hand sketching of multiple views from a pictorial drawing. Basics of drafting using AutoCAD software.	12
Total Instructional Hours		60

COURSE OUTCOMES:

- CO1: Understand and interpret the engineering drawings in order to visualize the objects and draw the conics and special curves.
CO2: Draw the orthogonal projections of straight lines and planes.
CO3: Interpret the projections of simple solid objects in plan and elevation.
CO4: Draw the projections of section of solids and development of surfaces of solids.
CO5: Draw the isometric projections and the perspective views of different objects.

TEXT BOOK:

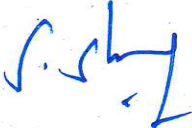
1. K.Venugopal, V.Prabu Raja, "Engineering Drawing, AutoCAD, Building Drawings", 5th edition New Age International Publishers, New delhi 2016.



2. K.V.Natarajan, "A textbook of Engineering Graphics", Dhanlaksmi Publishers, Chennai.

REFERENCES:

1. Basant Agrawal and C.M.Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing company Limited, New Delhi 2008.
2. N.S. Parthasarathy, Vela Murali, "Engineering Drawing", Oxford University PRESS, India 2015.


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Programme B.TECH.	Course Code 21ME2001	Name of the Course ENGINEERING PRACTICES	L 0	T 0	P 4	C 2
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OBJECTIVES:

To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical and Electrical Engineering.

GROUP A (CIVIL & MECHANICAL)

S.No Description of the Experiments

CIVIL AND MECHANICAL ENGINEERING PRACTICES

- 1 Preparation of Single pipe line and Double pipe line connection by using valves, taps, couplings, unions, reducers, and elbows.
- 2 Arrangement of bricks using English bond for 1brick thick wall and 1 1/2 brick thick wall for right angle corner junction.
- 3 Arrangement of bricks using English bond for 1brick thick wall and 1 1/2 brick thick wall for T junction.
- 4 Preparation of arc welding of Butt joints, Lap joints and Tee joints.
- 5 Practice on sheet metal Models– Trays and funnels
- 6 Hands-on-exercise in wood work, joints by sawing, planning and cutting.
- 7 Practice on simple step turning, taper turning and drilling.
- 8 Demonstration on Smithy operation.
- 9 Demonstration on Foundry operation.
- 10 Demonstration on Power tools.

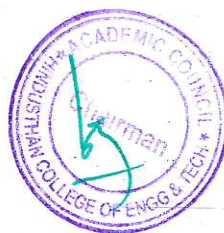
GROUP B (ELECTRICAL)

S.No Description of the Experiments

ELECTRICAL ENGINEERING PRACTICES

- 1 Residential house wiring using switches, fuse, indicator, lamp and energy meter.
- 2 Fluorescent lamp wiring.
- 3 Stair case wiring.
- 4 Measurement of Electrical quantities – voltage, current, power & power factor in single phase circuits.
- 5 Measurement of energy using single phase energy meter.
- 6 Soldering practice using general purpose PCB.
- 7 Measurement of Time, Frequency and Peak Value of an Alternating Quantity using CRO and Function Generator.
- 8 Study of Energy Efficient Equipment's and Measuring Instruments.


Total Practical Hours 45



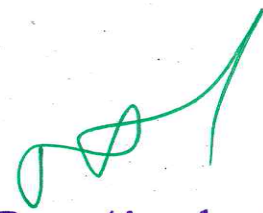
COURSE OUTCOME:

At the end of the course the students shall be able to

- CO1: Fabricate wooden components and pipe connections including plumbing works.
- CO2: Fabricate simple weld joints.
- CO3: Fabricate different electrical wiring circuits and understand the AC Circuits.



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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	21HE2071	LANGUAGE COMPETENCY ENHANCEMENT COURSE- II	0	0	2	1

(COMMON TO ALL BRANCHES)

Course Objective	Objectives
	<ul style="list-style-type: none"> ✓ To improve communication skills and Professional Grooming. ✓ To impart deeper knowledge of English Language and its practical application in different facets of life. ✓ To equip the techniques of GD, Public Speaking, debate etc.

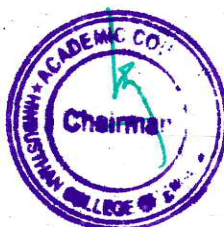
Unit	Description	Instructional Hours
	Listening	
I	Listening for gist and respond – Listen for detail using key words to extract specific meaning – listen for phonological detail – Listen and identify the main points for short explanations and presentation.	3
	Reading	
II	Strategies for effective reading – read and recognize different text types – Genre and Organization of Ideas – Quantifying reading – reading to comprehend – Interpreting sentences – contrasting, summarizing or approximating	3
	Speaking	
III	Speak to communicate – Make requests and ask questions to obtain personal information – use stress and intonation – articulate the sounds of English to make the meaning understood – speaking to present & Interact – opening and closing of speech.	3
	Writing	
IV	Plan before writing – develop a paragraph: topic sentences, supporting sentences – write a descriptive paragraph – elements of good essay – descriptive, narrative, argumentative – writing emails – drafting resumes – project writing – convincing proposals.	3
	Language Development	
V	Demonstration at level understanding of application of grammar rules – revision of common errors : preposition, tenses, conditional sentences –reference words – pronouns and conjunctions.	3
Total Instructional Hours		15

Course Outcome	Outcomes
	CO1- Introduced to different modes and types of communication.
	CO2- Practiced to face and react to various professional situations efficiently.
	CO3- learnt to practice managerial skills.
	CO4- Familiarized with proper guidance to writing.
	CO5- Trained to analyze and respond to different types of communication.

REFERENCE BOOKS :

1. Verbal Ability and Reading Comprehension by Arun Sharma, 9th edition, Tata Mc graw Hill
2. Word Power Made Easy by Norman Lewis, – Print, 1 June 2011.
3. High School English Grammar by Wren and Martin, S.CHAND Publications, 1 January 2017.
4. Practical course in Spoken English by J.K. Gangal, PHI Learning , Second edition, 1 January 2018.


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Programme B.TECH.	Course Code 21HE2072	Name of the Course CAREER GUIDANCE LEVEL II Personality, Aptitude and Career Guidance	L 2	T 0	P 0	C 0
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- Course Objective**
1. Solve Logical Reasoning questions of easy to intermediate level.
 2. Solve Quantitative Aptitude questions of easy to intermediate level.
 3. Solve Verbal Ability questions of easy to intermediate level.

Unit	Description	Instructional Hours
	LOGICAL REASONING	
I	Word group categorization questions - Cryptarithmic - Data arrangements - Blood relations	8
	QUANTITATIVE APTITUDE	
II	Ratio and Proportion: Ratio, Proportion, Variation, Simple equations, Problems on Ages, Mixtures and alligations - Percentages, Simple and Compound Interest: Percentages as Fractions and Decimals, Percentage Increase / Decrease, Simple Interest, Compound Interest, Relation Between Simple and Compound Interest - Number System	12
	VERBAL ABILITY	
III	Essential grammar for placements: Prepositions, Adjectives and Adverbs, Tenses, Forms and Speech and Voice, Idioms and Phrasal Verbs, Collocations, Gerund and Infinitives – Reading Comprehension for placements: Types of questions, Comprehension strategies - Articles, Prepositions and Interrogatives: Definite and Indefinite Articles, Omission of Articles, Prepositions, Compound Prepositions and Prepositional Phrases, Interrogatives - Vocabulary for placements: Exposure to solving questions of Synonyms, Antonyms, Analogy, Confusing words and Spelling correctness	10
Total Instructional Hours		30

- Course Outcome**
- CO1: Students will analyze and critique logical reasoning, including situations for which the student will recognize underlying assumptions and make reasonable assumptions.
- CO2: Students will be able to make decisions with mathematical, statistical, and quantitative information.
- CO3: Students would have obtained a multitude of opportunities resulting in the refinement of his/her language skills and the ability to use the skills for effective communication.

REFERENCE BOOKS:

- R1: How to Prepare for Quantitative Aptitude for the CAT- Arun Sharma
- R2: How to Prepare for Logical Reasoning for CAT
- R3: Objective General English – S.P.Bakshi


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SYLLABUS

Programme B.TECH.	Course Code 19AI3201	Name of the Course DATA STRUCTURES AND ALGORITHMS	L 3	T 0	P 0	C 3
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- Course Objective**
1. To impart the basic concepts of data structures, algorithms and recursive methods
 2. To understand Linked List and perform various operations on it
 3. To implement operations on Stack and Queues
 4. To implement traversal operations of trees and graphs
 5. To understand concepts about various algorithm design techniques, searching and sorting techniques

Unit	Description	Instructional Hours
	INTRODUCTION TO ALGORITHMS	
I	Introduction to Data vs Information - Data Structures - Classification - Abstraction - Abstract data types (ADT) - Array - characteristics - Storage Representations. Array Order Reversal - Recursion- Array operations, Algorithm complexity - Time and Space trade off	9
	BASIC DATA STRUCTURES-LINKED LIST	
II	Array Vs Linked List – Singly linked list - Representation of a linked list in memory - Operations on a singly linked list - Merging two singly linked lists into one list - Reversing a singly linked list - Polynomial Manipulation using List - Advantages and disadvantages of singly linked list - Circular linked list - Doubly linked list - Circular Doubly Linked List	9
	BASIC DATA STRUCTURES-STACKS & QUEUES	
III	Introduction - Array Representation of a Stack - Linked List Representation of a Stack - Stack Operations - Algorithm for Stack Operations - Stack Applications: Tower of Hanoi - Infix to postfix Transformation - Evaluating Arithmetic Expressions. Queue - Introduction - Array Representation of Queue - Linked List Representation of Queue - Queue Operations - Algorithm for Queue Operations -Queue Applications: Priority Queue	9
	TREES AND GRAPHS	
IV	Preliminaries of Tree ADT - Binary Trees - The Search Tree ADT - Binary Search Trees - AVL Trees - Tree Traversals - B-Trees - Heap Tree - Preliminaries of Graph ADT - Representation of Graph - Graph Traversal - BFS - DFS - Applications of Graph - Shortest - Path Algorithms - Dijkstra's Algorithm Minimum Spanning Tree - Prims Algorithm	9
	ALGORITHM DESIGN TECHNIQUES & SEARCHING AND SORTING TECHNIQUES	
V	Divide and Conquer Strategy - Greedy Algorithm - Dynamic Programming - Backtracking Strategy - List Searches using Linear Search - Binary Search - Fibonacci Search - Sorting Techniques - Insertion sort - Heap sort – Bubble sort - Quick sort - Merge sort - Analysis of sorting techniques	9
Total Instructional Hours		45

- Course Outcome**
- CO1: Understand the concept of data structures and recursive algorithms
CO2: Able to perform various operations on linked lists
CO3: Able to perform various operations on trees and graphs
CO4: Able to perform traversal operations of trees and graphs
CO5: Understand and implement the various algorithm design techniques, searching and sorting techniques.



