

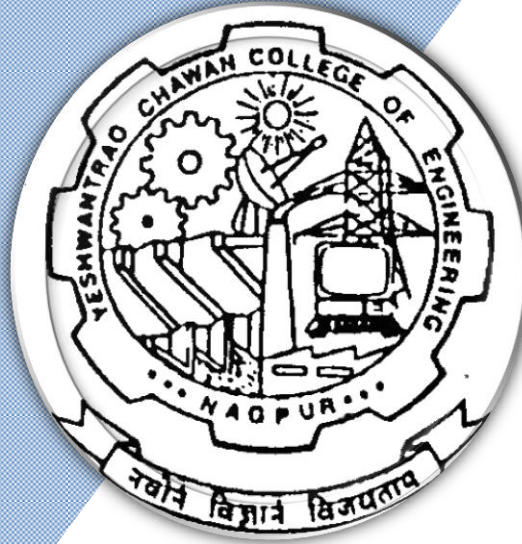
Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of Technology SoE & Syllabus 2021 1st Semester

(Department of Computer Technology)

Artificial Intelligence and Data Science



B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Technology)

Artificial Intelligence and Data Science

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
First Semester															
1	1	BS	GE	AIDS2101	Calculus, Sequences & Series	T	3	0	0	3	3	30	20	50	3 Hours
2	1	BS	GE	AIDS2102	Applied Chemistry	T	3	0	0	3	3	30	20	50	3 Hours
3	1	BS	GE	AIDS2103	Lab.: Applied Chemistry	P	0	0	2	2	1		60	40	
4	1	HS	GE	AIDS2104	Technical Communications	T	3	0	0	3	3	30	20	50	3 Hours
5	1	HS	GE	AIDS2105	Lab.: Technical Communications	P	0	0	2	2	1		60	40	
6	1	PC	CT	AIDS2106	Foundations of Data Science	T	3	0	0	3	3	30	20	50	3 Hours
7	1	PC	CT	AIDS2107	Lab.: Foundations of Data Science	P	0	0	2	2	1		60	40	
8	1	BES	CT	AIDS2108	Computer Programming	T	3	0	0	3	3	30	20	50	3 Hours
9	1	BES	CT	AIDS2109	Lab.: Computer Programming	P	0	0	2	2	1		60	40	
TOTAL FIRST SEM							15	0	8	23	19				

List of Audit Course															
1	1	HS	GE	GE2131	Universal Human Value	T	2	0	0	0	0				
2	1	HS	GE	AU2121	YCCE Communication Aptitude Preparation (YCAP1)	A	3	0	0	3	0				
3	2	HS	GE	AU2122	YCCE Communication Aptitude Preparation (YCAP2)	A	3	0	0	3	0				
Second Semester															
1	2	BS	GE	AIDS2151	Probability & Statistics	T	3	0	0	3	3	30	20	50	3 Hours
2	2	BS	GE	AIDS2152	Applied Physics	T	3	0	0	3	3	30	20	50	3 Hours
3	2	BS	GE	AIDS2153	Lab.: Applied Physics	P	0	0	2	2	1		60	40	
4	2	HS	GE	AIDS2154	Constitution of India	T	3	0	0	3	3	30	20	50	3 Hours
5	2	BES	CT	AIDS2155	Computer Architecture and Organization	T	3	0	0	3	3	30	20	50	3 Hours
6	2	PC	CT	AIDS2156	Object Oriented Programming	T	3	0	0	3	3	30	20	50	3 Hours
7	2	PC	CT	AIDS2157	Lab.: Object Oriented Programming	P	0	0	2	2	1		60	40	
8	2	PC	CT	AIDS2158	Data Structures	T	3	0	0	3	3	30	20	50	3 Hours
9	2	PC	CT	AIDS2159	Lab.: Data Structures	P	0	0	2	2	1		60	40	
10	2	PC	CT	AIDS2160	Software Lab	P	0	0	2	2	1		60	40	
TOTAL SECOND SEM							18	0	8	26	22				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activities decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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Artificial Intelligence and Data Science

I Semester

AIDS2101: Calculus, Sequences and Series

Objective	Course Outcome
<ol style="list-style-type: none">To give basic knowledge of sequence and Series.To explain the differential calculus and its applications.To extend the concept of integration to double and triple integrals.To teach various methods for solving higher order differential equations and its applications.	<p>Students will be able to</p> <ol style="list-style-type: none">Apply the knowledge of differentiation, sequence and series to solve engineering problems.Determine the expansion and derivatives of functions of several variables and use it to find extreme values of functions.Evaluate the improper integrals, multiple integrals and apply it to compute the area and volume of various structures.Solve higher order differential equations and its applications.

Unit No.	Contents	Max. Hrs.
1	Sequence and Series Sequence, types of sequence, test of convergence of sequences, Cauchy sequence, infinite series, power series, Alternating series, tests of convergence and absolute convergence of series.	6
2	Ordinary Differentiation Successive differentiation; Leibnitz theorem, Taylor's and Maclaurin's series for functions of single variable and its applications.	7
3	Partial Differentiation First and higher order derivatives of Functions of several variables, Euler's theorem, Chain Rule, Jacobians, Maxima and minima and saddle point of functions of two variables.	7
4	Curve Tracing and Improper Integrals Tracing of curves, Beta, Gamma functions and its applications.	6
5	Multiple integrals Elementary double integrals, Change of variables (simple transformations), Coordinate Transformation, Change of order of integration (Cartesian and polar), Elementary triple integrals and Applications to find area, volume.	7
6	Differential Equations Higher order differential equations with constant coefficients. Cauchy's and Legendre's homogeneous differential equations, Applications of differential equations	6

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Artificial Intelligence and Data Science

Text Books

1. Advance Engineering Mathematics by Erwin Kreyzig, John Wiley and Sons, INC.
2. Engineering Mathematics - by H.K. Dass, 11th revised edition, 2003, S.Chand, Delhi.
3. Advanced Engineering Mathematics - by H.K. Dass, 8th Ed, 2007, S.Chand, Delhi.
4. Engineering Mathematics by Dr. B.S. Grewal
5. Applied Mathematics by P.N.Wartikar and J.N.Wartikar, Pune Vidyarthi Griha Prakashan, Pune

Reference Books

1. G B Thomas and R L Finney: Calculus and Analytical Geometry, 9th ed, Addison-Wesley, 1999.
2. Calculus-by Michael Spivak and Tom Apostol (Vols I and II)
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Prakashan, Reprint 2008.

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Artificial Intelligence and Data Science

I Semester

AIDS2102: Applied Chemistry

Objective	Course Outcome
<ul style="list-style-type: none">To impart intensive and extensive knowledge of the subject enriching students to understand the role of Chemistry in the field of engineering.To keep students abreast with the latest developments and applications of modern materials.To gain basic principles, instrumentation and applications of analytical techniques.	<ol style="list-style-type: none">Interpret different thermodynamic functions. (L2)Describe basic concepts of electrochemistry and apply the knowledge for energy storage devices. (L3)Illustrate chemical reaction rate and drug molecules synthesis. (L3)Classify advanced engineering materials in technological applications. (L2)Develop analytical and instrumental skills. (L3)

Unit No.	Contents	Max. Hrs.
1	Energetics: Introduction, Internal energy, enthalpy, Gibb's free energy, Free energy change and chemical equilibrium. Spontaneous and non-spontaneous processes. I and II law of thermodynamics. Entropy and its significance. Numericals on Internal energy and enthalpy change. Thermodynamic applications to physical and chemical equilibrium.	07
2	Electrochemistry: Introduction, metallic and electrolytic conductance, resistance, specific resistance, conductance, specific conductance, equivalent and molar conductance. Variation of conductance with dilution. Electrode and electrode potentials. Nernst Equation. Faraday's laws and Numericals. Industrial applications: Electroforming, Electrowinning, Electrolytic refining.	06
3	Energy storage devices Basic concepts: Primary and secondary battery. Energy density, power density, energy efficiency, cycle life, shelf life. Secondary battery: Ni-metal hydride battery, Lithium-ion battery. H₂-O₂ Fuel cell: Principle, working, advantages, disadvantages, applications. Differences between battery and a fuel cell. Supercapacitors: Definition, types, characteristics and application.	06
4	Chemical Kinetics : Introduction, Rate of reaction and factors influencing rate of reaction, order & molecularity of reaction. Kinetic equations of different orders: Zero Order, First Order, Second Order and numericals.	06
5	Organic reactions and synthesis of drug molecules: Organic reactions: Introduction to reactions involving substitution, addition, elimination, oxidation, reduction with examples. Drugs: Introduction, types of drugs, Synthesis of commonly used drug molecules such as Ibuprofen, Aspirin and Paracetamol. Challenges in chemical synthesis. Applications of Artificial Intelligence in Chemistry.	07

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Unit No.	Contents	Max. Hrs.
6	Advanced Materials : Nanomaterials: Definition of nanomaterials, nano scale. Carbon Nanotubes and types. Application of Nanomaterials: Applications of nanomaterials in medicine, environment, and electronics. Nanotechnology for waste reduction and improved energy efficiency. Elementary ideas and applications of Nano biopolymers, Nano fertilizers and Nano ceramics. Threats of Nanomaterials. Silicon Chips: Introduction. Physical, chemical, electrical & mechanical properties and applications. Chemical sensors: Types and application	07

Text Books:

SN	Title	Edition	Authors	Publisher
1	A Textbook of Engineering Chemistry	Eleventh Edition.	S S. Dara	S.Chand & Co New Delhi
2	Engineering Chemistry	Sixteenth Edition	Jain & Jain	Dhanpat Rai & sons New Delhi.
3	Physical Chemistry	(Eighth edition-2006).	P. W. Atkins	Oxford Publications
4	Engineering Chemistry		B.Sivasankar	Tata McGraw-Hill

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Chemistry in Engineering		Lloyd A.Munro	Prentice-hall
2	Applied chemistry for engineers		T.S.Gyngell	
3	Engineering Chemistry		B.K.Sharma	Krishna Prakashan media private LTD
4	Chemistry of Advanced Materials		CNR Rao	RSC Publications
5	Handbook of Semiconductor Silicon Technology	1st Edition.	William C. O'Mara, Robert B. Herring	Noyes Publications Park Ridge, NJ, USA.

Website / Data sheet:

SN	Title
1	Silicon Chips: What are Computer Chips Made Of? https://www.intel.com/content/www/us/en/history/museum-making-silicon.html
2	What is silicon, and why are computer chips made from it? https://www.extremetech.com/extreme/208501-what-is-silicon-and-why-are-computer-chips-made-from-it

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Artificial Intelligence and Data Science

I Semester

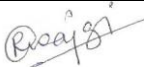

AIDS2103: Lab.: Applied Chemistry

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 2	Describe basic concepts of electrochemistry and apply the knowledge for energystorage devices. (L3)
CO4	Classify advanced engineering materials in technological applications. (L2)
CO 5	Develop analytical and instrumental skills. (L3)

Lab Experiment List:

Expt. No	Name of Experiment (Minimum 4 experiments from Group I & II each and Demonstrations on 2 experiments should be conducted)
	Group I:
1	To determine the strength of a given potassium dichromate solution with N/20 sodium thiosulphate solution.
2	Estimation of Nickel by complexometry.
3	Determination of copper by iodometric titration.
4	Estimation of Fe ²⁺ ions by redox titration.
5	Estimation of Fe ³⁺ ions by spectrophotometric method.
6	Synthesis of urea formaldehyde resin.
	Group II:
7	Preparation of Printed Circuit Board.
8	Determination of molecular weight of a polymer using Ostwald's viscometer.
9	Determination of ion exchange capacity of a cation exchange resin.
10	Proximate analysis of Coal.
11	Determination of thinner contain in oil paint.
12	Electroplating Copper on Stainless steel.
	Demonstration:
13	Determination of Faradays first law.
14	Determination of Faradays second law.
15	Determination of conductivity of water sample by conductivity meter

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I Semester

AIDS2104: Technical Communications

Objective	Course Outcome
<ol style="list-style-type: none">To Explain the fundamentals of communicationTo Classify the different speech sounds of EnglishTo Apply Different components of oral communicationTo Draft technical documents	Upon completion of the course, students will have the ability to, <ol style="list-style-type: none">Apply different modes for effective communicationcompetently use the phonology of English languageApply nuances of LSRW skillsCommunicate through different channels

Unit No.	Contents	Max. Hrs.
1	Basics of Communication Language as a tool of communication & characteristics of language Process of Communication, Levels of Communication, Flow of Communication, Networks of Communication, Classification of Barriers (Intrapersonal, Interpersonal, Organizational).	6
2	English Phonetics Speech Mechanism, Organs of speech, Consonant and Vowels sounds, Word stress rules	6
3	Interview Skills Purpose, expectations of employer and preparation for Interview, Types, Types of Questions & Answering Techniques, Telephonic Interviews – preparation and guidelines, Reading Techniques (Exercise based on Complex Unseen passages)	5
4	Oral Skills Group Communication- (Purpose, Different types of Group Communication, Organizational GD, GD as a part of selection process), Meeting (purposes, preparation, procedure and minutes of meeting), Listening Skills -definition types and traits	6
5	Presentation & Visual Communication Presentation and audience analysis, Organizing content, Nuances of presentation, Visual Communication – Introduction & importance, Role & Psychology of color in visual communication.	6
6	Technical Written Communication Memo, Email, Report -Types, Characteristics, prewriting aspects of report and preparing writing aspects of report), Types of paragraphs.	6

Text Books :

- Technical Communication, Raman & Sharma, Oxford University Press
- Textbook of English Phonetics for Indian Students, T. Balasubramaniam, Macmillan India Ltd

Reference Books :

- How to Develop Self – Confidence & Influence People by Public Speaking, Dale Carnegie
- Communication Skills, Asha Kaul
- Body Language, Allen Peas
- Gerson's Gerson – Technical Communication

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I Semester

AIDS2105: Lab.: Technical Communications

Objective	Course Outcome
<ol style="list-style-type: none">To Explain the fundamentals of communicationTo Classify the different speech sounds of EnglishTo Apply Different components of oral communicationTo Draft technical documents	Upon completion of the course, students will have the ability to, <ol style="list-style-type: none">Apply different modes for effective communicationcompetently use the phonology of English languageApply nuances of LSRW skillsCommunicate through different channels

Sr. No.	List of Experiment
1	Hands on for Consonants and vowel sounds
2	Grooming session for effective use of body language
3	Mock Sessions for Interview
4	Group Discussion
5	Creation of Visual Media – preparing poster boards, advertisements, banners and flyers
6	Official Report writing
7	Official Mail composing
8	Mail Merge
9	Exporting data from excel to Word

Text Books :

- Technical Communication, Raman & Sharma, Oxford University Press
- Textbook of English Phonetics for Indian Students, T. Balasubramaniam, Macmillan India Ltd

Reference Books :

- How to Develop Self – Confidence & Influence People by Public Speaking, Dale Carnegie
- Communication Skills, Asha Kaul
- Body Language, Allen Peas
- Gerson's Gerson – Technical Communication

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Artificial Intelligence and Data Science

I Semester

AIDS2106: Foundations of Data Science

Objective	Course Outcome
1. To understand the fundamentals of data analysis of data analysis	1. To interpret the data analysis task
2. To understand the data preparation and representation of data for analysis	2. To use the statistical techniques to prepare and present the data for analysis
3. To learn the fundamentals of probability theory and probability distribution	3. To use the probability theory to handle uncertainty in the applications
4. To comprehend the application domains of data analysis	4. To interpret the applications of data analysis

Unit No.	Contents	Max. Hrs.
1	Introduction to Data Science; role of data scientist, Types of Data, tool boxes for data scientists, introduction to R studio	7
2	Understanding different data sets Introduction to Data analysis, Types of Data analysis, Applications. Technologies involved in the data analysis	7
3	Preparing data for analysis: reading data from files, web, databases, Grouping and Displaying Data to Convey Meaning. Measure of central tendency, dispersion	7
4	Probability theory: basic concepts, applications, types. Bayes theorem	7
5	Probability distribution, Binomial distribution, Poisson distribution, Normal distribution. random variable.	7
6	Application domains of data analysis. Case studies in various application domains.	7

Text Books :

1. "Statistics for Management", Richard I. Levin & David S. Rubin, 7th Edition, Pearson Education.

Reference Books :

1. "Practical Statistics for Data Scientists, 50 Essential Concepts", Peter Bruce & Andrew Bruce, O'Reilly Media
2. "An Introduction to Statistical Learning with Applications in R", Gareth James, Daniela Witten, Trevor Hastie & Robert Tibshirani, Springer Press

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I Semester

AIDS2107: Lab.: Foundations of Data Science

Sr. No.	List of Experiment
1	Introduction to R and excel
2	Extraction of data using R
3	Handling and understanding data using R
4	Implementations of conditional statements in R
5	Implementation of Loops in R
6	Introduction to data visualization in R
7	Implementing probability functions
8	Data Handling using Excel
9	Project activity on standard data set

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Artificial Intelligence and Data Science

I Semester

AIDS2108: Computer Programing

Course Learning Objective:	Course Outcome
The Students will :- 1. Study overview of Computer System and basics to write an algorithm 2. Study different loop control structures. 3. Study the basic concepts of Functions, Pointers, arrays 4. Study the basics of Strings, Structures, union and File 5. Understand various sorting algorithms	After completion of the course students will be able: 1. Write algorithms & design flowcharts for given problem. 2. Write program using loops and Arrays for fixed size data storage 3. Implement programs using functions and pointers 4. Implement program using Implement program using structures, strings and files 5. Implement sorting algorithms

Unit No.	Contents	Max. Hrs.
1	Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Algorithms & Conventions used in writing algorithms, Flowcharts. Overview of Programming Language, sample „C“ code, compiler, operating system, running C programs, Types of programming errors.	06
2	Character set, variables, identifiers & keywords, Data types, Operators, Types of operators and expressions, sizeof() operator, constants and its types, Symbolic constant, typedef statement, Introduction to library functions, basic input/output statements, precedence of operators, write straight line programs, Decision control statements: if, if - else and nested if-else statements, else-if ladder statement, switch-case control statement, Programming Examples.	08
3	Loop Structures: While, do while and for loops, break and continue statement, „goto“ statement, C programs based on these loop structures.	07
4	Concept of functions, Modular programming, user defined and library functions, function prototypes, formal parameters, actual parameters, return types, function call- call by value, C programs using functions, Recursive functions, comparing recursion against iteration, C programs using recursive functions, Concepts of pointer.	08
5	Introduction to Arrays, One dimensional array, array manipulation, insertion, deletion of an element, searching techniques- Linear and binary search, sorting techniques - Bubble, insertion and selection sort. Two dimensional array: programs for basic matrix operations-addition, multiplication and transpose, converting a matrix in upper or lower triangular matrix, Array as function arguments.	09

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Unit No.	Contents	Max. Hrs.
6	Introduction to strings, string handling functions. Introduction to structures and Union. Concepts of files, Types of files, file opening in various modes, file closing, reading and writing text files, concept of pre-processor directives and macros, Command line Argument.	06

Textbooks:

T1: The C Programming Language.	J.B.W.Kernighan & D.M.Ritchie	Prentice Hall
T2: Mastering C	K.R.Venugopal & S.R. Prasad	TMH,2007.
T3: Programming in ANSI C	E. Balaguruswamy	Mc Graw Hill Education

Reference Book

R1:Problem Solving And Program Design In C	Jeri. R. Hanly, Elliot B. Koffman	Pearson Education
R2: Programming with C	Byron Gottfried	Schaum;s Outline Series
R3: How to solve it by computers	R. G. Dromey	Prentice Hall India

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I Semester

AIDS2109: Lab. : Computer Programing

Course Learning Objective:	Course Outcomes
<p>The Students will :-</p> <ol style="list-style-type: none"> 1. Study the different types of basic linux commands to get familiar with Linux environment to run „C” programs. 2. Study different basic 'C' programming language constructs and it's implementations. 3. Study to design programs using different loop control structures. 4. Study the basic concepts of Functions, Pointers and the Modular Programming. 5. Study the concept of different dimensional arrays as a data structures and its applications. 6. Study the basics of Structures and File handling. 	<p>After completion of the course students will be able :</p> <ol style="list-style-type: none"> 1. To implement different types of basic linux commands to get familiar with Linux environment to run „C” programs. 2. To Understand & implement straight line program by using basic „C” programming language constructs. 3. To Design & implement programs using different loop control structures. 4. To Design & implement user defined functions, understand the concept of Pointers & Modular programming. 5. To Understand, analyze different dimensional Arrays as a data structure and designing & implementation of programs. 6. To Understand, analyze the basics of structures, data handling through files and designing & implementation of programs.

Sr.	Problem Statements																												
1 A	Introduction to Linux Operating system & it's different commands.																												
1 B	Introduction to Vi editor, Compilation and Execution of a program in Linux																												
2 A	<ol style="list-style-type: none"> 1) Write a C program to display Your Name, Address and City in different lines. 2) Write a C program to convert centigrade into Fahrenheit. Formula: $C = (F - 32) / 1.8$. 																												
2 B	<ol style="list-style-type: none"> 1) Write program using conditional operators to evaluate the following function and print the value of y. $y = 2.4x + 3$, for $x \leq 2$ $y = 3x - 5$, for $x > 2$ 																												
3	<p>Write a program to implement the following table, which tries to predict if a customer would buy a product. In particular, you need to ask for inputs Age, Gender and City, and print one of the three outputs Yes, No or Cannot Say.</p> <table border="1"> <thead> <tr> <th>Age</th> <th>Gender</th> <th>City</th> <th>Will Buy?</th> </tr> </thead> <tbody> <tr> <td>25-30</td> <td>M</td> <td>Chennai</td> <td>Yes</td> </tr> <tr> <td>33-45</td> <td>F</td> <td>Bangalore</td> <td>Yes</td> </tr> <tr> <td>57-80</td> <td>F</td> <td>Chennai</td> <td>No</td> </tr> <tr> <td>25-30</td> <td>F</td> <td>Hyderabad</td> <td>No</td> </tr> <tr> <td>13-19</td> <td>M</td> <td>Bangalore</td> <td>Yes</td> </tr> <tr> <td>16-20</td> <td>M</td> <td>Chennai</td> <td>No</td> </tr> </tbody> </table>	Age	Gender	City	Will Buy?	25-30	M	Chennai	Yes	33-45	F	Bangalore	Yes	57-80	F	Chennai	No	25-30	F	Hyderabad	No	13-19	M	Bangalore	Yes	16-20	M	Chennai	No
Age	Gender	City	Will Buy?																										
25-30	M	Chennai	Yes																										
33-45	F	Bangalore	Yes																										
57-80	F	Chennai	No																										
25-30	F	Hyderabad	No																										
13-19	M	Bangalore	Yes																										
16-20	M	Chennai	No																										

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(Department of Computer Technology)

Artificial Intelligence and Data Science

4	Write a menu driven program to perform following operations. 1) To display maximum number among inputted three number. 2) To display the final prize based on assumption that if total purchase price is above 2500 rs then discount is 25% and if total prize is above 5000 then discount is 30% else 40% discount. 3) To Display percentage of 2 nd number to 1 st number if two number is entered by the user. 4) Exit.
5	Write a program print weather entered number is Prime or not
6	Write a program to print the sum of exponential series $e(x) = 1 + x/1! + x^2 / 2! + x^3 / 3! + \dots$
7	Write a program to print following pyramid 1 1 2 3 1 2 3 4 5 1 2 3 4 5 6 7
8	i) Write a program in C that will scan a number N and then output the sum of the powers from 1 to N. thus, if the input is 4, the output should be 288. E.g. $(1)^1 + (2)^2 + (3)^3 + (4)^4 = 1 + 4 + 27 + 256 = 288$ [1,2,3,4] Use power function to calculate the power of number. ii) Write a recursive function to print Factorial of a entered number. iii)
9	Write a program to sort an elements using bubble Sort.
10	Produce a multiplication table. Top left hand corner will show 1x1 and bottom right shows 12x12, as below. 1 2 3 4 5 6 7 8 9 10 11 12 2 4 6 8 10 12 14 16 18 20 22 24 3 6 9 12 15 18 21 24 27 30 33 36 4 8 12 16 20 24 28 32 36 40 44 48 5 10 15 20 25 30 35 40 45 50 55 60 6 12 18 24 30 36 42 48 54 60 66 72 7 14 21 28 35 42 49 56 63 70 77 84 8 16 24 32 40 48 56 64 72 80 88 96 9 18 27 36 45 54 63 72 81 90 99 108 10 20 30 40 50 60 70 80 90 100 110 120 11 22 33 44 55 66 77 88 99 110 121 132 12 24 36 48 60 72 84 96 108 120 132 144
11	Write a program To copy one string to another string without using library function
12	Define a structure for a student having name, roll number and marks obtained in six, subjects. Write a program to input the details for 20 students and print the same.
13	Write a program that copies a file to another file. The names of two files should be sent as command line arguments.

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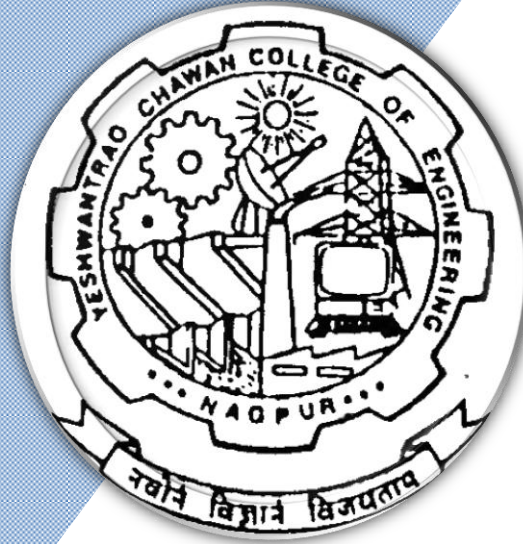
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(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of Technology SoE & Syllabus 2021 2nd Semester

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B.TECH SCHEME OF EXAMINATION 2021-22

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SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
First Semester															
1	1	BS	GE	AIDS2101	Calculus, Sequences & Series	T	3	0	0	3	3	30	20	50	3 Hours
2	1	BS	GE	AIDS2102	Applied Chemistry	T	3	0	0	3	3	30	20	50	3 Hours
3	1	BS	GE	AIDS2103	Lab.: Applied Chemistry	P	0	0	2	2	1		60	40	
4	1	HS	GE	AIDS2104	Technical Communications	T	3	0	0	3	3	30	20	50	3 Hours
5	1	HS	GE	AIDS2105	Lab.: Technical Communications	P	0	0	2	2	1		60	40	
6	1	PC	CT	AIDS2106	Foundations of Data Science	T	3	0	0	3	3	30	20	50	3 Hours
7	1	PC	CT	AIDS2107	Lab.: Foundations of Data Science	P	0	0	2	2	1		60	40	
8	1	BES	CT	AIDS2108	Computer Programing	T	3	0	0	3	3	30	20	50	3 Hours
9	1	BES	CT	AIDS2109	Lab.: Computer Programing	P	0	0	2	2	1		60	40	
TOTAL FIRST SEM							15	0	8	23	19				

List of Audit Course															
1	1	HS	GE	GE2131	Universal Human Value	T	2	0	0	0	0				
2	1	HS	GE	AU2121	YCCE Communication Aptitude Preparation (YCAP1)	A	3	0	0	3	0				
3	2	HS	GE	AU2122	YCCE Communication Aptitude Preparation (YCAP2)	A	3	0	0	3	0				

Second Semester															
1	2	BS	GE	AIDS2151	Probability & Statistics	T	3	0	0	3	3	30	20	50	3 Hours
2	2	BS	GE	AIDS2152	Applied Physics	T	3	0	0	3	3	30	20	50	3 Hours
3	2	BS	GE	AIDS2153	Lab.: Applied Physics	P	0	0	2	2	1		60	40	
4	2	HS	GE	AIDS2154	Constitution of India	T	3	0	0	3	3	30	20	50	3 Hours
5	2	BES	CT	AIDS2155	Computer Architecture and Organization	T	3	0	0	3	3	30	20	50	3 Hours
6	2	PC	CT	AIDS2156	Object Oriented Programming	T	3	0	0	3	3	30	20	50	3 Hours
7	2	PC	CT	AIDS2157	Lab.: Object Oriented Programming	P	0	0	2	2	1		60	40	
8	2	PC	CT	AIDS2158	Data Structures	T	3	0	0	3	3	30	20	50	3 Hours
9	2	PC	CT	AIDS2159	Lab.: Data Structures	P	0	0	2	2	1		60	40	
10	2	PC	CT	AIDS2160	Software Lab	P	0	0	2	2	1		60	40	
TOTAL SECOND SEM							18	0	8	26	22				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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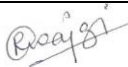

Artificial Intelligence and Data Science

II Semester

AIDS2151: Probability & Statistics

Objective	Course Outcome
<ol style="list-style-type: none">1. This course provides an indication of the relevance and important of the probability theory in solving practical problems in the field of multidisciplinary engineering applications.2. To provide undergraduate foundation in both probability distributions and mathematical statistics relevant to engineering problems.3. To teach mathematical skill sustained from this course to form a suitable base for analytical and theoretical concept encountered in engineering profession.	<p>Students will be able to</p> <ol style="list-style-type: none">1. Identify an appropriate probability distribution for a given discrete or continuous random variable and compute probabilities.2. Make use of probability distributions to solve real life problems.3. Apply concepts of sampling theory to find probabilities and estimates parameters of various problems.4. Inspect scientific data, use proper curve fitting and find correlation, regression of variables.

Unit No.	Contents	Max. Hrs.
1	Random Variables & Probability Distributions Conditional probability, Baye's theorem. Random variables: Discrete and Continuous random variables, Probability function and Distribution function, Joint distributions. Independent Random variables, Conditional Distribution.	7
2	Mathematical Expectation Mathematical Expectation, Variance & Standard Deviation, Moments, Moment generating function, Skewness and Kurtosis.	7
3	Special Probability Distributions Binomial, Geometric, Poisson, Exponential, Normal distributions, Central Limit theorem.	6
4	Sampling Theory Population and sample. Statistical inference. Sampling with and without replacement. Population parameters, sample statistics. Sampling distribution of means. Sampling distribution of proportions.	6
5	Estimation Unbiased and efficient estimates. Point estimates and interval estimates. Confidence interval for means, Confidence interval for proportions, Confidence interval for differences and sums of mean and proportions.	7
6	Curve Fitting Fitting of straight line, $y = a + bx$, a parabola $y = a + bx + cx^2$, exponential curves and power curves by method of least squares; Lines of regression and correlation; Rank correlation.	6

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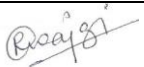

Artificial Intelligence and Data Science

Text Books

1. Advanced Engineering Mathematics - by H.K. Dass, 8th Ed, 2007, S.Chand, Delhi.
2. Engineering Mathematics by Dr. B.S. Grewal
3. The theory and problems of probability and Statistics: M. R. Spiegel, Schaum series. (McGraw Hill)
4. Basic Statistics for Business and economics by E. K.Bowen, M. K.Star (McGraw Hill)

Reference Books

1. A First course in probability by Sheldon Ross, Sixth Edition, Pearson Education.
2. Fundamentals of Mathematical statistics by S. C.Gupta and V.K.Kapoor.
3. Probability and Statistics for Engineering 6th edition, Miller Freund and Johnson.
4. Higher Engineering Mathematics, Dr. V. Ramana , Tata McGraw Hill.

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II Semester

AIDS2152: Applied Physics

Objective	Course Outcome
<ul style="list-style-type: none">To understand fundamental principles of engineering physics specifically concern to quantum physics, crystal structure, semiconductor, electron ballistics, Laser and optical fibre and their engineering applications.To provide problem solving experience and learning of concepts through it in engineering physics, in both the classroom and the laboratory learning environment.	At the end of Course students are able to <ul style="list-style-type: none">Explain fundamentals of quantum mechanics and its application to problems dealing with quantum particle.Develop ability to classify structure of crystal and analyze the characteristics of semiconductor materials in terms of crystal structures, charge carriers and energy bands for device applications.Illustrate working principle of lasers, ultrasonic waves and its properties for useful applications in the field of industry.Analyze the motion of charged particle in electric and magnetic fields and its applications to electron optic devices.Examine the light guiding ability optical fibre through total internal reflection and its application in communication system.