TEXT BOOKS:

- T1: Jean-Paul Tremblay, Paul G. Sorenson, "An Introduction to Data Structures with Application", TMH, 2017.
T2: Richard F. Gilberg, Forouzan, "Data Structures", Cengage, 2nd Edition, 2004.

REFERENCE BOOKS:

- R1: Larry R. Nyhoff, "ADTs, Data Structures, and Problem Solving with C++", Prentice Hall Edition, 2004.
R2: Thomas H. Cormen, Charles E. Leiserson, "Introduction to Algorithms", 3rd Edition, MIT Press, 2010.


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Programme B.TECH.	Course Code 19AI3202	Name of the Course FOUNDATIONS OF ARTIFICIAL INTELLIGENCE	L 3	T 0	P 0	C 3
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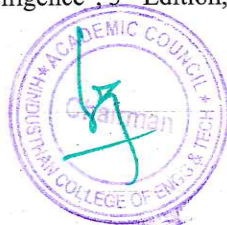
- Course Objective**
1. To understand concepts of Artificial Intelligence and characteristics of intelligent agents
 2. To learn the different search strategies in AI
 3. To understand various knowledge representation techniques
 4. To understand the concepts of Planning and uncertainty
 5. To learn the concepts of learning in AI

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Introduction - Foundations of AI - History of AI - Intelligent agent - Types of agents - Structure - Problem solving agents - AI programming languages - Introduction to LISP and PROLOG - Uninformed search strategies - Breadth first search - Uniform cost search - Depth first search - Depth limited search - Bidirectional search - Searching with partial Information.	9
	SEARCHING TECHNIQUES	
II	Informed search - Strategies - A* Heuristic function - Hill Climbing - Simulated Annealing - Constraint satisfaction problem - Local Search in continuous space - Genetic algorithm - Optimal decisions in games - Pruning - Imperfect decisions - Alpha - Beta pruning - Games that include an element of chance.	9
	KNOWLEDGE REPRESENTATION	
III	Knowledge based agent - The Wumpus world environment - Propositional logic - Inference rules - First-order logic - Syntax and semantics - Situation calculus - Building a knowledge base - Electronic circuit domain - Ontological Engineering - Forward and backward chaining - Resolution - Truth maintenance system.	9
	PLANNING AND UNCERTAINTY	
IV	Planning - Representation of planning - Partial order planning - Planning and acting in real world - Acting under uncertainty - Bayes's rules - Semantics of Belief networks - Inference in Belief networks.	9
	LEARNING	
V	Learning from observation - Inductive learning - Decision trees - Explanation based learning - Statistical Learning methods - Reinforcement Learning Case Study: Chat bot System.	9
Total Instructional Hours		45

- Course Outcome**
- CO1: Understand the characteristics of intelligent agents
CO2: Understand and implement the Informed search strategies
CO3: Able to Represent a problem using first order logic.
CO4: Apply the Baye's rule to solve the problem
CO5: Analyze the different learning systems to solve a given problem.


TEXT BOOKS:

- T1: Stuart J.Russel, Peter Norvig, "Artificial Intelligence A Modern Approach ", 3rd Edition, Pearson Education, 2009.
T2: Elaine Rich, Kevin Knight, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009.

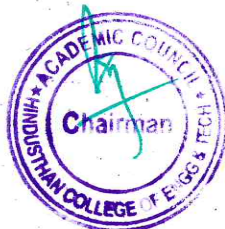


REFERENCE BOOKS:

- R1: M.Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc., 1st Edition, 2008.
- R2: David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", 2nd Edition, Cambridge University Press, 2010.
- R3: Wolfgang Ertel, "Introduction to Artificial Intelligence", 1st Edition, Springer, 2017.


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Programme B.TECH.	Course Code 19MA3152	Name of the Course PROBABILITY AND APPLIED STATISTICS	L 3	T 0	P 2	C 4
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- Course Objective**
1. Provide students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science like computer networks.
 2. Explain the concept of two-dimensional random variables and determine covariance.
 3. Introduce the concepts of correlation and regression to understand the relation between two random variables and illustrate the applications of descriptive statistics along with R studio
 4. Design and develop R programs for testing of hypothesis with real time applications
 5. Analyze the design of experiment techniques to solve various engineering problems

Unit	Description	Instructional Hours
	PROBABILITY AND RANDOM VARIABLE	
I	Axioms of probability - Conditional probability - Total probability – Baye’s theorem. Random variable –Discrete and continuous random variables – Probability mass function - Binomial, Poisson distributions - Probability density function – Uniform, exponential, normal distributions - Moment generating functions – Mean and variance	9+3
	TWO DIMENSIONAL RANDOM VARIABLES	
II	Joint probability mass function - Joint probability density function – Marginal Probability mass function – Marginal probability density function - Conditional Probability mass function - Conditional Probability density function – Independent random variables.	9
	DESCRIPTIVE STATISTICS	
III	Measures of central Tendency - Measures of Dispersion – Skewness and Kurtosis. Correlation and Regression: Types of Correlation – Karl Pearson’s Coefficient of Correlation and Spearman’s Rank Correlation - Method of Least Squares – Linear Regression.	9+6
	Introduction to R programming - Application of descriptive statistics – Mean, Median, Mode, variance. Applications of Correlation and Regression	
	HYPOTHESIS TESTING	
IV	Test of significance of large samples - Test of significance for single mean - Test of significance for difference of means – Test of significance of small samples - Test for means– t test for single mean and difference of means - Chi – Square test – independence of attributes – goodness of fit.	9+6
	Application of Student t- test for Single mean & difference of means, Application of Chi – square test	
	THE ANALYSIS OF VARIANCE	
V	Applications of F distributions - One way classification and two-way classifications– Completely Randomized Design -Randomized Block Design – Latin square Design.	9
Total Instructional Hours		60

- Course Outcome**
- CO1: Understand the axiomatic formulation of Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena
- CO2: Express the phenomenon of two dimensional random variables
- CO3: Compute and interpret the descriptive statistics, correlation coefficient and rank correlation coefficient, use simple linear regression model to engineering data.
- CO4: Understand the concepts of statistical methods for testing of hypothesis with R studio.
- CO5: Apply design of experiment techniques to solve various engineering problems.



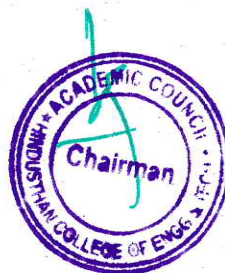
TEXT BOOKS:

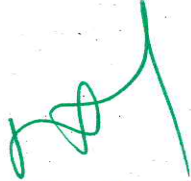
- T1: Gupta, S.C. & Kapoor, V.K. (2014). Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
- T2: Douglas C. Montgomery and George C. Runger. Applied Statistics and Probability for Engineers, (7th Edition), John Wiley and Sons, Inc., New York, January 2018.

REFERENCE BOOKS:

- R1: Richard A. Johnson and C. B. Gupta, Probability and Statistics for Engineers, (7th Edn.), Pearson Education, Indian Impression 2007.
- R2: Walpole R. E., Myers S.L. & Keying Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education Inc, 9th edition, 2012.


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Programme B.TECH.	Course Code 19AI3251	Name of the Course DIGITAL PRINCIPLES AND SYSTEM DESIGN	L 3	T 0	P 2	C 4
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- Course Objective**
- To understand different methods used for the simplification of Boolean functions
 - To study combinational circuits
 - To learn synchronous sequential circuits
 - To understand asynchronous sequential circuits
 - To study the fundamentals of HDL

Unit	Description	Instructional Hours
I	MINIMIZATION TECHNIQUES Number systems: Decimal, Binary, Octal, Hexadecimal - Number - Base conversion - Complements of Numbers: 1's and 2's complements - Boolean algebra and laws-De - Morgan's Theorem - Principle of Duality - Minimization of Boolean expressions - Minterm - Maxterm - Sum of Products (SOP) - Product of Sums (POS) - Karnaugh map Minimization - Don't care conditions (2variable, 3variable & 4variable) - Tabulation method.	10
II	COMBINATIONAL CIRCUITS Circuits for arithmetic operations: adder: Half adder, Full adder, subtractor: Half subtractor, Full subtractor - BCD adder - Magnitude comparator - Encoders, Decoders - Multiplexers, Demultiplexers, Code converters: Binary to Gray, Gray to Binary. <i>1. Experimental Design and implementation of Half Adder & Half Subtractor.</i> <i>2. Experimental Design and implementation of Binary to Gray and Gray to Binary Conversion.</i> <i>3. Experimental Design and implementation of Multiplexers and Demultiplexers</i>	9+6(P)
III	SYNCHRONOUS SEQUENTIAL CIRCUITS Flip flops: SR, JK, D, T - Design of synchronous sequential circuits: State diagram - State table - State minimization - State assignment. Shift registers: SISO, SIPO, PIPO, PISO - Counters: BCD, Up down counter. <i>Experimental Design and implementation of Synchronous and Asynchronous Counters</i>	9+4(P)
IV	ASYNCHRONOUS SEQUENTIAL CIRCUITS Analysis and design of asynchronous sequential circuits - Reduction of state and flow tables - Race - free state assignment - Hazards.	9
V	HARDWARE DESCRIPTION LANGUAGE Introduction to Hardware Description Language (HDL) - HDL for combinational circuits - Half adder, Full adder, Multiplexer, De-multiplexer, HDL for Sequential Circuits - Flip flops, Synchronous and Asynchronous Counters, Registers. <i>Coding Combinational/Sequential circuits using HDL</i>	9+4(P)
Total Instructional Hours		60

- Course Outcome**
- CO1: Simplify Boolean functions using different methods
CO2: Analyse, design and implement combinational logic circuits
CO3: Analyse, design and implement Synchronous sequential logic circuits
CO4: Analyse, design and implement Asynchronous sequential logic circuits
CO5: Simulate and implement combinational and sequential circuits using HDL

TEXT BOOKS:

T1: Morris Mano M. and Michael D. Ciletti, "Digital Design with an Introduction to the Verilog HDL", 5th Edition, Pearson Education, 2013.