Unit No.	Contents	Max. Hrs.
1	Unit-I : Quantum Physics [CO1, (PO1, PO2)] Wave-particle duality, Wave packet, Heisenberg uncertainty principle, Interpretation of wave function, Schrodinger Equations, Application to infinite potential well, Electron Microscope.	9
2	Unit-II: Crystal structure [CO2, (PO1, PO2)] Introduction, Space Lattice, Unit cell & symmetry in crystals, Bravais lattices, Calculation of parameters for SC, BCC & FCC lattices, Miller indices, Voids, Braggs law, crystal structure analysis.	8
3	Unit-III : Semiconductor Physics [CO2, (PO1, PO2)] Formation of energy bands in solids ; Classification of solids, Energy band diagram of Si/Ge , Intrinsic and extrinsic semiconductors, Conductivity, Law of mass action, Fermi function , Fermi level in intrinsic and extrinsic semiconductors, Dependence of Fermi level on impurity concentration and temperature, Hall effect, Hall sensors.	9
4	Unit-VI : Laser [CO3, (PO1, PO2)] Interaction of radiation with matter, Population Inversion and Optical resonance cavity , Three and four level laser, Ruby laser, He-Ne laser, Properties and engineering applications of laser.	9

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Unit No.	Contents	Max. Hrs.
5	Unit-V: Electron Ballistics [CO4, (PO1, PO2)] Motion of a charged particle in uniform electric and magnetic field, Cross field configuration; Electron refraction, Electron lens, CRO & its applications.	9
6	Unit-VI :Optical Fibre [CO5, (PO1, PO2)] Structure of Optical fibre, Total internal reflection, Classification of optical fibres : modes, materials & RI profile diagram, V-number, Attenuation & dispersion, Fibre optic sensors , fibre optic communication system.	8

Text books and Reference Books Recommended :

1. Fundamentals of Physics: D.Halliday , R.Resnick , J.Walker, Wiley India Pvt., Ltd., New Delhi
2. Electronic devices and Circuits by John Allison, Tata McGraw-Hill
3. Introduction to Modern optics by AjoyGhatak,Tata McGraw-Hill
4. Concept of Modern Physics : A.Beiser, Tata McGraw-Hill
5. A concise book of Engineering Physics by S A Band and S A Fadnavis, DasganuPrakashan
6. A Textbook of Engg. Physics: M.N.Avadhanulu , P.G.Kshirsagar, S.Chand and Company
7. Solid state Physics by S.O.Pillai, New Edge International Publishers
8. Solid State Physics by Palansamy, SciTech publishers

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II Semester

AIDS2153: Lab.: Applied Physics

Objective	Course Outcome
<ul style="list-style-type: none">To understand and strengthen the theoretical concepts by thorough experimentation.To learn the proper methods and techniques utilized in gathering experimental data.To become familiar with the proper use of some basic measuring instruments commonly found in physics laboratories.To learn how to analyze data and then reach scientific conclusions based on this analysis.To learn how effectively communicate experimental results in standard scientific way.	<ul style="list-style-type: none">By the end of course students will be able to Perform experiments based on syllabus adopting the proper methodology.Derive a scientific conclusion on the basis of experimental data.

Minimum Eight experiments are to be performed from the list as given below and One or Two demonstration experiments .

1. A study of cubic space lattices and atomic packing in solids.
2. Determination of amplitude and frequency of sinusoidal signal using C.R.O.
3. Determination of phase angle between sinusoidal signals using C.R.O.
4. Determination of radius of curvature of Plano convex lens using Newton's rings.(BEYOND SYLLABUS)
5. Determination of Band gap in a semiconductor by four probe method.
6. Determination of Band gap in a semiconductor using reverse biased p-n diode.
7. Study of V-I characteristics of diode in FB & RB mode.
8. Determination of Hall coefficient and density of charge carriers using Hall effect.
9. To measure the divergence of laser beam or beam spot size.
10. Determination of Numerical aperture and Acceptance angle of an optical fiber.
11. Measurement of attenuation in optical fiber.
12. Determination of wavelength of laser light using plane transmission grating.

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II Semester

AIDS2154: Constitution of India

Objective	Course Outcome
<ul style="list-style-type: none">To enable the student understand the importance of constitutionTo understand the structure of executive, legislature and judiciaryTo analyze federalism in the Indian contextTo understand philosophy of fundamental rights and dutiesTo understand and evaluate the Indian Political scenario of the emerging challenges.	<ul style="list-style-type: none">Explain the basic concepts of Constitution of India.Describe the various Fundamental rightsAnalyze the Impact of federalism on the StateExplain Industrial Law and Judiciary.

Unit No.	Contents	Max. Hrs.
1	Origin and Meaning Origin of history of Constitution, Meaning of the constitution law and constitutionalism, Kingship and Republic States in Ancient India	6
2	Concept of the Constitution of India Preamble, The union and its territory, Citizenship	6
3	Federalism Salient features of Federalism, Structures and features of Indian Federalism, Panchayat Raj System	6
4	Fundamental Rights Scheme of the Fundamental rights, duties, Scheme of the Fundamental Right to Equality, The scheme of the Fundamental Duties and its legal status	7
5	Legislative Power Federal structure and distribution of legislative, Financial power between the Union and the States, Parliamentary Form of Government in India – The constitution power and status of the President of India	7
6	Challenges to Indian Political Systems The Executive, Directive principles of State Policy, The Union Judiciary	7

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Text Books :

1. Dr G.N. Nimbarte, (2018) "Social Science" Sankalp Publication, Vidhya Nagar, Nagpur

Reference Books:

1. G. Austin (2004) Working of a Democratic Constitution of India, New Delhi: Oxford University Press.
2. A.S. Altekar, (2016) State and Government in Ancient India, Motilal Banarsidass Publishing House, New Delhi.
3. Basu, D.D (2005), An Introduction to the Constitution of India, New Delhi, Prentice Hall.
4. A. Vanaik and R. Bhargava (eds) (2010) Understanding Contemporary India: Critical Perspectives, New Delhi: Orient Blackswan.
5. A.G. Noorani (2000): Constitution questions in India: The President, Parliament and the Status, New Delhi: Oxford University Press.
6. Singh, M.P & Saxena, R (2008) Indian Politics: Contemporary Issues and Concerns. New Delhi: PHI Learning.
7. Constitution of India: Dr. B. R. Ambedkar: Government of India.

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II Semester

AIDS2155: Computer Architecture and Organization

Objective	Course Outcome
Student will be able: <ol style="list-style-type: none">To Understand Internal working of Computer System, its basic principles & execution of machine instructionsTo Understand basic processor design using Hardwired and microprogrammed control unit.To Know Organization of main memory, cache memory.To Know Various ways in which I/O operations are performed.	Upon successful completion of the course, the student will be able to: <ol style="list-style-type: none">Relate & Identify the function and design of the various units of computers that process data and store the information.Analyze and write control signal for executing machine instructions for different processors.Explain & Design the organization of memory, memory hierarchy, other peripheral devices, and estimate the cost of computation.Compare among different types of I/O operation

Unit No.	Contents	Max. Hrs.
1	Systems: Digital Systems, Binary Numbers, Binary Codes, Computer Arithmetic Number Base Conversions, Octal and Hexadecimal – conversions. Basic Logic Gates, Universal gates (NAND and NOR gates), other gates (XOR, XNOR gates). Boolean identities, De Morgan's Laws. k-map	7
2	Combinational and sequential circuits: (Simple block diagrams, truth tables and IC packages only required). Flip-flops: RS, clocked RS, JK, D and T flip flops, Master slave flip flops, Registers, latches and Tristate buffers. Basic Memory Organization	7
3	Von-Neuman architecture, Functional units, addressing methods, addressing modes, Execution of complete instructions, Bus organizations, sequencing of Control signals, Processor Design, hard wired control, Microprogrammed Control: Microinstructions, Grouping of control signals, Microprogram sequencing, Micro Instructions with next Address field, perfecting microinstruction.	7
4	Arithmetic (Fixed and Floating point): Number Representation, Addition of Positive numbers, Logic Design for fast adders, Addition and Subtraction, Arithmetic and Branching conditions, Multiplications of positive numbers, Signed- Operand multiplication, fast Multiplication, Booth's Algorithm	7
5	Integer Division, Floating point numbers and operations. The Main Memory: Basic concepts, Memory Hierarchy, Speed Size and Cost, Cache Memory, Performance Considerations.	7
6	Pipelining: Basic Concepts, Data Hazards, Instruction Hazards Computer Peripherals: I/O Devices, I/O transfers – program controlled, interrupt driven and DMA, Interrupt handling.	7

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Text Books

SN	Title	Edition	Authors	Publisher
1	Computer Organization	5th edition	V. Carl Hamacher, Zvonko Vranesic,	McGraw Hill Publications.
2	Computer Architecture & Organization	3rd edition	J.P. Hayes	McGraw Hill Publications
3	Modern Digital Electronics	3rd Edition	R. P. Jain	McGraw Hill

Reference Books

SN	Title	Edition	Authors	Publisher
1	Computer Organization and Architecture	6th edition	Willaiam Staliing	Pearson Education
2	Computer Architecture: A Quantitative approach	6th edition	John L. Hennessy, David A. Patterson	MK series in computer architecture and design

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II Semester

AIDS2156: Object Oriented Programming

Objective	Course Outcome
<ol style="list-style-type: none">Understand the concept of object-oriented programming and modellingHave an appreciation of the object-oriented programming concepts like reusability of code, inheritance, abstraction, and polymorphismGain an understanding of advance concepts of object-oriented programming like, generic components I/O stream classes and multithreadingDevelop an understanding of MVC architecture and how to build the event driven solution of the problem	<ol style="list-style-type: none">Understand the concept of object-oriented programming and modellingApply the knowledge of object-oriented programming to solve the given problemApply the knowledge of advanced concepts of object-oriented programming like I/O stream, generic components and multithreadingFormulate the standardized event driven solution for the real life scenarios using object oriented concepts

Unit No.	Contents	Max. Hrs.
1	Introduction to object oriented programming paradigm, procedure oriented programming vs OOP, features of OOP, benefits of OOP, defining class, instantiating a class. UML diagrams to represent class, objects and various relationships.	7
2	Functions in OOP, function overloading, Passing & returning Objects, pointers to members, constructors and its types, Access specifiers and packages. Inheritance, types of inheritance, run time polymorphism, abstract classes, Interface, collection interface	7
3	Exceptions – exception hierarchy – throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files	7
4	Multithreading, Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations	7
5	MVC architecture, Java web components and its architecture Graphics programming – Frame – Components – working with 2D shapes – Using color, fonts, and images	7
6	Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT event hierarchy – Introduction to Swing – layout management – Swing Components – Text Fields, Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Java Complete Reference	7th	Herbert Schildt	McGraw-Hill
2	Thinking in Java	4th	Bruce Eckel	Prentice Hall

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(Department of Computer Technology)

Artificial Intelligence and Data Science

II Semester

AIDS2157: Lab.: Object Oriented Programming

Sr. No.	Practical based on
1	Implement the concept of Class and its data members and member functions in Java
2	Implement the concept of class constructor and its type in Java.
3	Implement the concept of function overloading in Java
4	Implement the concept of run time polymorphism in Java.
5	Implement the concept of Abstraction in Java.
6	Implement the concept of all types of inheritance in Java.
7	Implement the collection listener to solve the problem in Java
8	Implement the concept of exception in Java.
9	Implement the concept of thread in Java
10	Implement the concept of Files in Java.
11	Implement the concept of generic functions and generic class in Java
12	Implement the concept of applet to prepare a web application in Java
13	Implement the event driven approach to prepare the web application in Java

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Artificial Intelligence and Data Science

II Semester

AIDS2158: Data Structures

Objective	Course Outcome
<ol style="list-style-type: none"> To understand various types of linked lists, their structures and operations performed on them. To understand structures and working of advanced data structures like skip list, disjoint set, hash table etc. To understand trees and graph data structures along with its representation methods and various terminologies 	<p>Upon successful completion of the course, the student will be able to:</p> <ol style="list-style-type: none"> Implement the concept of linked list, skip lists, disjoint sets data structures for real world problem Use the concepts of advance data structures like skip list, disjoint set, hash table Implement the concept of tree and graph data structures for real world applications.

Unit No.	Contents	Max. Hrs.
1	Overview of arrays and array based algorithms - searching and sorting: merge sort, quick sort, Heaps and heap sort, sparse matrices, time complexity	7
2	Lists - Singly-linked lists, doubly linked lists and circular linked lists. Operations on linked list etc. Applications of lists in polynomial representation	7
3	Introduction to Skip lists, data structures for disjoint set representation, hash table	6
4	Trees, binary trees, binary trees- basic algorithms and various traversals. Binary Search Trees (BSTs) and insertion, deletion in BSTs.	8
5	Height-balanced (AVL) trees, Splay tree, Red-black trees, Multi-way trees-B and B+ and applications	8
6	Graphs – their representation & traversals. Spanning trees, topological sort, shortest path algorithm, all-pairs shortest paths	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Data Structures with C	8 th 2013	Seymour Lipschutz	Mc Graw Hill Education
2	Data structures using C	8 th 2016	Reema Thareja	Oxford

Reference Books

SN	Title	Edition	Authors	Publisher
1	Introduction to Algorithms	3rd 2015	Thomas Cormen, Charles Leiserson, Ronal Rivest, Clifford Stein	PHI
2	Fundamentals of Data Structures in C++	2nd, 2009	Ellis Horowitz, Sartaj Sahani, Dinesh Mehta	University Press
3	Data Structures and Program Design in C	2nd, 2009	Robert Kruse, Cl Tondo	Pearson Education

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Artificial Intelligence and Data Science

II Semester

AIDS2159 : Lab.: Data Structures

Sr. No.	List of Experiment
1	Program to sort an array using Merge sort method
2	Program to search an element in an array
3	Program based on Singly Linked List
4	Program based on operations on doubly linked list
5	Program based on implementing one data structure using another data structure
6	Program based on Binary tree
7	Program based on Binary search tree
8	Program based on Hashing
9	Program for detecting loop in a network

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Artificial Intelligence and Data Science

II Semester

AIDS2160: Software Lab

Objective	Course Outcome
1. To make student aware about various programming frameworks of Python	1. Select any framework for python programming as per their understanding
2. To make student familiar with syntax of various data structures and their operations along with control statements in Python	2. Write any python program using various data structures and control statements
3. To make students comprehend concepts of file handling, classes and objects	3. Write program where file handling and concepts of classes and objects are needed
4. To make student aware about various packages inbuilt in Python along with their usages	4. Develop advanced applications using functionalities provided under various packages of python

Sr. No.	List of Experiment
1	Introduction to Python language and Installation of Python write a Python program to implement arithmetic, logical operators
2	Write a program using control structures:Loops, if-else, if-elif etc.
3	Write a program using functions and recursion :list, strings
4	Write a program using dictionary, tuples,sets
5	Write program using array
6	Program using Numpy
7	File handling
8	Study of Pandas dataframes and implement dataframes related operations
9	Program using Matplotlib
10	Project work :Data Extraction to Visualization

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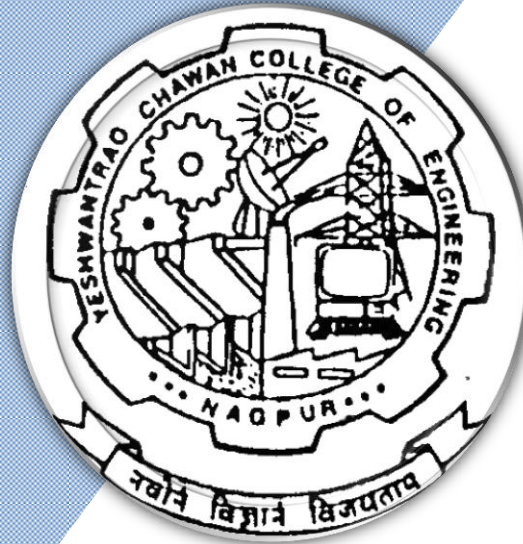
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B.TECH SCHEME OF EXAMINATION 2021-22

SoE No.
ADS-203.1

(Scheme of Examination w.e.f. 2022-23 onward)

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Artificial Intelligence and Data Science

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
Third Semester															
1	3	BS	CT	AIDS2201	Discrete Maths and Graph Theory	T	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	CT	AIDS2202	Statistics for Data Science	T	3	0	0	3	3	30	20	50	3 Hours
3	3	PC	CT	AIDS2203	Computer Networks	T	3	0	0	3	3	30	20	50	3 Hours
4	3	PC	CT	AIDS2204	Lab.: Computer Networks	P	0	0	2	2	1		60	40	
5	3	PC	CT	AIDS2205	Software Engineering	T	3	0	0	3	3	30	20	50	3 Hours
6	3	PC	CT	AIDS2206	Lab.: Software Engineering	P	0	0	2	2	1		60	40	
7	3	PC	CT	AIDS2207	Operating Systems	T	3	0	0	3	3	30	20	50	3 Hours
8	3	PC	CT	AIDS2208	Web Technology	P	0	0	4	4	2		60	40	
9	3	PC	CT	AIDS2209	Lab2.: Software	P	0	0	2	2	1		60	40	
TOTAL THIRD SEM							15	0	10	25	20				
Fourth Semester															
1	4	BS	GE	AIDS2251	Linear Algebra	T	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	CT	AIDS2252	Theoretical foundation of Computer Science	T	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	CT	AIDS2253	Design & Analysis of Algorithms	T	3	0	0	3	3	30	20	50	3 Hours
4	4	PC	CT	AIDS2254	Lab.: Design & Analysis of Algorithms	P	0	0	2	2	1		60	40	
5	4	PC	CT	AIDS2255	Database Management Systems	T	3	0	0	3	3	30	20	50	3 Hours
6	4	PC	CT	AIDS2256	Lab.: Database Management Systems	P	0	0	2	2	1		60	40	
7	4	PC	CT	AIDS2257	Bayesian Data Analysis	T	3	0	0	3	3	30	20	50	3 Hours
8	4	PC	CT	AIDS2258	Lab3.: Software	P	0	0	2	2	1		60	40	
TOTAL FOURTH SEM							15	0	6	21	18				

List of Audit Course

1	3	HS		GE2121	Environmental studies	T	2	0	0	2	0				
2	3	HS		AU2123	YCCE Communication Aptitude Preparation (YCAP3)	A	3	0	0	3	0				
3	4	HS		AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE, IIoT, AIML, CSD, AIDS	A	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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Artificial Intelligence and Data Science

III Semester

AIDS2201: Discrete Maths and Graph Theory

Objective	Course Outcome
<ol style="list-style-type: none"> This course will provide the mathematical fundamentals needed to understand computer application To provide the mathematical concepts necessary in the study of propositional and predicate logic. To discuss the concepts of algebraic systems like semi groups and groups. To use graph theory to analyze the complex structure which helps in writing efficient code. 	<p>With the completion of this syllabus students will be able to</p> <ol style="list-style-type: none"> Identify the importance of statements in deriving valid inferences. Use relations and ordering methods to identify the relationship among the inferences. Select suitable algebraic systems to find solution for real time problems. Find the suitable computing methods and applying graph theory concepts to solve complex problems.

Unit No.	Contents	Max. Hrs.
1	Mathematical Logic and Set Theory: Statement and Notation: Negation, Conjunction, Disjunction, Tautologies, Truth Tables, Basic Concepts of Set Theory, Inclusion & equality of set, Power Set, Ordered Pairs and n-tuples, Operations on Sets , mathematical induction. Propositions, Predicate logic.	6
2	Relations and Functions: Relations and Ordering, Relation Matrix and Graphs, Partition and Covering of a set, Equivalence relation, Partial order relation, Partially Ordered sets, Functions , Composition of functions, Inverse Functions, Characteristics function of a set.	6
3	Group Theory: Groups, Subgroups and Homomorphism, Cosets and Lagrange's theorem, Normal subgroups. Semi groups and Monoids Homomorphism of semigroups and monoids, Sub semi groups and monoids.	7
4	Rings: Definitions and Examples, sub ring, Integral domain, ring homomorphism, ideal of ring polynomial.	6
5	Field and Lattices : Definitions and Examples, Finite Field, Ordered sets, Hasse Diagrams of partially Ordered sets. Lattices, Bounded Lattices, Complements Lattices, Definitions and Examples of Finite Field, Ordered sets, Hasse Diagrams of partially Ordered sets. Lattices, Bounded Lattices, Complements Lattices.	7
6	Graph Theory: Basic concepts of graph theory, Basic definitions, Paths and circuits, Reach ability and connectedness, Matrix Representation of graphs, Tree and their representation and operations, Rooted trees, Path lengths in rooted trees, Multi graphs and weighted graphs, and graph isomorphism, shortest paths in weighted graphs, Hypergraphs, transitive closure, Spanning trees, Kruskal's algorithm, Prim's algorithm.	7

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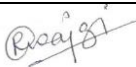
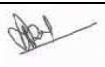
Artificial Intelligence and Data Science

Text Books:

1. Discrete Mathematics Structure with application to Computer Science by J. P. Tremblay & R. Manohar ,23rd re-print,2005,Tata McGraw-Hills Publication Company Limited, New Delhi.
2. Discrete Mathematics by Lipschutz Schaums's Outline series,2nd edition,Tata McGraw-Hills Publication Company Limited, New Delhi.

Reference Books:

1. Discrete Mathematical structures :-By Bernard Kolman ,Robert C.Busby, Sharon Ross,3rd edition,2001,Prentice Hall of India, New Delhi.

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Artificial Intelligence and Data Science

III Semester

AIDS2202 : Statistics for Data Science

Objective	Course Outcome
1. To introduce the basic statistical formulae and visualization techniques	1. Able to analyze and find the hidden meaning from the given data and visualize the results
2. To comprehend the concepts of probability and probability distribution	2. Able to solve the real-life problem using the probability theory and use it for decision making
3. To understand the concepts of sampling, sampling distribution and estimation	3. Able to analyze the samples from the population and solve the problem to get predictive solution using the estimation theory
4. To understand the concept of hypothesis testing	4. Able to analyze the sample data and use it to test the assumptions made for the population parameter

Unit No.	Contents	Max. Hrs.
1	Introduction: The role of statistics. Numerical and graphical methods for describing and summarizing data.	7
2	Probability: Basic terminology in probability, probability rules, Probabilities under conditions of statistical independence, probabilities under conditions of statistical dependence.	7
3	Probability distribution: What is probability distribution, random variables, use of expected value in decision making, and various probability distributions	7
4	Sampling and Sampling Distribution: introduction to sampling, random sampling, Introduction to sampling distribution. Design of experiment	6
5	Estimation: Introduction, Point estimates, Interval estimates and confidence interval, interval estimates using t distribution, determining the sample size in estimations	6
6	Testing Hypothesis: Introduction, testing hypothesis, One sample test	6

Text Books				
SN	Title	Edition	Authors	Publisher
1	Introduction to probability and statistics for engineers and scientist	3rdEdition	Sheldon M. Ross	Elsevier
2	Statistics for Management	7thEdition	Richard I. Levin & David S. Rubin	Pearson Education

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Artificial Intelligence and Data Science

Reference Books

SN	Title	Edition	Authors	Publisher
1	Practical Statistics for Data Scientists, 50 Essential Concepts.		Peter Bruce & Andrew Bruce	
2	An Introduction to Statistical Learning with Applications in R		Gareth James, Daniela Witten, Trevor Hastie & Robert Tibshirani	

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Artificial Intelligence and Data Science

III Semester

AIDS2203 : Computer Networks

Objective	Course Outcome
1. Understand the importance of layering architecture and classify different types of networks. 2. Study of different protocols at various layers. 3. Study of modern networking tools.	1. Understand design issues of layers and network reference model 2. Solve the given problems related to networking domain. 3. Analyze different networking protocol at various layers 4. Evaluate the performance of network using different tools

Unit No.	Contents	Max. Hrs.
1	Introduction: The uses of computer networks, LAN's, MAN's, WAN's, protocol hierarchies, design issues for layers, interfaces and services, connection oriented and connectionless services, service primitives relationship of services to protocols. The OSI reference model. TCP/IP reference model, Comparison of OSI & TCP/IP reference models, Critique of OSI model & protocols, critique of TCP/IP reference model.	7
2	Transmission Impairments, Transmission Media: Guided, unguided, Architecture of the Internet, Wireless LANs: IEEE 802.11, IEEE 802., The Public Switched Telephone Network, Switching: circuit, packet and message switching, Modems.	7
3	The Data Link Layer: Data link layer design issues- Framing, Error Control, Flow Control, Link Management, Error detection and Correction-Error-Correcting Codes, error-detecting codes, Elementary data link protocols-An Unrestricted simplex Protocol, A simplex stop and wait protocol, A simplex protocol for a noisy channel, Sliding window protocols- A one bit sliding window protocol, Go Back N protocol, Selective Repeat Protocol.	7
4	The Medium Access Sublayer: Static and Dynamic Channel allocation in LAN's and MAN's, Access Protocols-ALOHA, Persistent and Non Persistent CSMA, CSMA/CD, Collision free protocols, Binary countdown, Limited-connection protocol. The adaptive tree walk protocol.	7
5	The Network Layer: Network Layer design issues-services provided to the transport layer, Logical Addressing: classbase and classless, Subnetting and Supernetting, Routing and Routing Algorithms-Flooding, Flow-Based, Distance Vector, Link State, Hierarchical. Congestion Control algorithms- Preallocation of buffers, Packet discarding, Choke packets, Load shedding, Jitter control. Leaky bucket algorithm, token bucket algorithm, IP header format (IPv4, IPv6).	7
6	The Transport Layer: Transport layer design issues-services provided to the session layer, Quality of service, transport service primitives, Elements of transport protocols-Addressing, Establishing and Releasing a connection, Flow control and Buffering, Multiplexing, Crash Recovery. Transmission Control Protocol (TCP). The Application Layer: DNS, SMTP, FTP, TFTP	7

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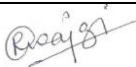
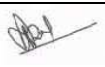
Artificial Intelligence and Data Science

Text Books :

C Computer Networks by Andrew S. Tannenbaum Pearson Education

Reference Books :

Computer Networks: A Top-Down Approach by Behrouz A Forouzan and Firouz Mosharraf McGraw Hill Publication

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III Semester

AIDS2204 : Lab. : Computer Networks

Sr. No.	List of Experiment
1	How to bring two computers in the network. Configure TCP/IP to configure Internet on your computer.
2	Use Network Utility Command like ping, ipconfig, netstat, tracert to observe the network details.
3	To implement Hamming Code using C and C++.
4	To implement Dijkstra's Routing algorithm using backtracking approach.
5	Use traffic monitoring tool Wireshark to observe network traffic with packet details.
6	Configure router. Configure network using Cisco Packet Tracer software and show packet transmission from source to destination.
7	Configure network using Distance vector routing protocol in Cisco Packet Tracer
8	Use Openssl command to perform Asymmetric key encryption(RSA) and also implement RSA algorithm.
9	Client server communication using socket programming
10	Advanced Practical: Study of NSG tool

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III Semester

AIDS2205 : Software Engineering

Objective	Course Outcome
<ol style="list-style-type: none">1. Study software engineering best practices and different strategies applicable for software development, software requirement and its design activity.2. Explore the various testing types and its strategies.3. Understand configuration management, version control and change control process of Software development.4. Understand project management, planning, scheduling, risk management, project and process metrics.5. Get an overview of open source Software Engineering tool viz. Subversion and understand some concepts such as Re-engineering and Reverse engineering.	<p>Upon successful completion of the course, the student will be able to:</p> <ol style="list-style-type: none">1. Choose appropriate software engineering process model, requirement engineering principles and software designing fundamentals for a given project.2. Select appropriate testing strategy and apply testing principles for testing a given application.3. Apply basics of software configuration management, version control and change control in software development.4. Evaluate cost estimation, effort and severity of software risk for given application.5. Perform basic operations on Sub-version for software version control.

Unit No.	Contents	Max. Hrs.
1	Introduction to Software Engineering, A Generic View of process, Process models: Water fall Model, RAD Model, Prototyping Model, Component Development Model, Agile Model, Requirement Engineering: Requirement Engineering Task Initialization Eliciting Requirement, Developing Use Case, Analysis Model, Negotiation, Validation	6
2	Building the Analysis mode: Requirement Analysis, Analysis Modeling Approaches, Data Modeling Concept, Object Oriented Analysis, Types of Modeling, Design Engineering: Design Concept, Design Model.	7
3	Testing Strategies: Strategic Approach, Strategic issues, Strategies for conventional Software, Strategies for Object Oriented Software, Validation Testing, Testing Tactics: White-Box Testing, Basis Path testing: Flow Graph Notation, Independent Pr	7
4	Configuration Management: Base lines, Software Configuration items, The SCM Process, Identification of Objects in the Software Configuration, Version Control, Change Control, Configuration Audit, Status Reporting, SCM Standards	5
5	Project Management, Metrics for Process and Projects, Project Estimation, Risk Management: Reactive vs. Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection.	7
6	Advanced Topics in Software Engineering: Re engineering Computer aided software engineering, Open source SE tools introduction, Example-Subversion: Overview, Typical subversion usage and work flow.	5

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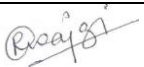

Artificial Intelligence and Data Science

Text Books :

1. Software Engineering—A Practitioner's Approach (Sixth Edition) by Roger S. Pressman— McGraw Hill.
2. Object Oriented Software Engineering by Leth Bridge, Pearson Edu.

Reference Books :

1. Software Engineering, 9th Edition, Ian Sommerville, University of St Andrews, Scotland, ©2011 , Pearson

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III Semester

AIDS2206 : Lab. : Software Engineering

Sr. No.	List of Experiment
1	Introduction to Software Engineering fundamentals, UML and RATIONAL ROSE Interface.
2	To study and create Software Requirement Specification document for given case study
3	To study and draw UML Use Case diagram for the given case study.
4	To study and draw UML Class diagram for given Case Study.
5	To study and draw UML Activity diagram for given Case Study
6	To study and draw UML Sequence Diagram for given Case Study
7	To study and draw State Diagram for given Case Study
8	8 Write a Program to find out the Estimation (cost and effort) by using COCOMO model.
9	To Perform Manual and Automated testing using CASE tool for given Case Study
10	10 To Study and execute Version Control using Subversion

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(Department of Computer Technology)

Artificial Intelligence and Data Science

III Semester

AIDS2207 : Operating Systems

Objective	Course Outcome
1. To learn different types of OS & services provided by OS.	1. Analyze & compare different OS & its services.
2. To understand process management and inter-process communication.	2. Apply & analyze CPU scheduling algorithm & also find different ways to synchronize the process.
3. To know the deadlock concepts & deadlock avoidance algorithms.	3. Use different methods to handle deadlock.
4. To understand the need of memory management.	4. Apply various memory management techniques.
5. To learn different file system organization.	5. Compare various disk scheduling algorithms based on their performances.

Unit No.	Contents	Max. Hrs.
1	Introduction, services provided by OS, functions of OS, system calls. Process management-introduction, process control block, process states, process context switch, threads: user level and kernel level.	7
2	CPU scheduling, goals of scheduling, CPU scheduling algorithms: FCFS, SJF, SRTF, RR, Priority based. Inter-process communication: process cooperation and synchronization, race condition, critical section, mutual exclusion and implementation, semaphores, classical inter-process communication problems.	8
3	Deadlocks: System Model, deadlock characterization-necessary conditions, resource allocation graph (RAG), methods for handling deadlock-deadlock avoidance, deadlock detection, deadlock prevention, recovery from deadlock.	7
4	Memory management techniques-contiguous and non-contiguous, paging and segmentation, translation look aside buffer (TLB) and overheads.	6
5	Virtual memory and demand paging, page faults, page replacement algorithms, thrashing and working set model	6
6	File systems-introduction, disk space management and space allocation strategies, directory structures, disk caching, disk arm scheduling strategies: FCFS, SSTF, SCAN, CSACN, LOOK, CLOOK, File Organization: Sequential, Index, Index Sequential	6

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Artificial Intelligence and Data Science

Text Books

SN	Title	Edition	Authors	Publisher
1	Operating system concepts	5th Edition	A. Silberchatz and P.Galvin	Addison Wesley Longman Inc.
2	Operating system Principles	7th Edition	A. Silberchatz and P.Galvi	John Wiley & Sons Inc.

Reference Books

SN	Title	Edition	Authors	Publisher
1	Modern operating systems	2nd edition	A.S. Tanenbaum	Prentice Hall of India publication.
2	Operating System	5th Edition	William Stalling	Pearson Education publication.

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Artificial Intelligence and Data Science

III Semester

AIDS2208 : Web Technology

Objective	Course Outcome
<ol style="list-style-type: none">1. Introduction to internet technology2. Study of basic of web page designing and validations3. Introduction to the concepts of data storage using XML4. learn the advance technique for designing the interactive web page	<p>After successful completion of the course students will be able to:</p> <ol style="list-style-type: none">1. Illustrate various internet technologies2. Design the web pages using some basic techniques3. Implement the XML technology to store the data4. Develop the interactive web pages using the advanced technique

S.N	List of Practical
1.	[A] Introduction to internet (overview of internet, email, www, broadband, FTP) [B] Study and implement basic HTML Tags
2.	Create a web form by using form tags in HTML(use any example)
3.	Develop and demonstrate the usage of inline, internal and external style sheet using CSS.
4.	Introduction to XML. Program to demonstrate the use of External and Internal DTD. (Write an XML file which will display the Book information which includes the following: 1) Title of the book 2) Author Name 3) ISBN number 4) Publisher name 5) Edition 6) Price)
5.	Write a program in JavaScript to perform arithmetic operations.
6.	Write a Program in JavaScript To create Dialogue Boxes.
7.	Write a program in JavaScript to demonstrate the use of While and For Loop.
8.	Write a program in JavaScript to demonstrate the use of Conditional Statements and Functions.
9.	Write JavaScript to validate the following fields of the Registration page. <ol style="list-style-type: none">1. First Name (Name should contains alphabets and the length should not be less than 6 characters).2. Password (Password should not be less than 6 characters length).3. E-mail id (should not contain any invalid and must follow the standard pattern <u>name@domain.com</u>)4. Mobile Number (Phone number should contain 10 digits only).5. Last Name and Address (should not be Empty).
10.	Mini project: Submission of Website with Report.