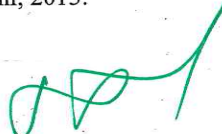
REFERENCE BOOKS:

R1: S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design", 4th Edition, Vikas Publishing House Pvt. Ltd, New Delhi, 2012.

R2: Thomas L. Floyd, "Digital Fundamentals", Pearson Education, New Delhi, 2013.


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Programme B.TECH.	Course Code 19AI3252	Name of the Course CLEAN CODING AND DEVOPS	L 3	T 0	P 2	C 4
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- Course Objective**
1. Understand about the clean code
 2. Explain the importance of naming conventions
 3. Understand the importance of comments in the applications
 4. Understand and install different tools used in DevOps stack
 5. Explain the benefits of DevOps and how various industries are benefitting
 6. Explain how to automatically rollback a release if it is failed

Unit	Description	Instructional Hours
	INTRODUCTION TO CLEANCODING Coding principles introduction-Bad and Good code-marshalling and unmarshalling-Names and Functions-distinct names-Defining meaningful context-Usage of domain and function names-Usage of exceptions and its error code names/descriptions.	
I	Lab Exercises- Write a Fibonacci Program using Clean coding, Exporting multiple variables, Assigning a value to the same thing conditionally using ternary operators, Declaring and assigning variables from array indexes.	9+3(P)
	COMMENTS, FORMATTING AND OBJECTS Right comments and types of formatting- Clean and bad comments-Vertical and horizontal formatting-Objects and data structures-Data abstraction-Data and object antisymmetric-Data transfer objects	
II	Lab Exercises- Structural Formatting the code, Eligible to vote using comments, Arithmetic Operator using Horizontal openness and density..	8+2(P)
	INTRODUCTION TO DEV-OPS An overview about DevOps - Why it is needed? How it is different from traditional IT and Agile - DevOps Principles - DevOps Lifecycle - An overview about CI/CD pipeline and various tools - setup a complete CI/CD pipeline from scratch using DevOps tools - How DevOps is used in various technologies/industries.	
III	Lab Exercises- Set up of Devops, Create a build and release agent	9+4(P)
	ADVANCED DEV-OPS An overview of advanced DevOps concepts - Automatic Rollback and Provisioning, Scalability, Clustering and Infrastructure as Code.	
IV	Lab Exercises- Import code and create Devops build pipeline, Create the Devops release pipeline	9+4(P)
	INTRODUCTION TO DEV-OPS ON CLOUD An overview of Cloud computing - Introduction to IBM Cloud - Why DevOps on cloud - IBM Cloud services - Setup a CI/CD pipeline in IBM Cloud.	
V	Lab Exercises- Continuously deliver to Production, Track functional changes throughout the CI/CD pipeline	9+3(P)

Total Instructional Hours (44 + 16) 60

- Course Outcome**
- CO1: Understand the importance of comments in the applications
CO2: Understand the data and object antisymmetric
CO3: Understand Cloud computing concepts
CO4: Explain why DevOps on cloud and various DevOps services available on IBM Cloud

TEXT BOOKS:

T1: IBM Course Ware.



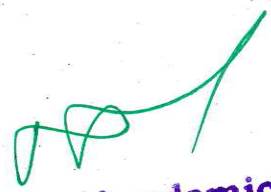
REFERENCE BOOKS:

R1: Robert C Martin, "Clean Code: A Hand Book of Agile Software Craftsmanship", 2008.

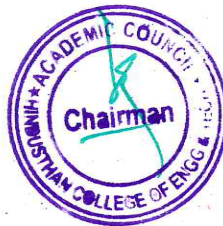
R2: Ingo M.Weber, Len Bass, and Liming Zhu, "DevOps: A Software Architect's Perspective", 2015.



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Programme B.TECH.	Course Code 19AI3001R	Name of the Course DATA STRUCTURES AND ALGORITHMS LABORATORY	L 0	T 0	P 3	C 1.5
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Course Objective

1. To learn the methodical way of solving problem.
2. To comprehend the different methods of organizing large amount of data.
3. To efficiently implement the different data structures.

S. No. Description of the Experiments

- 1 **Singly Linked List and Doubly Linked List**
 - a) Create and display Singly Linked List.
 - b) Given a singly linked list with head node root, write a function to split the linked list into k consecutive linked list "parts".
 - c) Find kth node from the end of linked list
 - d) Reverse a doubly linked list.
 - e) Merge two sorted singly Linked Lists without creating new nodes.
- 2 **a) Implementation of Stack**

Arun reads lot of story books and he keeps all the story books piled as a single stack. He wants to write a program to keep the order of the books in the pile. The program must implement the following functionalities.

Add a book to the top of the pile when 1 is followed by the name of the book.

Remove a book from the top of the pile when -1 is given as the input (provided the pile has at least one book).

Print the name of the book on the top of the pile when 2 is given as the input (provided the pile has at least one book).

The program must exit when 0 is given as the input.

b) Implementation of Queue

Riyaz has a book of tickets and wants to store ticket numbers in a data structure. New tickets are added to the end of the booklet. Ticket at the top of the stack is issued to the customer. Implement the data structure should Riyaz use to represent the ticket booklet?

 - a) Given an Infix expression convert it into its postfix Equivalent using stack data structure.
 - b) Write a program to implement deque using linked lists
- 4 **Binary search tree and traversal**
 - a) Insertion, Deletion, Searching in a BST
 - b) Find kth smallest and kth largest element in a BST

Check if a given sequence represents the in-order, pre-order and post-order traversal of a BST.
- 5 **Write a program for AVL tree having functions for the following operations:**
 - a) Insert an element (no duplicates are allowed),
 - b) Delete an existing element,

Traverse the AVL (in-order, pre-order, and post-order)
- 6 **Heaps using priority queue**

Geek hosted a contest and N students participated in it. The score of each student is given by an integer array arr. The task is to print the number of each student (indexes) in the order they appear in the scoreboard. A student with a maximum score appears first. If two people have the same score then higher indexed student appears first.
- 7 **Write a C program to Implement Hash Tables with Quadratic Probing.**



8 a) Merge Sort

Write a function that takes two list, each of which is sorted in increasing order, and merges the two into one list, which is in descending order, and returns it. In other words, merge two sorted linked list from their end.

b) Quick Sort

Given an array arr[], its starting position low and its ending position high. Implement the partition() and quickSort() functions to sort the array.

9 Implementation of the following graph traversal algorithms:

- a) Depth first traversal
- b) Breadth first traversal

10 Minimum spanning tree using prim's and kruskal's algorithm.

Given a graph which consists of several edges connecting its nodes, find a subgraph of the given graph with the following properties: The subgraph contains all the nodes present in the original graph. The subgraph is of minimum overall weight (sum of all edges) among all such subgraphs. It is also required that there is exactly one, exclusive path between any two nodes of the subgraph. One specific node S is fixed as the starting point of finding the subgraph using Prim's Algorithm. Find the total weight or the sum of all edges in the subgraph.


11 Time Complexity

- a) Write a C program to print the time complexity of merge sort algorithm
- b) C program to store time taken by bubble sort, insertion sort and selection sort

Total Practical Hours: 45

Course Outcome

- CO1: Apply good programming design methods for program development.
- CO2: Apply the different data structures for implementing solutions to practical problems. Develop recursive programs using trees and graphs.
- CO3: Develop recursive programs using trees and graphs.


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Programme
B.TECH.

Course Code
19AI3002

Name of the Course
ARTIFICIAL INTELLIGENCE
LABORATORY

L T P C
0 0 3 1.5

Course
Objective

1. To learn Prolog
2. To understand and learn LISP
3. To learn the methodical way of solving problem

S. No.

Description of the Experiments

- 1 Installation of gnu-prolog, Study of Prolog (gnu-prolog), its facts, and rules
- 2 Write simple fact for the statements using PROLOG
- 3 Write a program to solve the Monkey Banana problem
- 4 Write a program to implement factorial, fibonacci of a given number
- 5 Write a program to solve 4-Queen problem
- 6 Write a program to solve traveling salesman problem
- 7 Write a program to solve water jug problem using LISP
- 8 Write a program which behaves a small expert for medical Diagnosis

Total Practical Hours: 45

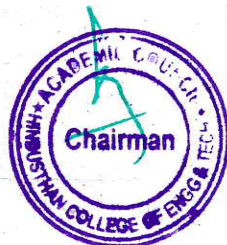
Course
Outcome

CO1: Able to implement facts and rules in Prolog

CO2: Able to solve problems using LISP

CO3: Apply good programming design methods for program development


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Programme B.TECH.	Course Code 19MC3191	Name of the Course INDIAN CONSTITUTION	L 2	T 0	P 0	C 0
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- Course Objective**
1. Sensitization of student towards self, family (relationship), society and nature.
 2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals.
 3. Strengthening of self-reflection.
 4. Development of commitment and courage to act.

Unit	Description	Instructional Hours
	BASIC FEATURES AND FUNDAMENTALE PRINCIPLES	
I	Meaning of the constitution law and constitutionalism - Historical perspective of the constitution of India - salient features and characteristics of the constitution of India.	4
	FUNDAMENTAL RIGHTS	
II	Scheme of the fundamental rights - fundamental duties and its legislative status - The directive principles of state policy - its importance and implementation - Federal structure and distribution of legislative and financial powers between the union and states.	4
	PARLIAMENTARY FORM OF GOVERNMENT	
III	The constitution powers and the status of the president in India - Amendments of the constitutional powers and procedures - The historical perspective of the constitutional amendment of India - Emergency provisions: National emergency, President rule, Financial emergency.	4
	LOCAL GOVERNANCE	
IV	Local self-government -constitutional scheme of India - Scheme of fundamental right to equality - scheme of fundamental right to certain freedom under article19 - scope of the right to life and personal liberty under article 21.	4
	INDIAN SOCIETY	
V	Constitutional Remedies for citizens - Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.	4
Total Instructional Hours		20

Course Outcome CO1: Understand the functions of the Indian government.
CO2: Understand and abide the rules of the Indian constitution.

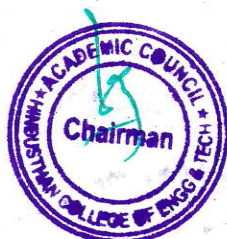
TEXT BOOKS:

- T1: Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi, 2011.
T2: R.C.Agarwal, "Indian Political System", S.Chand and Company, New Delhi, 1997.
T3: Maciver and Page, "Society: An Introduction Analysis", Mac Milan India Ltd., New Delhi, 1997.
T4: K.L.Sharma, "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi, 1997.

REFERENCE BOOKS:

- R1: Sharma, Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi, 2017.
R2: U.R.Gahai, "Indian Political System", New Academic Publishing House, Jalaendhar.
R3: R.N. Sharma, "Indian Social Problems", Media Promoters and Publishers Pvt. Ltd.

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Programme B.TECH.	Course Code 19MA4105	Name of the Course DISCRETE MATHEMATICAL STRUCTURES	L 2	T 1	P 0	C 3
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- Course Objective**
1. Understand the concepts of Logics and rules of inference
 2. Learn the basic concepts of Relations and Functions
 3. Generate counting problems using mathematical induction and recurrence relations
 4. Examine the Boolean algebra which is used in the Boolean logics and circuits
 5. Describe the basic knowledge of graph theory and trees which are applied in Computer networks

Unit	Description	Instructional Hours
	LOGICS AND PROOFS	
I	Basic Connectives – Truth Tables – Logical Equivalence – Normal forms - Principal normal forms -Rules of Inference.	9
	RELATION AND FUNCTION	
II	Relations- Types of relations - Equivalence Relation –Closure of relations - Partial Order Relation – Functions – Types of functions - Injective, surjective and bijective functions – composition of functions - Inverse functions.	9
	COMBINATORICS	
III	Mathematical induction – Recurrence relations – Solving linear recurrence relations-generating functions.	9
	LATTICES AND BOOLEAN ALGEBRA	
IV	Lattices – Properties of lattices – Lattices as algebraic system – Sub lattices - some special lattices – Boolean algebra – Definition and simple properties.	9
	GRAPHS AND TREES	
V	Graphs and their properties –Sub Graph – Isomorphism – Eulerian and Hamiltonian Walks – Trees - spanning tree – minimum spanning tree – Rooted Trees.	9
Total Instructional Hours		45


- Course Outcome**
- CO1: Explain and apply basic notions of symbolic logic
CO2: Identify the differences between a relation and a function
CO3: Solve problems using counting techniques and recurrence relations
CO4: Understand the knowledge about Lattices and Boolean Algebra
CO5: Apply the properties of graphs and trees in computer networks.

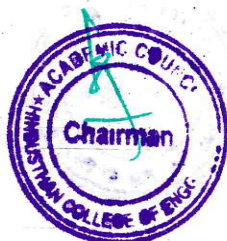
TEXT BOOKS:

- T1: Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw–Hill Pub. Co. Ltd, New Delhi, Re-print (2017).
T2: Ralph. P. Grimaldi, “Discrete and Combinatorial Mathematics: An Applied Introduction”, Fifth Edition, Pearson Education Asia, Delhi, 2016.

REFERENCE BOOKS:

- R1: T. Veerarajan, “Discrete Mathematics with Graph Theory and Combinatorics”, Tata. McGraw-Hill Education, 15th reprint, 2012.
R2: Kenneth H. Rosen, “Discrete Mathematics and its Applications”, seventh Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 2013.
R3: Thomas Koshy, “Discrete Mathematics with Applications”, Elsevier Publications, 2010.


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Programme B.TECH.	Course Code 19AI4201	Name of the Course DATABASE MANAGEMENT SYSTEMS	L 3	T 0	P 0	C 3
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- Course Objective**
1. To understand the role of data, files and databases in information systems and learn the fundamentals of data models
 2. To study SQL and relational database design
 3. To represent ER diagram for any customized applications
 4. To understand various normal forms
 5. To understand the fundamental concepts of transaction processing, concurrency control techniques and recovery procedures

Unit	Description	Instructional Hours
	INTRODUCTION TO DATABASE SYSTEMS	
I	Introduction to database system - Characteristics of the Database Approach - Advantages of using the DBMS Approach - History of Database Applications. Data Models - Schemas, and Instances - Three-Schema Architecture and Data Independence - Database Languages.	8
	RELATIONAL DATABASE	
II	Structure of Relational Databases - Database Schema, Keys - Relational Query Languages - The Relational Algebra. Introduction to SQL: Overview of the SQL Query Language - SQL Data Definition - Basic Structure of SQL Queries - Additional Basic Operations - Set Operations - Null Values - Aggregate Functions - Nested Subqueries Join - Views - Integrity Constraints - Triggers.	10
	CONCEPTUAL DATA MODELING	
III	Using High - Level Conceptual Data Models for Database Design - Entity Types - Entity Sets - Attributes, and Keys - Relationship Types - Relationship Sets - Roles-Weak Entity Types - ER Diagrams - Naming Conventions - and Design Issues - The Enhanced Entity - Relationship (EER) Model.	9
	NORMALIZATION THEORY	
IV	Functional Dependencies - Normal Forms Based on Primary Keys - Boyce-Codd Normal Form - Multivalued Dependency and Fourth Normal Form - Join Dependencies and Fifth Normal Form.	9
	TRANSACTION MANAGEMENT	
V	Transactions: Transaction Concept - A Simple Transaction Model - Transaction Atomicity and Durability - Transaction Isolation - Serializability - Transaction Isolation and Atomicity. Concurrency Control: Lock-Based Protocols - Deadlock Handling - Multiple Granularity Recovery System: Failure Classification - Recovery Algorithm.	9
	Total Instructional Hours	45

- Course Outcome**
- CO1: Understand the functional components of DBMS and data models
CO2: Able to write SQL queries
CO3: Analyze a system and design ER diagram and Relational Schema
CO4: Able to perform normalization and write queries using normalization criteria
CO5: Illustrate the concepts for transaction processing, concurrency control and recovery procedures for RDBMS.



TEXT BOOKS:

- T1: Ramez Elmasri and Shamkant B.Navathe, "Fundamentals of Database Systems", Pearson Education, 7th edition, 2013. (UNIT I, III & IV).
- T2: Abraham Silberschatz, Henry F.Korth and S.Sudarshan, "Database System Concepts", Mc Graw Hill, 7th edition, 2019. (UNIT II, V)

REFERENCE BOOKS:

- R1: Raghu Rama Krishnan, "Database Management Systems", Tata Mcgraw Hill, 6th edition, 2010.
- R2: Carlos Coronel and Steven Morris, "Database System Design and Implementation", Cengage Learning, 11th edition, 2013.


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Programme B.TECH.	Course Code 19AI4202	Name of the Course DATA VISUALIZATION	L 3	T 0	P 0	C 3
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Course Objective

1. Design and create data visualization.
2. Conduct exploratory data analysis using visualization.
3. Craft visual presentation of data for effective communication.
4. Design and evaluate color palettes for visualization design alternative.
5. Apply data transformation such as aggregation and filtering for visualization.
6. Identify opportunities for application of data visualization in various domains

Unit	Description	Instructional Hours
	INTRODUCTION TO STATISTICS	
I	Data collection methods, Descriptive Statistics Mean, Median, Mode, Inferential Statistics, Random Variables, Probability Distributions, Normal Distribution, Sampling and Sampling Distribution.	9
	VISUALIZATION USING R	
II	Overview of R, Descriptive data analysis using R, Data manipulation with R Data visualization with R, R studio installation, Data manipulation with R (dplyr, data.table, reshape2package, tidyr package, Lubricate package), Data Visualization with R (working with Graphics, ggplot2).	7+2(P)
	WATSON STUDIO	
III	Data visualization in Watson studio, Adding data to data refiner, Visualization of data in Watson studio.	5+4(P)
	DATA ANALYSIS USING PYTHON	
IV	Introduction to python, Python scripting basics, Data types - Introduction to Jupyter notebook, Numpy and Pandas, Python and Anaconda installation, Pandas (text data, date time columns, indexing and selecting data, group by Merge/join datasets).	3+6(P)
	VISUALIZATION USING PYTHON	
V	Data Visualization tools in python, Basic plots using Matplotlib, Specialized Visualization tools using Matplotlib, Advanced Visualization tools using Matplotlib-Seaborn functionalities, Spatial visualization and analysis in python in folium, Usage of Seaborn functionalities, Case studies.	5+4(P)
Total Instructional Hours		(29 + 16) 45

Course Outcome

CO1: Know the history of data visualization and its connection with computer graphics.

CO2: Students understand the foundations and characteristics of data, which forms the beginning of the visualization pipeline.

CO3: Understand the role of user interaction within visualizations, understand the visualization design process.

CO4: Students know some commercial data visualization packages with functionality.

TEXT BOOKS:

T1 :IBM CE-Data visualization.

REFERENCE BOOKS:

R1: Information Dashboard Design: Displaying Data for At-a-glance Monitoring
R2: The Big Book of dash board by Steve Wexler.
R3: Mastering python data Visualization.