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Artificial Intelligence and Data Science

III Semester

AIDS2209 : Lab2.: Software

Sr. No.	List of Experiment
1	Implement basic functionality of R
2	Implement data import and export functionality in R
3	Implement R functions to calculate basic statistics of data source
4	Apply the basic visualization techniques in R to understand data
5	Apply some advanced visualization techniques in R to analyze the data
6	Solve the problems using probability distributions in R
7	Using a case study compare various probability distributions
8	Analyze the data using sampling technique
9	Analyze the data to find out estimated value
10	Analyze the data using hypothesis testing

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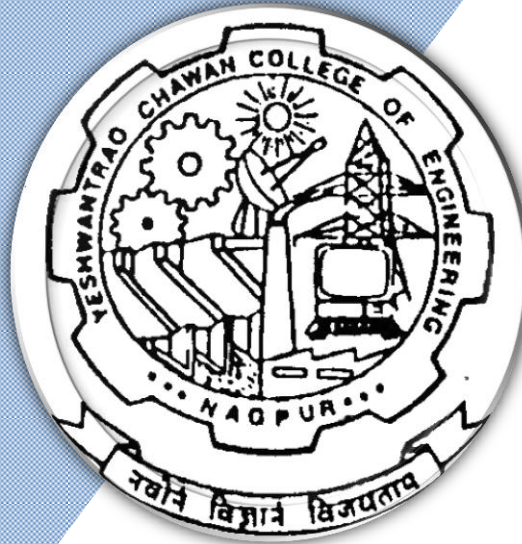
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Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of Technology SoE & Syllabus 2021 4th Semester

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B.TECH SCHEME OF EXAMINATION 2021-22

SoE No.
ADS-203.1

(Scheme of Examination w.e.f. 2022-23 onward)
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Artificial Intelligence and Data Science

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
Third Semester															
1	3	BS	CT	AIDS2201	Discrete Maths and Graph Theory	T	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	CT	AIDS2202	Statistics for Data Science	T	3	0	0	3	3	30	20	50	3 Hours
3	3	PC	CT	AIDS2203	Computer Networks	T	3	0	0	3	3	30	20	50	3 Hours
4	3	PC	CT	AIDS2204	Lab.: Computer Networks	P	0	0	2	2	1		60	40	
5	3	PC	CT	AIDS2205	Software Engineering	T	3	0	0	3	3	30	20	50	3 Hours
6	3	PC	CT	AIDS2206	Lab.: Software Engineering	P	0	0	2	2	1		60	40	
7	3	PC	CT	AIDS2207	Operating Systems	T	3	0	0	3	3	30	20	50	3 Hours
8	3	PC	CT	AIDS2208	Web Technology	P	0	0	4	4	2		60	40	
9	3	PC	CT	AIDS2209	Lab2.: Software	P	0	0	2	2	1		60	40	
TOTAL THIRD SEM							15	0	10	25	20				
Fourth Semester															
1	4	BS	GE	AIDS2251	Linear Algebra	T	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	CT	AIDS2252	Theoretical foundation of Computer Science	T	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	CT	AIDS2253	Design & Analysis of Algorithms	T	3	0	0	3	3	30	20	50	3 Hours
4	4	PC	CT	AIDS2254	Lab.: Design & Analysis of Algorithms	P	0	0	2	2	1		60	40	
5	4	PC	CT	AIDS2255	Database Management Systems	T	3	0	0	3	3	30	20	50	3 Hours
6	4	PC	CT	AIDS2256	Lab.: Database Management Systems	P	0	0	2	2	1		60	40	
7	4	PC	CT	AIDS2257	Bayesian Data Analysis	T	3	0	0	3	3	30	20	50	3 Hours
8	4	PC	CT	AIDS2258	Lab3.: Software	P	0	0	2	2	1		60	40	
TOTAL FOURTH SEM							15	0	6	21	18				

List of Audit Course

1	3	HS		GE2121	Environmental studies	T	2	0	0	2	0				
2	3	HS		AU2123	YCCE Communication Aptitude Preparation (YCAP3)	A	3	0	0	3	0				
3	4	HS		AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE, IIoT, AIML, CSD, AIDS	A	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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Artificial Intelligence and Data Science

IV Semester

AIDS2251: Linear Algebra

Objective	Course Outcome
<ol style="list-style-type: none">To provide mathematical knowledge required to analyze problems encountered in engineering.The students are acquainted with the solution of system of linear equation, eigen values and eigen vectors.To apply principles of matrix algebra to linear transformations and inner products.Student can apply this course in many areas of engineering such as computer graphics, cryptography, wire-less communication, signal processing, robotics and animation.	<p>After completion of the course, the student will be able to</p> <ol style="list-style-type: none">Solve systems of linear equations using rank of matrixDetermine eigenvalues and eigenvectors and solve eigenvalue problems.Explain the concepts of vector space and subspace, span and basis.Apply principles of matrix algebra to linear transformations and inner product.

Unit No.	Contents	Max. Hrs.
1	Elementary matrix operations Introduction to Matrices and Determinants, Solution of Linear Equations, Cramer's rule, Inverse of a Matrix.	6
2	Matrix Algebra Rank of a matrix, Gaussian elimination, LU Decomposition (Crout's method), Solving Systems of Linear Equations using the tools of Matrices.	6
3	Diagonalization of matrix Eigen Values and Eigen vectors, Linear dependence and independence of Eigen Vectors, Orthogonal Eigen vector, Diagonalization of matrix, Cayley-Hamilton Theorem and Sylvester's Theorem.	7
4	Vector Space Vector Space, Subspace, Sum of Sub space, linear combination, Linear dependence and independence, Span and basis, Spanning sets, Generators.	6
5	Linear Transformation Linear transformation, Ranges and Kernel (null space) of linear transformation, Inverse of linear transformation, Algebra of linear transformation, Singular and nonsingular linear transformation.	7
6	Inner product Spaces Inner product space and Norms, orthogonal vector, the Gram Schamidt orthogonalization Process , orthogonal compliment, Adjoint of Linear operator, Normal and self adjoint operator, Unitary and orthogonal operator, Bilinear and Quadratic form.	7

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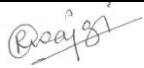

Artificial Intelligence and Data Science

Text Books :

1. Advance Engineering Mathematics (9th Edition), Kreyszig. Wiley
2. Higher Engineering Mathematics (40th edition), B.S. Grewal, Publisher: S.Chand & Company Limited
3. Linear Algebra, Hoffman and Kunze, prentice Hall of India, New Delhi
4. Linear Algebra and its Applications, Gilbert Strang, Nelson Engineering (2007)

Reference Books :

1. Linear Algebra, 3rded: Schaum outline series , Seymour Lipschutz et al.
2. An introduction to linear algebra, Affiliated East West Press, New Delhi P.G. Bhattacharya, S.K. Jain and S.R., V. Krishnamoorthy et al.
3. First course in Linear Algebra, Wiley Eastern Ltd., New Delhi, Nagpaul.
4. Matrix and Linear Algebra, K.B.Datta, Prentice Hall of India.

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Artificial Intelligence and Data Science

IV Semester

AIDS2252: Theoretical foundation of Computer Science

Objective	Course Outcome
1. To understand the basic properties of formal languages and Finite Automata, regular expression and Regular Grammar.	1. Apply basic properties of formal languages and to design finite automata for regular expression and Regular Grammar.
2. To study of different types of grammars and the properties of Context Free Grammar	2. Construct context free grammar for various languages.
3. To understand the basic properties of CFL and Designing of Push Down Automata	3. Solve various problems of push down automata for context free language
4. To understand the basic properties of Turing machine and study of Recursive Language, undecidability, post Correspondence problem and Recursive enumerable language	4. Design Turing Machines for given any computational problem.

Unit No.	Contents	Max. Hrs.
1	Alphabet, Symbols, Sets, Strings, Language, Operations, Relations, Design of Finite State Machines, Acceptance of strings and languages, Non Deterministic Finite Automation, Deterministic Finite Automation, Equivalence between NFA and DFA, NFA with ϵ -transition, Minimization of FA.	8
2	Regular Regular sets, Regular expressions, Manipulation of regular expressions, Equivalence between RE and FA. Pumping Lemma, closure properties of regular sets (Proofs not required), Regular grammars, Right linear and left linear regular grammars, inter-conversion between LLG & RLG, Equivalence between regular grammar and F.A., Inter-conversion between RE and RG.	7
3	Context free grammar, Derivation trees (Syntax tree and Parse tree), Ambiguous Grammar, Context Free Language (CFL), Normal Form of grammar: Chomsky Normal form, Greibach normal form.	7
4	Push Push down automata, definition, and model, acceptance of CFL by empty Stack and by final state, equivalence CFL and PDA, Inter-conversion, Closure of properties of CFL, DPDA & NDPDA.	6
5	Turing machine, Definition, Model of TM, Design of Turing Machine, Computable functions, Recursive enumerable language, Recursive Language, Properties of Recursive enumerable language, Church's hypothesis, Chomsky hierarchy of language, Linear bounded automata and context sensitive language, Universal Turing Machin	6
6	Un-decidability Problems related to Recursive enumerable language and Turing Machine, post correspondence problem. Recursive function Theory –Basis functions and operations on them. Bounded minimization preemptive μ recursive function unbounded minimization and recursive function	6

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Artificial Intelligence and Data Science

Text Books

SN	Title	Edition	Authors	Publisher
1	Introduction to Automata Theory, Languages, and computation	3 rd Edition	Hopcroft J.E., Rajeev Motwani, Jeffrey D. Ullman	Pearson Education
2	Introduction to languages and the Theory of Computation	3 rd Edition	John C.Martin	Mc Graw Hill

Reference Books

SN	Title	Edition	Authors	Publisher
1	Introduction to the Theory of Computation	2 nd Edition	Michael Sipser	GALE CENGAGE Learning
2	Theory of Computation	1 st Edition	Dr. O. G. Kakde	Laxmi Publication

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Artificial Intelligence and Data Science

IV Semester

AIDS2253: Design & Analysis of Algorithms

Objective	Course Outcome
1. To introduce basic algorithmic techniques, time requirements of an algorithm and mathematical techniques used in analysis of algorithms	1. Students should be able to design some algorithms
2. Learn analysis of algorithms for a wide variety of foundational problems occurring in computer science applications with discussions on complexity and NP-completeness.	2. Analyze their performance with respect to selected evaluation parameters

Unit No.	Contents	Max. Hrs.
1	Mathematical foundations, summation of arithmetic and geometric series, $\sum n$, $\sum n^2$, bound summations using integration, Analysis of algorithms, analyzing control structures, worst case and average case analysis, Asymptotic notations, Analysis of sorting algorithms such as selection sort, insertion sort, bubble sort, heap sort, external Sorting, lower bound proof.	6
2	Recursive functions and recurrence relations, solutions of recurrence relations using technique of characteristic equation and generating functions, elementary and advanced data structures with operations on them and their time complexity, Amortized analysis.	7
3	Divide and conquer basic strategy, binary search, quick sort, merge sort, Fast Fourier Transform etc. Greedy method –basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, single source shortest path etc.	7
4	Dynamic Programming basic strategy, multistage graphs, all pair shortest path, single source shortest paths, optimal binary search trees, traveling salesman problem.	6
5	Basic Traversal and Search Techniques, breadth first search, connected components, Backtracking basic strategy, 8 – Queen's problem, graph colouring, Hamiltonian cycles etc.	6
6	NP-hard and NP-complete problems, basic concepts, non deterministic algorithms, NP-hard and NP- complete, Cook's Theorem, decision and optimization problems, polynomial reduction.	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Computer Algorithms	Third	Horowitz, Sahani, Rajsekharan	Galgotia Publications Pvt. Ltd.
2	Introduction to Algorithms	Third	Thomas H. Cormen	Prentice Hall of India.

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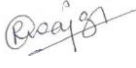

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Reference Books

SN	Title	Edition	Authors	Publisher
1	Fundamentals of Algorithms	Second	Brassard and Bratley	Prentice Hall

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IV Semester

AIDS2254: Lab. : Design & Analysis of Algorithms

Sr. No.	List of Experiment
1	Write a program for insertion sort and display its time complexity for different number of inputs.
2	Write a program for heap sort and compare its time complexity with insertion sort for different number of inputs.
3	Write a program for merge sort and display its time complexity for different number of inputs.
4	Write a program for quick sort and compare its time complexity with merge sort for different number of inputs.
5	Write a program for fractional knapsack problem using greedy strategy and analyse its time complexity for different number of inputs.
6	Write a program for job sequencing with deadline problem using greedy strategy and analyse its time complexity for different number of inputs.
7	Write a program for travelling salesman problem using dynamic programming and analyse its time complexity for different number of inputs.
8	Write a program for all pair shortest path using dynamic programming and analyse its time complexity for different number of inputs.
9	Write a program for 8 queen's problem using backtracking
10	Write a program for graph coloring problem using backtracking

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IV Semester

AIDS2255: Database Management Systems

Objective	Course Outcome
<ol style="list-style-type: none"> To learn different database system concepts To learn the designing of Entity Relationship Diagram. To know relational data model, relational algebra & SQL Queries. To understand relational database design. To know about data integrity issues 	<p>Upon successful completion of the course, the student will be able to:</p> <ol style="list-style-type: none"> Analyze & compare different levels of abstraction & data independence. Design Entity Relationship Diagram for any scenario. Solve queries based on relational algebra & SQL. Identify functional dependencies & normalize the database and apply ACID properties. Analyze transaction management, various concurrency control protocols and crash recovery methods.

Unit No.	Contents	Max. Hrs.
1	Introduction to Database Management System: General File System and Database system Concepts and Architecture, Data Models, Schemas and Instances, Abstraction & Different Levels of Data Abstraction, Data Independence: Logical & Physical Independence.	8
2	Entity-Relationship Model: Entities and Entity Sets, Relationships and Relationship Sets, Attributes, Mapping Constraints, Keys, Entity Relationship Diagram, Reducing E-R Diagrams to Tables, Generalization, Aggregation, Design of an E-R Database Scheme	6
3	SQL: Data definition language (DDL), Data Manipulation Language (DML), Basic structure of SQL Queries, Set operations, Null Values, Nested subqueries, views, modification of database, transaction, Joins. Advanced SQL: SQL data types & schemas, Integrity Constraints, Domain Constraints, Assertions, triggers, Advanced SQL Features.	8
4	Relational Data Model: Structure of Relational Databases Relational Algebra: Structure of relational databases, Fundamental Relational-Algebra Operations, Additional relational algebra operations, extended relational algebra operations, modification of the databases	6
5	Relational Database Design: Pitfalls in Relational Database Design, Functional Dependencies, Normalization using Functional Dependencies, Alternative Approaches to Database design. Transaction Management: ACID Properties, Implementation of ACID Properties, Database processes to support ACID Properties, Schedules, and Testing of Serializability.	6

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Unit No.	Contents	Max. Hrs.
6	Concurrency Control: Lock-based Protocols, Timestamp Based Protocols, Validation Techniques, Multiple Granularity, Multi version Timestamp Protocol, Transaction isolation levels, Read consistency. Crash Recovery: Failure Classification, Log Based Recovery, Buffer Management, Checkpoints, Shadow Paging.	6

Text Books				
SN	Title	Edition	Authors	Publisher
1	Database System Concepts	6 th Edition	Korth, Silberschatz	McGraw-Hill publication
2	Fundamentals of Database Systems	5 th Edition	Elmasri, Navathe & Gupta	Pearson Education.