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Programme B.TECH.	Course Code 19AI4251	Name of the Course OPERATING SYSTEMS	L 2	T 0	P 2	C 3
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- Course Objective**
1. To learn the basic concepts and understand the structure of operating systems
 2. To learn and implement the concept of process management.
 3. To learn and understand synchronization and deadlock concepts
 4. To learn various memory management schemes
 5. To understand the concept of I/O and file systems and learn the basics of Linux Programming

Unit	Description	Instructional Hours
	OPERATING SYSTEMS OVERVIEW	
I	Computer System Overview - Basic Elements, Instruction Execution, Interrupts operating systems overview - Evolution of Operating System - Computer System Organization - Operating System Structure and Operations - System Calls - System Programs - OS Generation and System Boot.	7
	PROCESS MANAGEMENT	
II	Processes - Process concepts - Process scheduling - Operations on processes - Cooperating processes - CPU scheduling - Basic concepts - Scheduling criteria - Scheduling algorithms - Preemptive strategies - Non-preemptive strategies. <i>Illustrative Programs: Implementation of process scheduling mechanism (Round Robin, SJF, FCFS).</i>	5+4(P)
	SYNCHRONIZATION AND DEADLOCKS	
III	The critical section problem - Semaphores - Classic problems of synchronization - Critical regions - Monitors-Dead locks - Deadlock characterization - Prevention - Avoidance - Detection - Recovery. <i>Illustrative Programs: Producer Consumer Problem using Semaphores, Bankers Algorithm.</i>	5+4(P)
	MEMORY MANAGEMENT	
IV	Storage Management Strategies - Contiguous Vs. Non-Contiguous Storage Allocation - Fixed & Variable Partition Multiprogramming - Paging - Segmentation - Paging/Segmentation Systems - Page Replacement Strategies - Demand & Anticipatory Paging - File Concepts - Access Methods - Directory Structure - File Sharing - Protection - File - System Structure - Implementation. <i>Illustrative Programs: Simulate Paging Technique of Memory Management, Simulate Page Replacement Algorithms (FIFO, LRU, LFU).</i>	6+4(P)
	I/O SYSTEM, LINUX & SHELL PROGRAMMING	
V	Mass Storage Structure - Disk Structure- Disk Scheduling - Disk Management - Swap Space Management - RAID Structure - Shell Operation Commands - File Management Operation - Internet Service - Telnet - FTP - Filters & Regular Expressions - <i>Case Study (Linux) - Shell Programming - Variable, Arithmetic Operations, Control Structures, Handling Date, Time & System Information.</i>	6+4(P)

Total Instructional Hours 45(29+16)

- Course Outcome**
- CO1: Understand the fundamental components of a computer operating system and how computing resources are managed by the operating system
- CO2: Apply the concepts of various CPU scheduling algorithms
- CO3: Describe and solve Synchronization, Deadlock Problem
- CO4: Demonstrate the different memory management techniques used in Operating Systems.
- CO5: Implement the basic services and functionalities of the operating system using System Calls in Linux.




TEXT BOOKS:


- T1: Abraham Silberschatz, Peter Galvin and Gagne, "Operating System Concepts", 10th Edition, Addison Wesley, 2018.
T2: Tom Adelstein, Bill Lubanovic, "Linux System Administration Solve Real-life Linux Problems Quickly", O'Reilly Media, 2007.

REFERENCE BOOKS:

- R1: Andrew S. Tanenbaum, "Modern Operating Systems", 4th Edition, Pearson Publications, 2019.
R2: D M Dhamdhere, "Operating Systems: A Concept-Based Approach", 3rd Edition, Tata McGrawHill Education, 2017.
R3: Harvey M.Deitel, "Operating System", 3rd Edition, Addison Wesley, 2003.
R4: William Stallings, "Operating Systems - Internals and Design Principles", 9th Edition, Pearson Publications, 2018.


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Programme B.TECH.	Course Code 19AI4252	Name of the Course INTRODUCTION TO MACHINE LEARNING	L 3	T 0	P 2	C 4
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- Course Objective**
1. Identify the scope and necessity of Data Mining & Warehousing for the society
 2. To introduce students to the basic concepts and techniques of Machine Learning
 3. To learn and understand the concept of neural networks
 4. To understand classification and clustering techniques
 5. To understand evolutionary models

Unit	Description	Instructional Hours
I	<p>DATA MINING AND DATA WAREHOUSING</p> <p>Introduction - Steps in KDD - System Architecture - Types of data - Data mining functionalities - Classification of data mining systems - Integration of a data mining system with a data warehouse - Issues - Data Preprocessing - Data Mining Application Data warehousing components - Building a data warehouse - Multi Dimensional Data Model - OLAP Vs OLTP, Case Study: Modernizing a Data Warehouse for Machine Learning</p> <p><i>Perform the basic pre-processing operations on data relation such as removing an attribute and filter attribute bank data</i></p>	10+2(P)
II	<p>INTRODUCTION TO MACHINE LEARNING</p> <p>Learning - Types of Machine Learning - Supervised Learning - The Brain and the Neuron - Design a Learning System - Perspectives and Issues in Machine Learning - Concept Learning Task - Concept Learning as Search - Finding a Maximally Specific Hypothesis - Version Spaces and the Candidate Elimination Algorithm - Linear Discriminants - Perceptron - Linear Separability - Linear Regression. Case Study: Personal Smart Assistants, Predictive Analytics using Machine Learning</p> <p><i>Illustrative Examples: Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.</i></p> <p><i>For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm. Output a description of the set of all hypotheses consistent with the training examples.</i></p>	9+4(P)
III	<p>NEURAL NETWORKS</p> <p>Neural Networks - threshold logic units - linear machines - networks of threshold learning units - Training of feed forward networks by back propagations - neural networks vs. knowledge - based systems. Case Study: text translation, credit card fraud detection, medical diagnosis and solutions using neural networks</p> <p><i>Illustrative Examples: Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.</i></p>	9+4(P)
IV	<p>CLASSIFICATION AND CLUSTERING TECHNIQUES</p> <p>Support vector Machine - Decision Tree - Naïve Bayes - Random Forest - Density - Based Clustering Methods Hierarchical Based clustering methods - Partitioning methods - Grid based methods - K means clustering - pattern based with deep learning. Using classification and clustering in Retail marketing and Sports science. <i>Illustrative Examples: 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.</i></p> <p><i>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.</i></p>	9+4(P)
V	<p>EVOLUTIONARY MODELS</p> <p>Evolutionary Learning - Genetic algorithms - Genetic Offspring: - Genetic Operators - Using Genetic Algorithms - Reinforcement Learning - Overview - Getting Lost Example - Markov Decision Process. Case Study: Applying Genetic algorithm in Wireless Sensor Networks and Vehicle Routing problems</p> <p><i>Illustrative Examples: Implement genetic algorithm for an example of your choice</i></p>	7+2(P)



Course Outcomes	CO1:	Understand Data Mining & Warehousing concepts
	CO2:	Understand and Distinguish between types of learning
	CO3:	Build neural networks using algorithms
	CO4:	Implement applications with clustering and classification techniques
	CO5:	Understand evolutionary models

TEXT BOOKS:

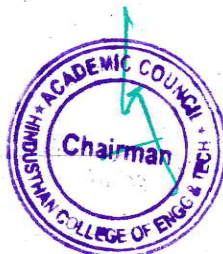
- T1: Stephen Marsland, "Machine Learning - An Algorithmic Perspective", 2nd Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
- T2: Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", 2nd Edition, Elsevier, 2007.
- T3: Nils J. Nilsson, "Introduction to Machine learning".

REFERENCE BOOKS:

- R1: Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, 3rd Edition, 2014.
- R2: Y. S. Abu-Mostafa, M. Magdon-Ismail, and H.-T. Lin, "Learning from Data", AML Book Publishers, 2012.
- R3: Andreas, C. Muller & Sarah Guido, "Introduction to Machine Learning with Python A guide for data scientists".
- R4: Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", 1st Edition, Cambridge University Press, 2012.
- R5: Tom M Mitchell, "Machine Learning", 1st Edition, McGraw Hill Education, 2013.


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Programme B.TECH.	Course Code 19AI4001R	Name of the Course DATABASE MANAGEMENT SYSTEM LABORATORY	L 0	T 0	P 3	C 1.5
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- Course Objective**
- To understand data definitions and data manipulation commands
 - To learn the use of nested and join queries
 - To understand views and constraints
 - To understand functions, procedures and procedural extensions of data bases
 - To understand design and implementation of typical database applications

S. No.	Description of the Experiments
1	Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving tables
2	Data Control and Transaction Control statements
3	Database Querying – Simple queries, Nested queries, Sub queries and Joins
4	Integrity Constraints
5	Views, Sequences and Synonyms
6	Database Programming: Implicit and Explicit Cursors
7	Procedures and Functions
8	Triggers
9	Exception Handling
10	Development of mini-projects with front end of your choice.

Total Practical Hours: 45

Scenario 1

Table 1: Busdiv

Buscode	BusDesc
01	Super Delux
02	Delux
03	Super Fast
04	Normal

Table 2: Busroute

Route_id	Route_no	Buscode	Origin	Dest	Fare	Dist	Capacity
201	33	01	Chennai	Madurai	170	300	45
202	25	02	Trichy	Madurai	45	100	50
203	15	03	Nellai	Madurai	30	90	50
204	36	04	Chennai	Bangalore	150	250	55
205	40	01	Bangalore	Madurai	170	250	45
206	38	02	Madurai	Chennai	160	300	50
207	39	03	Hyderabad	Chennai	160	190	50
208	41	04	Chennai	Cochin	148	320	55
209	47	02	Chennai	Coimbatore	165	300	50
210	46	04	Coimbatore	Chennai	150	300	55



Table 3: Busdepot

Place_id	Place	Address	Station
01	Chennai	12, Beach Rd	Broadway
02	Madurai	17, Bye Pass Rd	Ellis Nagar
03	Trichy	11, First Cross Road	Tollgate
04	Bangalore	15, Second St	Malleswaram
05	Hyderabad	115, Lakeview Rd	Charminar
06	Nellai	12, Temple Rd	Town

Table 4: Journey

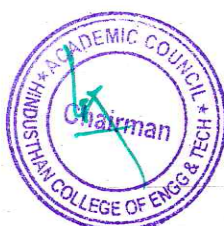
J-Id	Date	Time	Route_id	Buscode
01	13-Jan-97	10:00:00	201	01
02	13-Jan-97	12:00:00	201	01
03	13-Jan-97	13:00:00	201	01
04	13-Apr-97	15:00:00	202	02
05	13-Apr-97	17:00:00	202	03
06	13-Apr-97	19:00:00	203	04

Table 5: Ticket

J-Id	Tick_no	Dob	Doj	Time	Station	Origin	Dest	Adults	Child	Totfare	Route_id
01	001	10-Dec-96	13-Jan-97	10:00:00	Broadway	Chennai	Madurai	1	1	225	201
02	002	12-Dec-96	13-Jan-97	12:00:00	Broadway	Chennai	Madurai	2	0	90	202
03	003	01-Jan-97	13-Jan-97	13:00:00	Broadway	Chennai	Madurai	1	1	255	201
04	004	02-Feb-97	13-Apr-97	15:00:00	Tollgate	Trichy	Madurai	3	0	90	203
05	005	05-Mar-97	13-Apr-97	17:00:00	Tollgate	Trichy	Madurai	1	0	150	204
06	006	18-Mar-97	13-Apr-97	19:00:00	Town	Nellai	Madurai	1	1	90	202

Table 6: Ticketdetail

Tick_no	Name	Sex	Age	Fare
001	Latha	F	24	170
001	Anand	M	10	85
002	Pradeep	M	30	45
002	Kuldeep	M	32	45
003	Rakesh	M	48	170
003	Brindhha	F	08	85
004	Radhika	F	22	30
004	Juliat	F	21	30



Constraints

1.

Busdiv

Buscode(primary key)
Busdesc(Unique)

Busroute

Buscode(Foreign key)
Route_no(Unique)

2.

Journey

J_Id(primary key)
Day(Notnull)
Time(Notnull)

Ticket

J_Id(Foreign key)
Time(Notnull)
Origin(Notnull)
Dest(Notnull)

3.

Busroute

Route_id (primary key)

Journey

Route_id (Foreign key)

4.

Ticket

Tick_no (primary key)
Sex (Check constraint for
accepting either M of F)

Ticketdetail

Tick_no (Foreign key)

5.

Busdiv

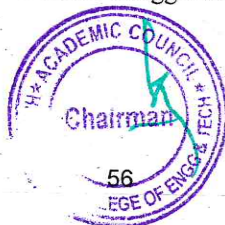
Buscode (primary key)

Journey

Buscode (Foreign key)

Create the above tables by applying the constraints specified and populate the tables. Perform various DML, TCL commands (Select, Insert, Update, Delete, Commit, Rollback, Savepoint, Grant, Revoke). Perform various operation involving arithmetic operators, logical operators, comparison operators, character, number, date functions. Create a view jview from the Journey table such that it contains Day, Time and route_id as J_day, J_time, J_r_id as column headings. Update the jview such that the J_day is "20-jan-98" where J_r_id is 201. Select the contents of corresponding table that jview is based and check whether update has occurred. Perform various join operations on the tables Busdiv and Busroute.

Create a synonym passenger for ticketdetail table. Select contents of passenger. Create a synonym busdetails for busroute table. Drop the passenger synonym. Create an index on route_id column of busroute table. Drop the index. Create a sequence ticket where minimum value is 1 and maximum value is 20 with an increment of 2 and starting with 1. Insert the sequence ticket into the tick_no column of ticket table. Alter the sequence such that the maximum value is 15. List only the sequences created by you. List only the views created by you. List all the indexes created by you. Drop all the database objects created by you. Create a procedure that will increment the selected records tofare in the ticket table by 100 update the table. Create a trigger that ensures no changes to the records on specified days.



Scenario 2:

Table 1: Emp

EmpNo	Ename	Job	MGR	HireDate	Sal	Comm	Deptno
7369	SMITH	CLERK	7902	17-DEC-80	800		20
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30
7521	WARD	SALESMAN	7698	22-FEB-81	1250	500	30
7566	JONES	MANAGER	7839	02-APR-81	2975		20
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7839	KING	PRESIDENT		17-NOV-81	5000		10
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7902	FORD	ANALYST	7566	03-DEC-81	3000		20
7934	MILLER	CLERK	7782	23-JAN-82	1300		10

Table 2: Dept

DeptNo	Dname	Loc
10	Accounting	New York
20	Research	Dallas
30	Sales	Chicago
40	Operations	Boston

Table 3: Salgrade

Grade	LoSal	HiSal
1	700	1200
2	1201	1400
3	1401	2000
4	2001	3000
5	3001	9999

Create the above tables by applying the necessary constraints and populate the tables. Perform various DML, TCL commands (Select, Insert, Update, Delete, Commit, Rollback, Savepoint, Grant, Revoke). Perform various operation involving arithmetic operators, logical operators, comparison operators, character, number, date functions. Perform various join operations on the tables Emp and Dept. Create Sequence Next_Empno Start with 8000 Increment By 1. Create view from emp table where job is salesman. Create a Procedure that lists all employees' numbers and names from the 'emp' table using a cursor. Create Procedure that selects an employee row given the employee number and displays certain columns. Create statement-level triggers that display a message after an insert, update, or deletion to the 'emp' table.



Scenario 3

A new supermarket will be opened in 3 months. The owner wants to have a software to manage the supermarket data (inventory, customers, sales,...). Design a database to insert, retrieve, update data. ex. When a product is sold to a customer, the database changes may need to be done reducing the inventory. Real world need for creating views. Provide different Users different roles for separate DB.

Scenario 4

Design database for university which should include details about student, faculty, course, department. Create, populate the database, perform updates and retrieval. Create views and triggers that does not allow manipulation during holidays. Provide different privileges to different users.

Course Outcome	CO1: Use typical data definitions and manipulation commands
	CO2: Design applications to test Nested and Join Queries
	CO3: Implement simple applications that use Views
	CO4: Critically analyze the use of Tables, Views, Functions and Procedures
	CO5: Implement applications that require a Front-end Tool.


Chairman - BoS
AIML - HICET




Dean (Academics)
HICET

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19AI4002	DATA VISUALIZATION LABORATORY	0	0	3	1.5

Course Objective

1. Design and create data visualization.
2. Conduct exploratory data analysis using visualization.
3. Craft visual presentation of data for effective communication.
4. Design and evaluate color palettes for visualization design alternative.
5. Apply data transformation such as aggregation and filtering for visualization.
6. Identify opportunities for application of data visualization in various domains

Description of the Experiments

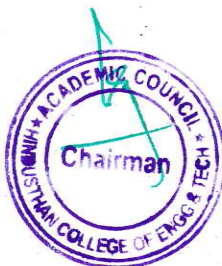
1. Data manipulation using dplyr package in R programming
2. Data manipulation using tidyr package in R programming
3. Data analysis using data. table package in R programming
4. Data Visualization using R programming
5. Pandas – Indexing and selecting operations
6. Pandas -Merging operations
7. Exploratory data analysis for loan prediction dataset
8. Creating a data frame from dictionary and accessing the data using pandas packages
9. Data analysis and visualization for COVID19 dataset
10. Creating different types of visualizations using python (matplotlib package) programming

Total Practical Hours 45

Course Outcome

Upon completion of this course, the students will be able to
 CO1: Know the history of data visualization and its connection with computer graphics
 CO2: Students understand the foundations and characteristics of data, which forms the beginning of the visualization pipeline
 CO3: Understand the role of user interaction within visualizations, understand the visualization design process
 CO4: Students know some commercial data visualization packages with functionality

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AIML - HiCET



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Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19MC4191	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE/VALUE EDUCATION	2	0	0	0

- Course Objective**
1. The course aims at imparting basic principles of thought process, reasoning and inferencing.
 2. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
 3. Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
 4. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view, basic principles of Yoga and holistic health care system, Indian philosophical traditions, Indian linguistic tradition and Indian artistic tradition.

Unit	Description	Instructional Hours
I	Basic Structure of Indian Knowledge System	4
II	Modern Science and Indian Knowledge System	4
III	Yoga and Holistic Health care	4
IV	Philosophical tradition	4
V	Indian linguistic tradition (Phonology, Morphology, Syntax and semantics), Indian artistic tradition and Case Studies.	4
Total Instructional Hours		20

- Course Outcome**
- CO1: Ability to understand the structure of Indian system of life
CO2: Connect up and explain basics of Indian Traditional knowledge in modern scientific perspective.

REFERENCE BOOKS:

- R1: V. Sivaramakrishna (Ed.), "Cultural Heritage of India-Course Material", Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.
- R2: Swami Jitatanand, "Modern Physics and Vedant", Bharatiya Vidya Bhavan.
- R3: Fritzo Capra, Tao of Physics.
- R4: Fritzo Capra, The wave of Life.
- R5: V N Jha (Eng. Trans.), "Tarkasangraha of Annam Bhatta", International Chinmay Foundation, Velliarnad, Amakuum.
- R6: "Yoga Sutra of Patanjali", Ramakrishna Mission, Kolkatta.
- R7: GN Jha (Eng. Trans) Ed. R N Jha, "Yoga-darshanam with Vyasa Bhashya", Vidyanidhi Prakasham, Delhi, 2016.
- R8: RN Jha, "Science of Consciousness Psychotherapy and Yoga Practices", Vidyanidhi Prakasham, Delhi, 2016.
- R9: P R Sharma (English translation), Shodashang Hridayam.

**Chairman - BoS
AIML - HICET**



**Dean (Academics)
HICET**

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19HE4073	IDEATION SKILLS	1	0	0	0

Course Objective	1. To study the importance of ideation.
	2. To learn about the various tools for Ideation.
	3. To provide an insight in Prototyping and its significance.

Unit	Description	Instructional Hours
IDEATION: INTRODUCTION TO DESIGN THINKING METHODOLOGY		
I	Design Thinking Methodology and how it can be used as a powerful tool for developing new and innovative solutions - Inspiration – Implementation - Disruptive technology.	4
IDEATION: TOOLS FOR IDEATION		
II	Various resources to kindle new ideas for innovation. Explore the types of ideas in the past – Effect of the ideas and innovation of past on the world – Innovation Thinking – Case studies.	4
IDEATION: INTRODUCTION TO CUSTOMER DISCOVERY		
III	Intro to Customer Discovery - development of customer discovery plan that can lead to powerful business innovation - Customer Discovery Plan	4
PROTOTYPING AND PRODUCT IDEATION		
IV	Introduction to Prototyping - minimum viable product - High fidelity prototype vs low fidelity prototype – Prototyping tools	3
Total Instructional Hours		15

Course Outcome	Upon completion of the course, students will be able to
	CO1: Develop a strong understanding and importance of ideation
	CO2: Learn about the different kinds of tools for Ideation.
	CO3: Learn the need and significance of prototyping and its significance.