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Database Systems	3 rd Edition	Connolly	Pearson Education
2	Database Systems	6 th Edition	S. K. Singh,	Pearson Education

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IV Semester

AIDS2256: Lab.: Database Management Systems

Sr. No.	List of Experiment
1	Study of My-SQL
2	Designing of an ER Diagram.
3	Designing of Database Schema based on ER diagram
4	Implementation of different DDL commands
5	Implementation of Constraints: Referential Constraints, Domain Constraints
6	Implementation of different DML Commands
7	Study and Implement Inner join
8	Study and Implement Outer Join
9	Consider the schema for Movie Database:ACTOR (Act_id, Act_Name, Act_Gender)DIRECTOR (Dir_id, Dir_Name, Dir_Phone)MOVIES (Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)MOVIE_CAST (Act_id, Mov_id, Role)RATING (Mov_id, Rev_Stars) Write SQL queries to 1.List the titles of all movies directed by 'Hitchcock'. 2.Find the movie names where one or more actors acted in two or more movies. 3.List all actors who acted in a movie before 2000 and also in a movie after2015 (use JOIN operation). 4.Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title. 5.Update rating of all movies directed by 'Steven Spielberg' to 5

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Artificial Intelligence and Data Science

IV Semester

AIDS2257: Bayesian Data Analysis

Objective	Course Outcome
Students will be able to 1. Understand the fundamental theories of Bayesian statistics 2. Understand the concept of inferences from data using various probability models 3. Comprehend various model checking techniques. 4. Discuss various predictive error measures for model comparison	Students will be able to 1. Demonstrate the fundamental theories of Bayesian statistics 2. Construct a probability model for computing the posterior distribution 3. Examine the model using model checking techniques 4. Estimate the predictive model accuracy and expand in the direction of improvement

Unit No.	Contents	Max. Hrs.
1	Fundamentals of Bayesian Inference : The three steps of Bayesian data analysis, General notation for statistical inference , Bayesian inference, probability as a measure of uncertainty	6
2	Single Parameter Models : Estimating a probability from binomial data, Posterior as compromise between data and prior information, Summarizing posterior inference, Informative prior distributions, Normal distribution with known variance, Other standard single-parameter models, informative prior distribution, Noninformative prior distributions.	7
3	Multiparameter model : Averaging over 'nuisance parameters', Normal data with a noninformative prior distribution, Normal data with a conjugate prior distribution, Multinomial model for categorical data, Multivariate normal model with known variance, Multivariate normal with unknown mean and variance	7
4	Hierarchical models : Constructing a parameterized prior distribution, Exchangeability and hierarchical models, Bayesian analysis of conjugate hierarchical models, Normal model with exchangeable parameters, Hierarchical modeling applied to a meta-analysis	7
5	Model checking : The place of model checking in applied Bayesian statistics, Posterior predictive checking , Graphical posterior predictive checks, Model checking for the educational testing example	7
6	Evaluating, comparing, and expanding models : Measures of predictive accuracy, Information criteria and cross-validation, Model comparison based on predictive performance, Model comparison using Bayes factors, Continuous model expansion. Application domains	7

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Artificial Intelligence and Data Science

Text Books :

1. Gelman, A., Carlin, J. B., Stern, H. S., Rubin, D. B. (2013) Bayesian Data Analysis, Third Edition, Chapman & Hall/CRC.

Reference Books :

1. R. Christensen, W. Johnson, A. Branscum, T. E. Hanson (2010) Bayesian Ideas and Data Analysis: An Introduction for Scientists and Statisticians, CRC Press.

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Artificial Intelligence and Data Science

IV Semester

AIDS2258: Lab3.: Software

Objective	Course Outcome
<ol style="list-style-type: none">To understand the syntax of various data structures along with their operationsTo comprehend concepts of file handling and object oriented programmingTo make students aware about various programming frameworks and libraries of PythonTo understand the functionalities provided under various packages required to build any web-based application	<ol style="list-style-type: none">Write a python program to apply various data structures conceptApply the concept of file handling and object-oriented programming in pythonSelect the required framework and appropriate libraries to write a program in pythonDevelop web-based application using functionalities provided under various packages

Sr. No.	List of Experiment	CO
1	Revision to Python language: Lists, Dictionary, Sets, Tuples, Numpy. write a Python program using: Lists comprehension, Dictionary comprehension	CO1
2	Write a program using: File handling	CO2
3	Write a program using: Exception Handling	CO2
4	Write a program using: Enumeration, Lambda Function	CO2
5	Write program using: Decorators	CO2
6	Write a program using object-oriented concept	CO2
7	Module reference: statistics, Random, Math	CO3
8	Study of Pandas data frames and implement data frames related operations	CO3
9	Program using: Matplotlib	CO3
10	Project work: GUI creation in Python (Flask framework)	CO4

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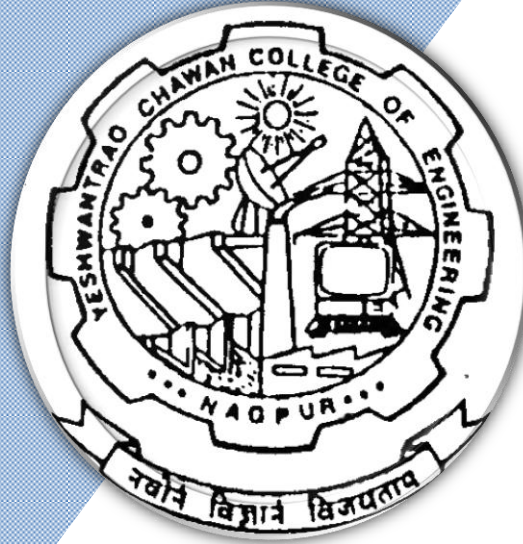
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Hingna Road, Wanadongri, Nagpur - 441 110



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Artificial Intelligence and Data Science



B.TECH SCHEME OF EXAMINATION 2021-22

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Artificial Intelligence and Data Science

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester															
1	5	PC	CT	AIDS2301	Artificial Intelligence	T	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	CT	AIDS2302	Lab.: Artificial Intelligence	P	0	0	2	1	1		60	40	
3	5	PC	CT	AIDS2303	Data Mining	T	3	0	0	3	3	30	20	50	3 Hours
4	5	PC	CT	AIDS2304	Lab.: Data Mining	P	0	0	2	1	1		60	40	
5	5	PC	CT	AIDS2305	Cyber Laws and Ethics in IT	T	3	0	0	3	3	30	20	50	3 Hours
6	5	PC	CT	AIDS2306	Open Source Tool lab	P	0	0	2	1	1		60	40	
7	5	PE	CT		Professional Elective-I	T	3	0	0	3	3	30	20	50	3 Hours
8	5	PE	CT		Professional Elective-I Lab	P	0	0	2	1	1		60	40	
9	5	OE	CT		Open Elective 1	T	3	0	0	3	3	30	20	50	3 Hours
10	5	OE	CT		Open Elective 2	T	3	0	0	3	3	30	20	50	3 Hours
TOTAL FIFTH SEM							18	0	8	22	22				

List of Professional Electives-I

Professional Electives -I

1	5	PE-I	CT	AIDS2311	PE I: Digital Image Processing
	5	PE-I	CT	AIDS2312	PE I: Lab.: Digital Image Processing
2	5	PE-I	CT	AIDS2313	PE I: Internet of Things
	5	PE-I	CT	AIDS2314	PE I: Lab Internet of Things
3	5	PE-I	CT	AIDS2315	PE I: Numerical Methods
	5	PE-I	CT	AIDS2316	PE I: Lab.: Numerical Methods
4	5	PE-I	CT	AIDS2317	PE I: Android App Development using Kotlin
	5	PE-I	CT	AIDS2318	PE I: Lab: Android App Development using Kotlin

Open Elective 1

1	5	OE1	CT	AIDS2321	OE I: Introduction to Data Science
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Open Elective 2

1	5	OE2	CT	AIDS2331	OE II: Foundations of AI
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Audit Courses

1	5	HS		AU2126	YCCE Communication Aptitude Preparation (YCAP5.1) for CV,ME,CT,IT,CSE, IIoT, AIDS, CSD, AIML	A	3	0	0	3	0			
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MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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Artificial Intelligence and Data Science

V Semester

AIDS2301: Artificial Intelligence

Objective	Course Outcome
Objective of this course is to give students the basic understanding of Artificial Intelligence and to provide them the foundations for building AI based systems.	<ol style="list-style-type: none">1. To understand basic concepts in Artificial Intelligence, intelligent agents and to define the problem as a state space search2. To understand the blind search and heuristic search techniques and apply them in problem solving3. To understand the knowledge representation and its issues and inference methods for intelligent decision making4. To understand the knowledge representation and reasoning under uncertainty5. To understand basics of learning and development of expert systems

Unit No.	Contents	Max. Hrs.
1	Introduction to AI: Definition of AI, early work in AI, the importance of AI, AI and related fields, distributed AI, task domains of AI, Introduction to intelligent agents, agents and environments, rationality, the nature of environments, the structure of agents. Problems, problem spaces and searches, defining the problem as a state space search,	6
2	Production systems and control strategies: depth first and breadth first search, back tracking, problem characteristics, issues in the design of search programs. Heuristic search techniques: generate and test, hill climbing, best first search, A* search, problem reduction, constraint satisfaction problems	7
3	Knowledge representation: issues, representation and mapping approaches, procedural Vs declarative knowledge, introduction to propositional logic, knowledge representation using predicate logic, unification and resolution algorithms. Introduction to Prolog language: Representation of Predicates, rules, and facts in prolog.	7
4	Representation of knowledge using rules, logic programming, forward and backward reasoning, matching, control knowledge. Knowledge representation using semantics nets and frames, scripts	6
5	Introduction to non-monotonic reasoning, logics for non-monotonic reasoning, Statistical reasoning: probability and Bay's theorem, certainty factors and rule based system.	6
6	Learning: general learning model, overview of different forms of learning, Expert Systems: Design & Development of Expert System, knowledge based Systems, Rule Based Expert System, Expert System Shell, Application Areas of Expert System	6

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Artificial Intelligence and Data Science

Text Books				
SN	Title	Edition	Authors	Publisher
1	Artificial Intelligence A Modern Approach	Third	Stuart Russell, Peter Norvig	Pearson
2	Artificial Intelligence	Third	by E. Richard K. Knight and S. Nair.	McGraw Hill

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Introduction to Artificial Intelligence and Expert System		D. W. Patterson	PHI

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Artificial Intelligence and Data Science

V Semester

AIDS2302: Lab.: Artificial Intelligence

Sr. No.	List of Experiment
1	Implementing Breadth First Search
2	Implementing Depth First Search
3	Implementing Heuristic search Algorithm
4	Implementing A* Algorithm
5	Solving a Constraint Satisfaction Problem
6	Developing a small Expert System Using Prolog
7	Solving Classification Problem using Bayes Theorem
8	Implementing Breadth First Search

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Artificial Intelligence and Data Science

V Semester

AIDS2303 : Data Mining

Objective	Course Outcome
1. Understand the fundamentals of data mining techniques for data processing and mining techniques for knowledge extraction	1. Understand the various supervised and unsupervised data processing and mining techniques for knowledge extraction
2. Comprehend the various data mining algorithms and how to apply a mining algorithms to sample data	2. Apply various data mining techniques to extract knowledge from the given problem
3. To understand the different methods of evaluation of Data mining algorithms	3. Analyse the various data mining techniques
4. To understand new advanced techniques to extract the knowledge from the data	4. Evaluate the various supervised and unsupervised data processing and mining techniques for knowledge extraction

Unit No.	Contents	Max. Hrs.
1	Introduction to Data Mining and Knowledge Discovery, Data Mining Applications, Pattern Analysis, Cluster Analysis, Outlier Analysis, Predictive Analysis, Data Visualization, Proximity measures, Data Preprocessing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.	8
2	Association Rules: Association Rule Mining, Apriori Algorithm, Frequent Itemsets, Closed Itemsets, Pattern Evaluation Method, Advanced Association Rule Techniques, Measuring the quality of rules.	7
3	Supervised Techniques: Classification, Decision Tree Induction, Bayes Classification Method, Rule-Based Classification, Model Evaluation and Selection, Discriminant Analysis, Logistic Regression.	7
4	Unsupervised Techniques: Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-based Methods, Grid-based Methods, Evaluation of Clustering, Outlier Detection	6
5	Recommendation System, Advanced Techniques, Text Mining: Extracting attributes (Keywords), structural approaches (parsing, soft parsing), Bayesian approach to classifying text, Web Mining: Classifying web pages, extracting knowledge from the web, Mining Spatial Databases, Temporal Data Mining.	6
6	Visualization and Prediction Visualization: Motivation for visualization, General concepts, Techniques Prediction: Linear regression (Least Square method), Analyzing regression error, Analyzing goodness of fit	6

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Artificial Intelligence and Data Science

Text Books

SN	Title	Edition	Authors	Publisher
1	Data Mining: Concepts and Techniques	3rd Edition, 2012	J. Han, M. Kamber	Morgan Kaufman
2				

Reference Books

SN	Title	Edition	Authors	Publisher
1				
2				

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Artificial Intelligence and Data Science

V Semester

AIDS2304 : Lab.: Data Mining

Sr. No.	List of Experiment
1	Implementation of data preprocessing using R
2	Practical based on association rule mining 1
3	Practical based on association rule mining 2
4	Practical based on classification, algorithm1
5	Practical based on classification, algorithm2
6	Implementation of k-means clustering
7	Implementation of hierarchical clustering
8	Implementation of text mining
9	Implementation of regression analysis

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V Semester

AIDS2305 : Cyber Laws and Ethics in IT

Objective	Course Outcome
1. To understand the basic concepts of Cyber Law. 2. To understand concepts, principles, and strategies applicable to Jurisdiction System for cyber laws. 3. To understand IT Law in India as well as on international level. 4. To understand concepts of E commerce, Law and Ethics.	1. The students will understand the importance of professional practice, Law and Ethics in their personal lives and professional careers. 2. The students will learn the rights and responsibilities as an employee, team member and a global citizen 3. To understand offences and penalties for cybercrimes under IT Act. 4. Interpret Cyber Ethics.

Unit No.	Contents	Max. Hrs.
1	Introduction to Cyber Law: Evolution of computer technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.	8
2	Information Technology Act: Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.	7
3	Cyber Law and Related Legislation: Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).	7
4	Privacy and Security: Basic Principal of Data Protection Act, Health Insurance Portability Accountability Act, concepts of ISO 27001 security Audit, Payment Card Industry Data Security Standard (PCI DSS), Computer crime investigation process and evidence collection, Incident Response Procedures, Net Neutrality	8

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5	Electronic Business and Legal Issues: Evolution and development in E-commerce, paper vs paper less contracts E-Commerce models- B2B, B2C, E security. Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends.	7
6	Cyber Ethics: The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics. Application Area : Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends	8

Text Books

SN	Title	Edition	Authors	Publisher
1				

Reference Books

SN	Title	Edition	Authors	Publisher
1	Cyber Laws: Intellectual property & E Commerce, Security.	--	Kumar K	Dominant Publisher
2	Cyber Ethics 4.0	--	Christoph Stuckelberger, Pavan Duggal	Globethic
3	Cryptography and E-Commerce	2001	Hon C Graff	A Wiley Tech Brief, Wiley Computer Publisher
4	The Information Technology Act, 2005: A Handbook	2011	OUP Sudhir Naib	New York
5	Cyber law: the Law of the Internet	1997	Jonathan Rosenoer	Springer-verlag

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V Semester

AIDS2306 : Open Source Tool Lab

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

Course Objectives:	Course Outcome:
To understand data connectivity and data visualization in Power BI	CO 1: Connect to and visualize data in Power BI
To create visual representations of data as it's captured, stored, and used at business.	CO 2: Build data model and get the insights from data.
To blend and transform raw data into beautiful interactive dashboards.	CO 3: Design compelling Power BI reports.

Lab Experiment List:

Expt. No	Name of Experiment
1	Introduction to Power BI and the different Power BI elements
2	Importing data into the Power BI from local data files and cloud servers
3	Clean, transform, and load data in Power BI
4	Create simple pre-defined models for visualization
5	Combine different visualization modes
6	Slice the dataset in Power BI
7	Matrices and tables in Power BI
8	Extract data relations and trends
9	Publish Power BI reports
10	Customizing the data analytics with Power BI and Power Automate

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V Semester

AIDS2311 : PE I: Digital Image Processing

Objective	Course Outcome
<ol style="list-style-type: none">1. Overview the Fundamental concepts of Digital Image Processing2. Explore image enhancement techniques in spatial domain and frequency domain3. Understand the fundamental concept of image compression4. To Study various similarity based, and dissimilarity-based image segmentation approaches.5. Understand the basic concepts of image representation and description.	<p>Upon successful completion of the course students will be able to:</p> <ol style="list-style-type: none">1. Describe and understand Basic relationships between pixels.2. Compare and Implement various image enhancement techniques in spatial domain and frequency domain.3. Compare and illustrate different image compression techniques to understand the advantage of image compression4. Identify and demonstrate the applications of similarity based and dissimilarity-based approaches for image segmentation.5. Interpret and illustrate various representation techniques.

Unit No.	Contents	Max. Hrs.
1	Introduction: Fundamental Steps in Image Processing, Elements of DIP systems, A Simple Image Model, Sampling and Quantization, Some Basic Relationships between Pixels.	5
2	Image Enhancement in the Spatial Domain: Introduction to Spatial domain, Basic Gray Level Transformations, Histogram Processing, Histogram Equalization, Spatial Domain Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	6
3	Transforms: Introduction to the Fourier Transform, Discrete Fourier Transformation, Fourier Properties, 2DFT, inverse Fourier transform, Typical Applications. Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters.	6
4	Image Compression: Fundamentals of Image compression, coding redundancy, spatial and temporal redundancy, Irrelevant Information, Measuring Image Information, Image compression models, Various compression methods.	6

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5	Image Segmentation: Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking and Boundary Detection, Thresholding, Region-oriented Segmentation.	6
6	Image Representation: Chain Codes, Polygonal Approximations, Signatures, Skeleton of a Region. Description: Boundary Descriptors, Shape Numbers, Regional Descriptors, Simple Descriptors, Topological Descriptors. Introduction to various color image processing models.	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Digital Image Processing	3rd edition	Rafael C. Gonzalez and Richard, E. Woods	Prentice Hall
2	Digital Image Processing	3rd edition	Jayaraman, S. Esakkirajan, T. Veerakumar	Tata McGrawHill.