TEXT BOOKS:

T1 - Mark Baskinger and William Bardel, "Drawing Ideas: A Hand-Drawn Approach for Better Design", 2013

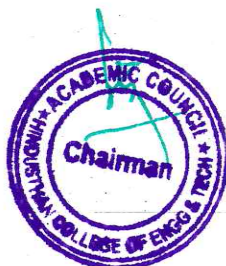
T2 - Nigel Cross, "Design Thinking", Kindle Edition

REFERENCE BOOKS:

R1 - Kurt Hanks and Larry Belliston, "Rapid Viz : A New Method for the Rapid Visualization of Ideas", 2008.

R2 - Kathryn McElroy , "Prototyping for Designers: Developing the Best Digital and Physical Products", 2017.


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Dean (Academics)
HICET

AIML - CO'S, PO'S & PSO'S MAPPING

Semester – I

Course Code & Name: 21HE1101 Technical English

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	1	2	-	1	2	1	2	3	1	3	3	2
CO2	1	2	1	1	1	2	1	1	1	3	1	2	2	3
CO3	1	2	1	1	1	2	1	1	2	3	1	2	2	2
CO4	1	1	-	1	1	1	1	1	2	3	1	2	3	3
CO5	-	1	1	1	1	1	1	2	2	3	1	2	2	2
Avg	1	1.4	1	1.2	1	1.4	1.2	1.2	1.8	3	1	2.2	2.4	2.4

Course Code & Name: 21MA1101 Calculus

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO3	3	3	3	3	3	-	-	-	-	-	-	2	1	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	1
CO5	3	3	3	2	3	-	-	-	-	-	-	2	2	2
Avg	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2

Course Code & Name: 21PH1151 Applied Physics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	3	3
CO3	3	2	1	2	2	-	-	-	-	-	-	1	3	3
CO4	3	2	3	2	3	1	-	-	-	-	-	1	2	2
CO5	3	2	3	2	2	2	-	-	-	-	-	1	2	3
Avg	3	2.2	2	1.6	2	1.333333	-	-	-	-	-	1	2.4	2.4

Course Code & Name: 21CY1151 Chemistry for Engineers

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	-	2	1	1	-	-	-	-	1	1	1
CO2	3	2	2	-	2	1	-	-	-	-	-	1	1	-
CO3	3	2	2	-	2	1	1	-	-	-	-	1	1	-
CO4	3	2	2	2	2	1	-	-	-	-	-	1	1	1
CO5	3	2	2	-	2	1	-	-	-	-	-	1	1	1
Avg	3	2	2	2	2	1	1	-	-	-	-	1	1	1

Course Code & Name: 21CS1152 Object Oriented Programming using Python

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	-	2	-	-	-	-	-	-	2	2	2
CO2	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO3	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO4	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO5	2	3	3	-	2	-	-	-	2	-	-	2	2	2
Avg	2	3	3	-	2	-	-	-	2	-	-	2	2	2

Course Code & Name: 21EC1154 Basics of Electron Devices and Electric Circuits

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2	1	1				1	2	3	3
CO2	3	3	2	2	2	1	1				1	2	3	2
CO3	3	2	3	2	2	1	1				1	2	2	2
CO4	3	3	3	2	2	1	1				1	2	3	2
CO5	3	3	3	2	2	1	1				1	2	3	2
Avg	3	2.8	2.8	2	2	1	1				1	2	2.8	2.2

Semester – II

Course Code & Name: 21HE2101 Business English for Engineers

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1	1	1	2	1	2	2	3	-	3	1	-
CO2	2	1	1	1	1	2	2	2	2	3	-	2	-	1
CO3	2	2	1	1	1	2	2	2	2	3	1	3	1	-
CO4	2	2	1	1	2	2	2	2	3	3	1	3	1	1
CO5	1	1	1	1	1	2	2	1	2	3	1	3	1	1
Avg	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1

Course Code & Name: 21MA2104 Differential Equations and Linear Algebra

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	3
CO3	3	3	3	3	2	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	2	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	2	-	-	-	-	-	-	2	2	2
Avg	3	3	3	2.6	2	-	-	-	-	-	-	2	2	2.2

Course Code & Name: 21PH2151 Material Science

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	2	2
CO3	3	2	1	2	2	-	-	-	-	-	-	1	2	3
CO4	3	3	1	2	2	1	-	-	-	-	-	1	2	2
CO5	3	2	2	3	2	1	2	-	-	-	-	1	2	3
Avg	3	2.4	1.2	1.8	1.8	1	2	-	-	-	-	1	2	2.2

Course Code & Name: 21CY2151 Environmental Studies

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	-	-	-	-	2	3	3	2	-	-	2	-	-
CO2	2	-	-	-	-	2	3	3	2	-	-	2	-	-
CO3	2	1	1	-	-	2	3	3	2	-	-	2	-	-
CO4	2	1	2	-	-	2	3	3	2	-	-	2	-	-
CO5	2	1	2	-	-	2	3	3	2	-	-	2	-	-
Avg	2	1	1.7	-	-	1	2	3	2	-	-	2	-	-

Course Code & Name: 21CS2153 Java Fundamentals

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	-		3	-	-	1	1	-	2	2	3	3
CO2	3	3	2	2	3	-	-	1	1	-	2	2	2	3
CO3	3	3	2	2	3	-	-	1	1	-	2	2	2	3
CO4	3	3	-	2	3	-	-	1	1	-	2	2	2	3
CO5	3	-	2	2	3	-	-	1	1	-	2	2	2	3
Avg	3	2.4	1.2	1.6	3	0	0	1	1	0	2	2	2.2	3

Course Code & Name: 21ME2154 Engineering Graphics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2	-	-	-	-	-	-	2	1	1
CO2	3	3	3	2	2	-	-	-	-	-	-	3	2	2
CO3	3	3	3	2	2	-	-	-	-	-	-	3	3	3
CO4	3	3	3	2	2	-	-	-	-	-	-	3	1	1

CO5	3	3	3	2	2	-	-	-	-	-	-	3	2	2
Avg	3	3	3	2	2	-	-	-	-	-	-	2.8	1.8	1.8

Course Code & Name: 21ME2001 Engineering Practices Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	3	-	3	-	1	-	1	-	-	-	1	2
CO2														
CO3														
CO4														
CO5														
Avg	3		3		3				1				1	2

II	21HE2101 - Business English for Engineers	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1
	21MA2104 – Differential Equations And Linear Algebra	3	3	3	2.6	2	-	-	-	-	-	-	2	2	2.2
	21PH2151 - Material Science	3	2.4	1.2	1.8	1.8	1	2	-	-	-	-	1	2	2.2
	21CY2151 - Environmental Studies	2	1	1.7	-	-	1	2	3	2	-	-	2	-	-
	21CS2153 - Java Fundamentals	3	2.4	1.2	1.6	3	0	0	1	1	0	2	2	2.2	3
	21ME2154 – Engineering Graphics	3	3	3	2	2	-	-	-	-	-	-	2.8	1.8	1.8
	21ME2001 - Engineering Practices	3		3		3					1			1	2
	21HE2071 - Language Competency Enhancement Course-II														

1-Low, 2-Medium, 3-High, - No Correlation


Chairman - BoS
AIML - HiCET


Dean (Academics)
HiCET

AIML - CO'S, PO'S & PSO'S MAPPING

Semester – I

Course Code & Name: 19HE1101 Technical English

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	1	2	-	1	2	1	2	3	1	3	3	2
CO2	1	2	1	1	1	2	1	1	1	3	1	2	2	3
CO3	1	2	1	1	1	2	1	1	2	3	1	2	2	2
CO4	1	1	-	1	1	1	1	1	2	3	1	2	3	3
CO5	-	1	1	1	1	1	1	2	2	3	1	2	2	2
Avg	1	1.4	1	1.2	1	1.4	1.2	1.2	1.8	3	1	2.2	2.4	2.4

Course Code & Name: 19MA1101 Calculus

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO3	3	3	3	3	3	-	-	-	-	-	-	2	1	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	1
CO5	3	3	3	2	3	-	-	-	-	-	-	2	2	2
Avg	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2

Course Code & Name: 19PH1151 Applied Physics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	3	3
CO3	3	2	1	2	2	-	-	-	-	-	-	1	3	3
CO4	3	2	3	2	3	1	-	-	-	-	-	1	2	2
CO5	3	2	3	2	2	2	-	-	-	-	-	1	2	3
Avg	3	2.2	2	1.6	2	1.333333	-	-	-	-	-	1	2.4	2.4

Course Code & Name: 19CY1151 Chemistry for Engineers

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	-	2	1	1	-	-	-	-	1	1	1
CO2	3	2	2	-	2	1	-	-	-	-	-	1	1	-
CO3	3	2	2	-	2	1	1	-	-	-	-	1	1	-
CO4	3	2	2	2	2	1	-	-	-	-	-	1	1	1
CO5	3	2	2	-	2	1	-	-	-	-	-	1	1	1
Avg	3	2	2	2	2	1	1	-	-	-	-	1	1	1

Course Code & Name: 19CS1152 Object Oriented Programming using Python

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	-	2	-	-	-	-	-	-	2	2	2
CO2	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO3	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO4	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO5	2	3	3	-	2	-	-	-	2	-	-	2	2	2
Avg	2	3	3	-	2	-	-	-	2	-	-	2	2	2

Course Code & Name: 19EC1154 Basics of Electron Devices and Electric Circuits

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2	1	1				1	2	3	3
CO2	3	3	2	2	2	1	1				1	2	3	2
CO3	3	2	3	2	2	1	1				1	2	2	2
CO4	3	3	3	2	2	1	1				1	2	3	2
CO5	3	3	3	2	2	1	1				1	2	3	2
Avg	3	2.8	2.8	2	2	1	1				1	2	2.8	2.2

Semester – II

Course Code & Name: 19HE2101 Business English for Engineers

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1	1	1	2	1	2	2	3	-	3	1	-
CO2	2	1	1	1	1	2	2	2	2	3	-	2	-	1
CO3	2	2	1	1	1	2	2	2	2	3	1	3	1	-
CO4	2	2	1	1	2	2	2	2	3	3	1	3	1	1
CO5	1	1	1	1	1	2	2	1	2	3	1	3	1	1
Avg	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1

Course Code & Name: 19MA2104 Differential Equations and Linear Algebra

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	3
CO3	3	3	3	3	2	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	2	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	2	-	-	-	-	-	-	2	2	2
Avg	3	3	3	2.6	2	-	-	-	-	-	-	2	2	2.2