Reference Books

SN	Title	Edition	Authors	Publisher
1	Fundamentals of Digital Image Processing	2nd Edition	A.K.Jain	Prentice Hall.
2	Image Processing Principles & Applications	2nd Edition	Tinku Acharya & Ajoy K. Ray	Willey Inter-Science.

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V Semester

AIDS2312 : PE I: Lab.: Digital Image Processing

SN	Program based on
1	Write a program in MATLAB for following Point processing techniques in spatial domain a. Negation of an image b. Thresholding of an image c. Contrast Stretching of an image
2	Write a Program in MATLAB to Create a Histogram of a given Image.
3	Write a program in MATLAB to perform following smoothing operations on an image a. Average filter b. Ordered Statistics filter
4	Write a program to sharp an image using Laplacian mask.
5	Write a program to compress an image using Huffman Coding
6	Write a program to segment an image using multilevel thresholding.
7	Write a program to apply split and merge algorithm on a given image.
8	Write a program to find the code chain of a given image.
9	Write a program to find the shape number of a given image.
10	Write a program to find Euler number of image a given image.

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V Semester

AIDS2313: PE I: Internet of Things

Objective	Course Outcome
At the end of the course, the students will be able to- 1. Get acquainted with various IOT environments. 2. Study IOT architecture and its enabling technologies. 3. Acquire hands on laboratory experience, utilizing IOT kit.	 1. Design and evaluate various IOT environments. 2. Describe IOT architecture and its enabling technologies. 3. Analyze IOT environments using various communication technologies 4. Apply various IOT enabling technologies for creation of IOT environments.

Unit No.	Contents	Max. Hrs.
1	Introduction: Concepts behind the Internet of Things, Characteristics of IoT, IoT enabling technologies, IoT Communication Model, IoT architecture, Applications of IoT, Transducers, Sensors, Sensor classes, Sensor types, Actuators and its types	5
2	IOT Protocols: Application layer: MQTT, COAP, XMPP, AMQP, Network Layer: IPv4, IPv6, 6LoWPAN, IoT Communication protocols: IEEE802.15.4, ZigBee, Wireless HART, Zwave, Bluetooth, NFC, RFID .	7
3	Wireless Sensor networks: Components of sensor nodes, Node Behavior in WSNs, Applications, WSN Coverage, OGDC algorithm, Stationary and Mobile Wireless Sensor Networks.	6
4	Cloud Computing: Recent Trends in Computing, Characteristics, Components of Cloud Computing, Service Models, Deployment Models, Service Management, Cloud Security, IoT Data analytics, Case studies, Middleware for IoT.	6
5	Machine to Machine Communication: Node types, IP and Non-IP based M2M network Interoperability in Internet of Things: Current Challenges in IoT, Interoperability, Types of Interoperability	6
6	Software-Defined Networking: Current Network to SDN, SDN Architecture, Challenges, OpenFlow Protocol, APIs in SDN, Controller Placement, Recent Advances of SDN in IoT, Industrial internet of things, Case studies .	6

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Artificial Intelligence and Data Science

Text Books				
SN	Title	Edition	Authors	Publisher
1	Internet of Things A hands on approach	First Edition	Arshdeep Bahga and Vijay K. Madiseti	Orient Blackswan Private Limited - New Delhi

Reference Books				
SN	Title	Edition	Authors	Publisher
1	NPTEL course material on Introduction to Internet of Things			

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V Semester

AIDS2314 : PE I : Lab Internet of Things

1. To study IoT Kit
2. Design a sketch for running of LED's
3. Design a sketch to monitor state of switch by establishing serial communication between Arduino and computer.
4. Design a sketch to read analog value of potentiometer by establishing serial communication between arduino and computer.
5. Design a sketch for blinking LED's without using delay
6. Design a sketch to develop switch based binary LED counter. Also observe output on serial monitor.
7. Design a sketch to create a simple digital clock using LCD display.
8. Design a sketch to make use of EEPROM to control devices(LED)
9. To log data of temperature sensor over internet and monitor it from anywhere in the world.

Advance Practical:

10. Use of ESP-32

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Artificial Intelligence and Data Science

V Semester

AIDS2315 : PE I : Numerical Methods

Objective	Course Outcome
<ol style="list-style-type: none">To understand basics of error induced in numerical computationTo develop numerical algorithms and skills to implement algorithms to solve mathematical problems on the computerLearn technologies to solve integration numericallyUnderstand techniques to solve differential equations and systems of equations for convergence of iteration method.	<ol style="list-style-type: none">Apply appropriate formula to find different types of error in numerical computation and mitigate it.Choose and apply appropriate numerical techniques for problem solving interpret the results and assess accuracy.Apply appropriate techniques for numerical integrationDemonstrate basics of conditioning of problems and stability of numerical algorithms

Unit No.	Contents	Max. Hrs.
1	Introduction to numerical computing: Characteristics of Numerical computing, Approximations and errors in numerical computations, types of errors, analysis, error estimation, numerical instabilities in computation, convergence (convergence of iterative method)	5
2	Roots of Non-linear equations: Methods of solutions, Iterative methods, Horner's rule, Bisection method, Regula Falsi method, Iteration method, Newton Raphson method, Secant method	6
3	Solutions to System of Linear Algebraic Equations: Existence of Solution, Solution By Elimination, Cramers rule, Basic Gauss Elimination Method, Gauss Elimination With Pivoting, Gauss – Jordan Method, Tringularization Methods, Choleskey's Method, Gauss Siedel method of iteration. Round Off Errors And Refinement, Ill – Conditioned System, Matrix Inversion Method.	6
4	Interpolation and Approximation: Linear interpolation and high order interpolation using Lagrange and Newton Interpolation methods, finite difference operators and interpolation polynomials using finite differences.	6
5	Numerical Differentiation and Integration: Numerical differentiation and errors in numerical differentiation, NewtonCotes formulae, trapezoidal rule, Simpson's rule, Double integrals by Trapezoidal and Simpson rule, Romberg Integration.	6
6	Numerical Solution of Ordinary Differential Equation: Solution By Taylor's Series, Picard's Method Of Successive Approximation, Euler's Method, Error Estimates For The Euler Method, Runge-Kutta Method for 2nd and 4th order, Predictor-Corrector Methods	6

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Artificial Intelligence and Data Science

Text Books

SN	Title	Edition	Authors	Publisher
1	Introductory Methods of Numerical Analysis	Fifth Edition	S.S.Sastry	Prentice- Hall of India, New Delhi

Reference Books

SN	Title	Edition	Authors	Publisher
1	Numerical Methods	Standard Edition	E. Balagurusamy	Tata McGraw hill.
2	Schaum's Outlines: Numerical Analysis -	Second Edition	Francis Scheid	Tata McGraw Hill Publishing Co. Limited.
3.	Numerical Computational Methods	illustrated, revised	P.B. Patil, U.P. Verma	Alpha Science International Limited, 2009

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V Semester

AIDS2316 : PE I : Lab.: Numerical Methods

SN	Program based on
1	To find the absolute, relative percentage error in given function when: i. Three terms ii. Five terms are considered. The given function is: $y = e^x$
2	To find solution for Algebraic and Transcendental equation using Bisection Method.
3	To find solution for Algebraic and Transcendental equation using Regula Falsi Method.
4	To find solution for Algebraic and Transcendental equation using Newton Raphson Method
5	To find solution of Linear System of equations using Gauss Elimination Method.
6	To find solution of Linear System of equations using Gauss - Siedal Method of Iteration.
7	To Implement Lagrangian method of interpolation.
8	To calculate numerical Differentiation using Newton's Forward Interpolation formula
9	To calculate Integration using Simpson's rule/Trapezoidal Rule

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Artificial Intelligence and Data Science

V Semester

AIDS2321 : OE I: Introduction to Data Science

Objective	Course Outcome
1. To understand the fundamentals of data analysis of data analysis	1. To interpret the data analysis task
2. To understand the data preparation and representation of data for analysis	2. To use the statistical techniques to prepare and present the data for analysis
3. To learn the fundamentals of probability theory and probability distribution	3. To use the probability theory to handle uncertainty in the applications
4. To comprehend the application domains of data analysis	4. To interpret the applications of data analysis

Unit No.	Contents	Max. Hrs.
1	Introduction to Data Science; role of data scientist, Types of Data, tool boxes for data scientists, introduction to R studio	7
2	Understanding different data sets Introduction to Data analysis, Types of Data analysis, Applications. Technologies involved in the data analysis	7
3	Preparing data for analysis: reading data from files, web, databases, Grouping and Displaying Data to Convey Meaning. Measure of central tendency, dispersion	7
4	Probability theory: basic concepts, applications, types. Bayes theorem	7
5	Probability distribution, Binomial distribution, Poisson distribution, Normal distribution. random variable.	7
6	Application domains of data analysis. Case studies in various application domains.	7

Textbooks:

1. "Statistics for Management", Richard I. Levin & David S. Rubin, 7th Edition, Pearson Education.

Reference Books:

1. "Practical Statistics for Data Scientists, 50 Essential Concepts", Peter Bruce & Andrew Bruce, O'Reilly Media
2. "An Introduction to Statistical Learning with Applications in R", Gareth James, Daniela Witten, Trevor Hastie & Robert Tibshirani, Springer Press

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MOOCs Links and additional reading, learning, video material

- | | |
|----|---|
| 1. | https://nptel.ac.in/courses/106106179 |
| 2. | https://www.youtube.com/watch?v=wrIvuzi56oQ |

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Artificial Intelligence and Data Science

V Semester

AIDS2322 : OE I: Foundations of AI

Objective	Course Outcome
<ol style="list-style-type: none">To understand challenges involved in designing intelligent systems.To represent given problem using state space representation and solve it by using different search techniques.To understand knowledge representation methods using logic programming.To understand uncertainty theory in designing AI systems.	<ol style="list-style-type: none">Understand the fundamentals of artificial intelligence and identify performance measure for given intelligent agentApply searching techniques for problem solvingApply the concept of knowledge representation and transform real life information in different representationsSolve AI problems using the techniques of uncertainty

Unit No.	Contents	Max. Hrs.
1	Introduction: Intelligent Agents, Agents and Environments, Rationality, Nature of Environments, Structure of Agents, Problem solving agents, Problem Formulation	6
2	Uninformed search strategies : Depth, Breadth, Uniform Cost, Depth Limited, Iterative deepening DFS, Bidirectional Search	6
3	Informed search strategies : Heuristic Search and Exploration, Greedy best first search, A* search, Memory bounded heuristic search, Heuristic functions, inventing admissible Heuristic functions, Local Search algorithms, Hill-climbing, Simulated Annealing	7
4	Constraint Satisfaction Problems, Backtracking Search, variable and value ordering, constraint propagation, intelligent backtracking, local search for CSPs, Adversarial Search, Games, The minimax algorithm, Alpha-Beta pruning, Imperfect Real-Time Decisions	8
5	Knowledge Based Agents, Logic, Propositional Logic: Inference, Equivalence, Validity and Satisfiability, Resolution, Forward and Backward Chaining, First Order Logic: Models for first order logic, Symbols and Interpretations, Atomic sentences, complex sentences, Quantifiers, Inference in FOL, Unification, Forward Chaining, Backward Chaining, Resolution	8
6	Uncertainty, Handling uncertain knowledge, rational decisions, basics of probability, axioms of probability, inference using full joint distributions, independence, Baye's Rule and conditional independence, Bayesian networks, Semantics of Bayesian networks, Exact inference in Bayesian Networks	7

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Artificial Intelligence and Data Science

Textbooks:

- | | | | | |
|----|---|-------|--------------------------|--------------------|
| 1. | Artificial Intelligence A Modern Approach | Third | s. Russell and P. Norvig | Pearson Education. |
|----|---|-------|--------------------------|--------------------|

Reference Books:

- | | | | | |
|----|---|--------|--|-------------|
| 1. | Artificial Intelligence | Second | E. Rich and K. Knight and Shivashankar B. Nair | McGraw Hill |
| 2. | Introduction to Artificial Intelligence and Expert System | Third | D. W. Patterson | PHI |

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V Semester

AIDS2331: OE II: Introduction to DBMS

Objective	Course Outcome
1. To learn different database system concepts 2. To learn various DBMS models like Hierarchical, Network and relational models 3. To learn the designing of Entity Relationship Diagram. 4. To Learn DDL, DML and related SQL Queries	Upon successful completion of the course students will be able to: 1. Understand the fundamental concepts of Database management system 2. Apply DDL and DML SQL Queries on given scenario and data handling using XML 3. Design Entity Relationship Diagram for any scenario and conversion of ER Diagram into relational Schema

Unit No.	Contents	Max. Hrs.
1	An Overview of the Database Management System: What is database? Why database?, database system, database management system (DBMS), advantages of DBMS	6
2	An Architecture of the Database system: Three levels of architecture, mappings, role of database administrator (DBA), E-R model, three approaches of DBMS relational, hierarchical and network.	6
3	Relational Database Management System (RDBMS): Introduction, RDBMS terminology, relational model, base tables, key	5
4	The SQL Language: Introduction, Characteristics of SQL, data definition command	5
5	Data manipulation commands	5
6	Introduction to XML	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Data base System Concepts	Fifth	Silberschatz A, Korth H.F and Sudarshan S,	Tata McGraw-Hill.
2	Fundamentals of Database System	Third	R. Elmasri, S. B Navathe	Pearson Education

Reference Books

SN	Title	Edition	Authors	Publisher
1	Fundamentals of DBMS		Leon A and Leon M	Vijay Nicole & Tata McGraw-Hill
2	DBMS		Gill P.S	I.K. Internationa

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V Semester

AIDS2331: OE II: Current Trends and Technologies

Objective	Course Outcome
<ol style="list-style-type: none">Gain fundamental knowledge of electronic communication.Understand the technologies in Internet, e-Technologies & e-Learning.Learn the basics of Green Computing and its implementation in industriesDevelop the understanding of concepts in Social Media.	<p>Upon successful completion of this course, the student will be able to:</p> <ol style="list-style-type: none">Use the basics of internet for deployment of various servers and recourses.Design and implement technologies for e-Commerce and e-Learning.Choose appropriate implementation of Green Computing.Make use of Social Networking properly and securely.