Course Code & Name: 19PH2151 Material Science

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	2	2
CO3	3	2	1	2	2	-	-	-	-	-	-	1	2	3
CO4	3	3	1	2	2	1	-	-	-	-	-	1	2	2
CO5	3	2	2	3	2	1	2	-	-	-	-	1	2	3
Avg	3	2.4	1.2	1.8	1.8	1	2	-	-	-	-	1	2	2.2

Course Code & Name: 19CY2151 Environmental Studies

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	-	-	-	-	2	3	3	2	-	-	2	-	-
CO2	2	-	-	-	-	2	3	3	2	-	-	2	-	-
CO3	2	1	1	-	-	2	3	3	2	-	-	2	-	-
CO4	2	1	2	-	-	2	3	3	2	-	-	2	-	-
CO5	2	1	2	-	-	2	3	3	2	-	-	2	-	-
Avg	2	1	1.7	-	-	1	2	3	2	-	-	2	-	-

Course Code & Name: 19CS2153 Java Fundamentals

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	-		3	-	-	1	1	-	2	2	3	3
CO2	3	3	2	2	3	-	-	1	1	-	2	2	2	3
CO3	3	3	2	2	3	-	-	1	1	-	2	2	2	3
CO4	3	3	-	2	3	-	-	1	1	-	2	2	2	3
CO5	3	-	2	2	3	-	-	1	1	-	2	2	2	3
Avg	3	2.4	1.2	1.6	3	0	0	1	1	0	2	2	2.2	3

Course Code & Name: 19ME2154 Engineering Graphics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2	-	-	-	-	-	-	2	1	1
CO2	3	3	3	2	2	-	-	-	-	-	-	3	2	2
CO3	3	3	3	2	2	-	-	-	-	-	-	3	3	3
CO4	3	3	3	2	2	-	-	-	-	-	-	3	1	1

CO5	3	3	3	2	2	-	-	-	-	-	-	3	2	2
Avg	3	3	3	2	2	-	-	-	-	-	-	2.8	1.8	1.8

Course Code & Name: 19ME2001 Engineering Practices Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	3	-	3	-	1	-	1	-	-	-	1	2
CO2														
CO3														
CO4														
CO5														
Avg	3		3		3				1				1	2

Semester – III

Course Code & Name: 19MA3152 - Probability and Applied Statistics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	3	2	3
CO3	2	2	2	2	2	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	3	-	-	-	-	-	-	3	3	3
Avg	2.8	2.8	2.8	2.8	2.8	-	-	-	-	-	-	2.6	2.4	2.6

Course Code & Name: 19AI3201 Data Structures and Algorithms

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3			3	1		2	2	2	3
CO2	3	3	3	2	3			3	1		2	2	2	3
CO3	3	2	3	2	3			3	1		2	2	2	3
CO4	3	3	3	2	3			3	1		2	2	2	3
CO5	3	3	3	2	3			3	1		2	2	2	3
Avg	3	2.8	3	2	3	-	-	3	1	-	2	2	2	3

Course Code & Name: 19AI3202 - Foundations of Artificial Intelligence

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	3	0	1	3	0	0	3	1	1	2	2	1
CO2	2	2	3	1	1	1	0	0	3	1	1	2	2	2
CO3	3	2	3	2	2	0	0	0	1	1	1	2	2	3
CO4	3	1	3	1	1	2	0	0	1	2	1	2	3	3
CO5	1	2	2	1	3	2	1	0	2	3	3	2	3	1
Avg	2	1.6	2.8	1	1.6	1.6	0.2	0	2	1.6	1.4	2	2.4	2

Course Code & Name: 19AI3252 Clean Coding and Devops

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	3	2	3	1	1	2	2	2	3
CO2	3	3	3	2	3	3	2	3	1	1	2	2	2	3
CO3	3	2	3	2	3	3	2	3	1		2	2	2	3
CO4	3	3	3	2	3	3	2	3	1		2	2	2	3
CO5	3	3	3	2	3	3	2	3	1		2	2	2	3
Avg	3	2.8	3	2	3	3	2	3	1	0.4	2	2	2	3

Course Code & Name: 19AI3251 Digital Principles and System Design

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	1	1	0	1	0	1	1	3	0	0
CO2	3	3	2	2	2	2	0	1	0	1	0	1	0	2
CO3	3	3	2	2	2	2	0	1	0	1	0	2	0	1
CO4	3	3	2	2	2	2	0	1	0	1	1	1	0	1
CO5	3	3	2	2	2	2	0	1	0	1	1	1	0	2
Avg	3	3	2	2	2	2	0	1	0	1	1	2	0	1

Course Code & Name: 19AI3001 – Data Structures and Algorithms Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	0	0	0	1	0	0	0	0	0	1	1	1	0
CO2	3	2	1	1	1	0	0	0	1	0	0	1	1	0
CO3	3	2	1	1	1	0	0	0	1	1	0	1	0	1
CO4	3	2	1	1	0	0	0	0	1	0	1	1	0	1
CO5	3	0	0	0	0	0	0	0	0	1	1	1	1	0
Avg	3	1	1	1	1	0	0	0	1	0	1	1	1	0

Course Code & Name: 19AI3002 Artificial Intelligence Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	3	0	1	1	0	0	1	1	1	1	2	2
CO2	1	2	3	1	1	1	0	0	1	1	1	1	2	2
CO3	1	2	3	2	2	0	0	0	1	1	1	1	2	2
CO4	1	1	3	1	1	2	0	0	1	2	1	2	2	3
CO5	1	2	2	1	3	2	1	0	2	3	3	2	2	3

Avg	3	2	0	0	1	0	0	0	0	0	1	2	1	0
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Semester – IV

Course Code & Name: 19MA4105 - Discrete Mathematical Structures

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	1	1	-	-	-	-	-	1	2	2	2
CO2	2	3	2	1	1	-	-	-	-	-	1	2	2	2
CO3	2	2	2	2	1	-	-	-	-	-	1	2	2	2
CO4	2	2	3	1	2	-	-	-	-	-	2	2	3	3
CO5	2	3	3	2	2	-	-	-	-	-	3	2	3	3
Avg	2	2.6	2.4	1.4	1.4	-	-	-	-	-	1.6	2	2.4	2.4

Course Code & Name: 19AI4201 Database Management Systems

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	-	-	-	-	-	-	-	-	2	2	-
CO2	2	1	2	1	3	-	-	-	-	-	-	1	3	-
CO3	2	1	2	1	2	-	-	-	-	-	-	1	2	-
CO4	2	3	-	-	1	-	-	-	-	-	-	2	3	-
CO5	1	1	2	1	-	-	-	-	-	-	-	1	2	-
Avg	2	1.6	1.4	0.6	1.2	-	-	-	-	-	-	1.4	2.4	-

Course Code & Name: 19AI4202 Data Visualization

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	-	2	2	-	3	3	-	3	3	3
CO2	2	3	3	2	2	-	2	2	3	3	2	2	3	3

CO2	3	3	-	2	2	2	-	-	-	-	-	-	3	1
CO3	3	3	-	2	2	2	-	2	-	-	-	-	3	1
CO4	3	3	1	2	2	2	-	-	-	-	-	-	3	1
CO5	3	3	1	2	2	2	-	-	-	-	3	-	3	1
Avg	3	3	0.4	1.6	1.8	1.6	-	0.4	-	-	0.6	-	3	1

Course Code & Name: 19CS4002 Data Visualization Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	1	1	0	1	0	1	1	3	0	0
CO2	3	3	2	2	2	2	0	1	0	1	0	1	0	2
CO3	3	3	2	2	2	2	0	1	0	1	0	2	0	1
CO4	3	3	2	2	2	2	0	1	0	1	1	1	0	1
CO5	3	3	2	2	2	2	0	1	0	1	1	1	0	2
Avg	3	3	2	2	2	2	0	1	0	1	1	2	0	1

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING


REGULATIONS 2019

Mapping of Course Outcome and Programme Outcome:

Year	Sem	Course code & Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2		
I	I	19HE1101- Technical English	1	1.4	1	1.2	1	1.4	1.2	1.2	1.8	3	1	2.2	2.4	2.4		
		19MA1101- Calculus	3	3	3	2.6	2.8	-	-	-	-	-	-	-	2	1.8	2	
		19PH1151 - Applied Physics	3	2.2	2	1.6	2	1.33 3333	-	-	-	-	-	-	1	2.4	2.4	
		19CY1151 -Chemistry for Engineers	3	2	2	2	2	1	1	-	-	-	-	-	1	1	1	
		19CS1152 - Object Oriented Programming using Python	2	3	3	-	2	-	-	-	-	2	-	-	2	2	2	
		19EC1154- Basics of Electron devices And Electric Circuits	3	2.8	2.8	2	2	1	1						1	2	2.8	2.2
		19HE1071 - Language Competency Enhancement Course-I																
		19MC1191 – Induction Program																
	II	19HE2101 - Business English for Engineers	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1		
		19MA2104 – Differential Equations	3	3	3	2.6	2	-	-	-	-	-	-	-	2	2	2.2	

IV	19AI4201 – Database Management System	2	1.6	1.4	0.6	1.2	-	-	-	-	-	-	1.4	2.4	-
	19AI4202- Data Visualization	2.6	2.6	2.6	2.2	2	2	2.25	2	2.666667	2.666667	2.25	2.2	2.4	2.4
	19AI4251– Operating Systems	2.8	1	1.2	0.6	0	0	2.4	0	1.2	0	1.8	1.2	3	0.4
	19MA4105 - Discrete Mathematical Structures	2	2.6	2.4	1.4	1.4	-	-	-	-	-	1.6	2	2.4	2.4
	19AI4252 – Introduction to Machine Learning	3.00	2.80	3.00	0.80	1.00	0.60	1.60	-	0.60	-	0.80	1.80	2.00	1.80
	19AI4001 – Database Management System Laboratory	3	3	0.4	1.6	1.8	1.6	-	0.4	-	-	0.6	-	3	1
	19AI4002- Data Visualization Laboratory	3	3	2	2	2	2	0	1	0	1	1	2	0	1
	19MC4191-Essence of Indian tradition knowledge														

1-Low, 2-Medium, 3-High, - No Correlation


Chairman - BoS
AIML - HICET


Dean (Academics)
HICET