Unit No.	Contents	Max. Hrs.
1	Fundamentals of Communications: Types of communication-Wired, wireless, mobile, Modes of transmission: Simplex, Half Duplex, Full Duplex, Multiplexing techniques, History and evolution of wireless and mobile systems, Transition and characteristics of 1G, 2G, 3G, 4G, Spectrum, regulations, and frequency allocation	7
2	Fundamental of INTERNET: History, Internet working, Connections, Internet services, The World Wide Web, Tools for the WWW, Web servers, Web browsers, Web page makers and editors, Plugins and delivery vehicles.	6
3	e-Technologies: Electronic Commerce: Framework, Media Convergence of Applications, Consumer, Applications, Organization Applications, Electronic Payment Systems: Digital Token, Smart Cards, Credit Cards, Risks in Electronic, Payment System, Designing Electronic Payment Systems, Electronic Data Interchange (EDI): Concepts, Applications, (Legal, Security and Privacy) issues, EDI and Electronic Commerce, Standardization and EDI, EDI Software, Implementation, EDI Envelope for Message Transport, Internet-Based EDI.	7
4	e-Learning: Definition, Introduction, Types of e-Learning: Learner-led e-Learning, Facilitated e-Learning, Instructor-led e-Learning, Embedded e-Learning, Telemonitoring And e-Coaching ELearning Models: WBT, CBT, LMS, LCMS, Virtual School Systems, E-Learning Tools And Technologies: e-mail, Online Discussion, Chat and Instant Messaging, Voting, Whiteboard, Application Sharing, Conferencing, Online Meeting Tools, Case study.	6
5	Green Computing: Introduction, Why....Green Computing? Approaches to Green Computing-Virtualization, Power Management, Power supply, Storage, Video Card, Display, IT Equipment, Recycling, Remote Conferencing & Telecommuting Strategies, Product longevity, Resource allocation, Terminal servers, Operating system support, How to Implement? Industrial implementations of Green Computing- Blackle, Fit-PC, Zonbu computer, Sunray thin client.	6
6	Social Networking: Definition, Overview of Social Networking Sites, Types of Social Networking Sites: General purpose, Niche. Advantages of Social Networking Sites, Drawbacks of Social Networking Sites, Features and Need of Social Networking, Security Issues with Social Networking Sites, Case Studies	7

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Text Books

SN	Title	Edition	Authors	Publisher
1	Impact of E-Business Technologies on Public and Private Organizations		OzlemBak, Nola Stair	
2	Mobile Computing		Tomasz Imielinski Henry F. Korth	
3	Broadband telecommunications technology		Byeong Gi Lee, Minho Kang, Jonghee Lee	

Reference Books

SN	Title	Edition	Authors	Publisher
1	Introduction to broadband communication systems		Cajetan M. Akujuobi, Matthew, N. O. Sadiku	
2	E-Learning Tools and Technologies		William Hortan, Katherine Hortan	Wiley

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V Semester

Mandatory Learning Course

AU2126 : YCCE Communication Aptitude Preparation (YCAP5.1)

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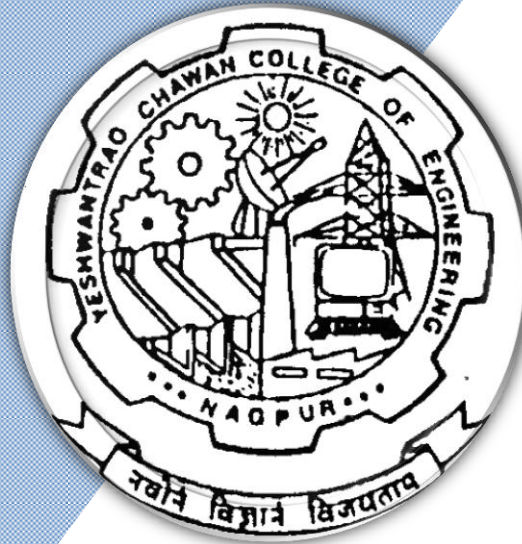
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Bachelor of Technology SoE & Syllabus 2021 6th Semester

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B.TECH SCHEME OF EXAMINATION 2021-22

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SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester															
1	6	HS	CT	AIDS2351	Management Studies	T	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	CT	AIDS2352	Business Analytics	T	3	0	0	3	3	30	20	50	3 Hours
3	6	PC	CT	AIDS2353	Business Analytics Lab	P	0	0	2	2	1		60	40	
4	6	PC	CT	AIDS2354	Machine Learning	T	3	0	0	3	3	30	20	50	3 Hours
5	6	PC	CT	AIDS2355	Machine Learning Lab	P	0	0	2	2	1		60	40	
6	6	PC	CT	AIDS2356	Advanced Web Technology Lab	P	0	0	2	2	1		60	40	
7	6	PE	CT		Professional Elective-II	T	3	0	0	3	3	30	20	50	3 Hours
8	6	OE	CT		Open Elective-III	T	3	0	0	3	3	30	20	50	3 Hours
9	6	OE	CT		Open Elective -IV	T	3	0	0	3	3	30	20	50	3 Hours
10	6	STR	CT	AIDS2357	Seminar	P	0	0	2	2	1			100	
TOTAL SIXTH SEM							18	0	8	26	22				

List of Professional Electives-II

Professional Electives -II

1	6	PE-II	CT	AIDS2361	PE-II : Computer Vision
2	6	PE-II	CT	AIDS2362	PE-II : Natural Language Processing
3	6	PE-II	CT	AIDS2363	PE-II : Robotics
4	6	PE-II	CT	AIDS2364	PE-II : Data Analytics for Industry 4.0
5	6	PE-II	CT	AIDS2365	PE-II : Social Media Analytics
6	6	PE-II	CT	AIDS2366	PE-II : Optimization Techniques
7	6	PE-II	CT	AIDS2367	PE-II : Internet of Things

Open Elective 3

1	6	OE-3	CT	AIDS2371	OE III: Introduction to Data Science
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Open Elective 4

1	6	OE-4	CT	AIDS2381	OE IV: Foundations of AI
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Audit Courses

1	6	HS		AU2130	YCCE Communication Aptitude Preparation (YCAP6.3) for CT, IT, CSE, IIoT, AIDS, CSD, AIML	A	3	0	0	3	0			
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MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activities decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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VI Semester

AIDS2351 : Management Studies

Objective	Course Outcome
<ol style="list-style-type: none">To provide the knowledge of various concept of economics and economyTo introduce economic alternatives and investment alternatives in the field of engineering and anywhere else.To introduce the fundamentals of management and marketing activities of Management .To introduce the Financial practice of Organization.	<ol style="list-style-type: none">Develop perspective about economy based on logical reasoning and estimate the economic outcomes.Interprets comparative advantage of resources.Explain the Functions of Management and identify tools and techniques of Marketing of goods and services.Analyze the role of Financial Accountancy and Management in the Organization.

Unit No.	Contents	Max. Hrs.
1	Introduction to Economics and engineering Economy: Economics and engineering economy, Utility analysis- Cardinal, ordinal, Law of diminishing marginal utility, Laws of demand and supply, elasticity of demand, its measurement and application.	6
2	Engineering Production and Costs Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Concepts and types of costs, Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation.	7
3	Market structures - equilibrium output and price Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duopoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination.	7
4	Principle of Management Evolution of Management Thought : Scientific and Administrative Theory of Management , Definition and Concept of Management, Functions of Management : Planning, Organizing, Directing, Coordinating and Controlling, Motivational Theories, Concept of Leadership .	6
5	Marketing Management Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting.	6

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6	Financial Accountancy and Management : Definition & Functions of Finance department, Sources of finance, Types of capital, Types of Taxes, Introduction of Accountancy and its rules, Preparation of Books of Account- Journal, Posting of transaction into ledger and preparation of trial balance, Introduction of trading account, profit and loss account and balance sheet.	7
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Text Books :

1. Modern Economics: H. L. Ahuja, 13th Edition, S. Chand Publisher, 2009.
2. Modern Economic Theory: K. K. Devett, 3rd edition, S. Chand Publisher, 2007
3. Principle of Economics: Mankiw N. Gregory, 7th edition, Thomson, 2013
4. Harold Koontz Ramchandra, Principles of Management, Tata McGraw hills
5. Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
6. Khan M Y - Financial Services (Tata Mc Graw Hill, 19)

Reference Books :

1. Advance Economic Theory: H. L. Ahuja, 17th Edition, S. Chand Publisher, 2009.
2. International Trade: M. L. Zingan, 12th edition, Vindra Publication, 2007.
3. Macro Economics: M. L. Zingan, 11th edition, Vindra Publication, 2007.
4. Economics: Samuelson,
5. Monetary Economics: M. L. Sheth, 1st Edition, Himalaya Publisher, 1995.
6. Economics of Development and Planning: S. K. Misra and V. K. Puri, 12th edition, Himalaya Publishing House, 2006.
7. Rajan Saxena: Marketing Management, Tata McGraw Hill.
8. Fabozzi - Foundations of Financial Markets and Institutions (Prentice hall, 3rd Ed.)
9. Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10. Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003).

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Artificial Intelligence and Data Science

VI Semester

AIDS2352: Business Analytics

Objective	Course Outcome
<ol style="list-style-type: none">Understand the concept of business intelligence, digital data and multidimensional data modeling.Have an appreciation of the process of building of multidimensional data model and various operations that can be performed on itGain an understanding of how to measure and present the business information.Develop an understanding of application of the business intelligence in the real-world scenario	<ol style="list-style-type: none">Apply the knowledge of basic concepts of Business Intelligence and multidimensional modelling and able to compare digital data types.Build and operate the multidimensional data model for the specific scenario to extract the information.Analyze the business information to construct the reports from it.Decide the mode / channel to implement the business intelligence solution for the specific problem.

Unit No.	Contents	Max. Hrs.
1	Introduction to Business Intelligence: Introduction to digital data and its types –structured, semi-structured and unstructured, BI Definitions & Concepts, BI Framework, BI Infrastructure Components –BI Process, BI Technology, BI Roles & Responsibilities, Business Applications of BI, BI best practices	8
2	Principles of Dimensional Modelling: Foundation for Fact based decision making, The STAR and SNOWFLAKE schema, Pros & Cons of the STAR/SNOWFLAKE Schema Dimensional Model, Slowly Changing Dimension tables, Fact-less Fact Tables, Aggregation Strategy, Time Dimension	7
3	Basics of Data Integration (Extraction Transformation Loading): Concepts of data integration, needs and advantages of using data integration, introduction to common data integration approaches, Meta data –types and sources, Introduction to data quality, data profiling concepts and applications, introduction to ETL using Pentaho data Integration (formerly Kettle).	7
4	Introduction to business metrics and KPIs, creating cubes using Microsoft Excel, Basics of Enterprise Reporting: A typical enterprise, Malcolm Baldrige -quality performance framework, balanced scorecard, enterprise dashboard, balanced scorecard vs. enterprise dashboard, enterprise reporting using MS Access / MS Excel, best practices in the design of enterprise dashboards.	6
5	Identifying Dimension tables and fact table, designing of dimension and fact tables" schema, design of snowflake schema, query redirection. Aggregations: Why aggregate? , designing Summary tables, which summaries to create.	6

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6	Case study: Overview and use of products from Pentaho and other open software. BI road Ahead: BI and mobility, BI and cloud computing, BI for ERP systems, Social CRM and BI	6
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Text Books

SN	Title	Edition	Authors	Publisher
1	Fundamentals of Business Analytics		R. N. Prasad, Seema Acharya	Wiley India
2	Data Warehousing in the real world A practical guide for building Decision Support System		Sam Anahory, Dennis Murray	PEARSON

Reference Books

SN	Title	Edition	Authors	Publisher
1				
2				

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Artificial Intelligence and Data Science

VI Semester

AIDS2353 : Business Analytics Lab

Sr. No.	Name of Practical
1	Design a conceptual multidimensional model for the given data.
2	Create a table for Time dimension using existing data source. Extract the data from various sources and move it to backup area.
3	Load the data from backup area to staging area and then Load data in data warehouse from staging area.
4	Create a chart report, by considering module names on the X-axis, Percentage Scored in the Various Modules on Y-axis.
5	Create a table report to display Year, Quarter, Month, Module name of the assessment conducted in the current month, Assessment type of the module conducted in the current month. Enable drill down for "Year," "Quarter, and "Month."
6	Graph the percentage sales over time to see the trends using given dataset. Also Pivot the data to see total sales by quarter and category and analyze the data
7	Report the sales by category and the corresponding freight charges. Filtering should be enabled in the Year and Quarter columns, and the selected Year and Quarter need to be visible. Also Sort the Sales data in terms of Year, Quarter and Month.
8	Extract the data from various sources using PENTAHO and apply the transformation on the data.
9	Describe the characteristics of data imported in R by using R functions.
10	Consider a data set and visualize it using appropriate visualization technique in 'R'
11	Apply data transformation and represent the data model in Orange tool
12	Perform data visualization using Tableau

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Artificial Intelligence and Data Science

VI Semester

AIDS2354 : Machine Learning

Objective	Course Outcome
<ol style="list-style-type: none">1. The basic concepts of machine learning and the relative strengths and weaknesses of different machine learning methods.2. To understand the concepts of different types of machine learning algorithms and how to apply a learning algorithms to sample.3. To understand the different methods of evaluation of machine learning algorithms4. To understand different ensembling methods and new techniques like deep and shallow learning	<p>Upon successful completion of the course students will be able to:</p> <ol style="list-style-type: none">1. Interpret machine learning techniques suitable for a given problem2. Apply machine learning techniques to solve the problems3. Compare machine learning techniques4. Evaluate different machine learning techniques

Unit No.	Contents	Max. Hrs.
1	Introduction, machine learning classes (i.e., supervised, unsupervised and reinforced), well posed and ill posed learning problems, designing a learning system, perspective and issues in machine learning, applications	7
2	Learning a class from Bayesian learning, learning theory (bias/variance tradeoffs; VC theory; large margins), Generative/discriminative learning, parametric/non-parametric learning linear and logistic regression, svm	7
3	Introduction, Density Estimation, Clustering Dimensionality reduction, PCA, kernel methods	7
4	Introduction, decision tree representation, appropriate problems for Decision Tree learning, the basics decision tree learning algorithm, hypothesis space search, inductive bias in decision tree learning, issues in decision tree learning.	7
5	Introduction, Factors, Response, and Strategy of Experimentation, Guidelines for Machine Learning Experiments, Cross-Validation and Resampling Method, Measuring Classifier Performance, Interval Estimation, Hypothesis Testing, Assessing a Classification Algorithm" Performance, Comparing Two Classification Algorithms, Comparing Multiple Algorithms: Analysis of Variance, Comparison over Multiple Datasets	7
6	Ensemble methods, Introduce the concepts behind deep learning and benefits of deep over shallow networks, introduce the concepts of reinforcement learning	7

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Text Books				
SN	Title	Edition	Authors	Publisher
1	“Introduction to Machine Learning”,	second edition	Ethem Alpaydin,	The MIT Press
2	“Machine Learning”,		Tom Mitchell,	McGraw-Hill Science/Engineerin, 1997

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Pattern Recognition and Machine Learning		Christopher M. Bishop,	
2	An Introduction to Reinforcement Learning		R. Sutton and A. Barto,	
3	Reinforcement Learning		C. Szepesvari, Algorithms	
4	Deep Learning		Ian Goodfellow, Yoshua Bengio, and Aaron Courville,	

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VI Semester

AIDS2355 : Machine Learning Lab

Sr. No.	Name of Practical
01	Overview of Machine Learning Python Libraries, Datasets, Environments, Keras, and Tensorflow.
02	Implementation of Supervised Learning Algorithms from Scratch.
03	Implementation of Unsupervised Learning Algorithms from Scratch.
04	Introduction to Tensors, TensorFlow Basic Syntax, TensorFlow Graphs, Variables and Placeholders
05	Tensor flow implementation of regression , k -nn for structured data using csv file
06	Tensor flow implementation of k means for structured data using csv file
07	Implement Neural Network for MLP Digit-Classifer using TensorFlow
08	Save and Restore Models

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VI Semester

AIDS2356 : Advanced Web Technology Lab

S.N	List of Practical
1.	Write a JavaScript function that creates a table, accept row, column numbers from the user, and input row-column number as content (e.g. Row-0 Column-0) of a cell.
2.	Create employee registration webpage using HTML5 form objects
3.	Implement CSS3 for Online shopping system
4.	Create a dynamic web page which displays arithmetic operations [addition, subtraction, division, multiplication and modulus] using HTML Forms
5.	Write a suitable scripts which show methods of Server object [HTML Encode, URL Encode, Mappath, Execute and Transfer]
6.	Write a script which creates and retrieves Cookies information
7.	Create a dynamic web page which displays capabilities of a web browser using Browser Capabilities Component using JavaScript
8.	Create a simple XMLHttpRequest and retrieve data from a TXT file.
9.	Create a simple script to download Images Using AJAX,
10.	Create a simple script to Auto-Populate Select Boxes using AJAX

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VI Semester

AIDS2361 : PE-II : Computer Vision

Objective	Course Outcome
Students will learn the algorithms and techniques in computer vision. Students learn how to process and image data by formulating problems with algorithms and techniques covered in this course.	<ol style="list-style-type: none">1. The study of computer vision provides our students with the knowledge to correctly apply the laws of nature to the creative formulation and solution of engineering problems through the use of analytical, computational and experimental techniques.2. The underlying principles such as geometric image formation models provide a solid background on the pertinent computer science, mathematical, and electrical engineering concepts that make up the foundations of the discipline of electrical engineering and computer science engineering, as well as their closely associated fields.3. Two-dimensional filtering theory will help provide mastery of a broad and working knowledge of the principles of electrical engineering and computer science4. Computer vision topics such as image formation, segmentation, and object detection will provide students with the ability to apply knowledge of computing, mathematics, science and engineering to solve problems in multidisciplinary research.

Unit No.	Contents	Max. Hrs.
1	Image formation, Image Transformations, Homogenous coordinates, Projective geometry, Camera geometry, camera calibration, vanishing points	4
2	Image Filters, Edge Detection. Corner Detection. Fitting, Feature Detection and Matching. Homographies. Image Stitching/Mosaicing	10
3	Epipolar Geometry. Stereo Vision, Segmentation, Recognition and Classification	8
4	Optical flow 3D reconstruction Object detection, Object recognition Object tracking	8
5	Computational tools for creating Image Panoramas: homographies, RANSAC for point-matching, SIFT (scale invariant feature transform) for detection of salient feature points, Algorithms for - shape from shading, depth from needle map; optical flow, Kanade-Lucas-Tomasi algorithm, applications of optical flow in underwater imagery; shape from stereo, epipolar geometry; structure from motion;	5
6	Photometric stereo - deriving shape from multiple images of an object taken under different lighting conditions; applications to illumination invariant face recognition, face relighting, Machine Learning in computer vision: Face detection using Adaboost, Object detection using parts, Classifiers. SVMs, Neural Nets, Deep Learning	5

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Text Books				
SN	Title	Edition	Authors	Publisher
1	Computer Vision: A Modern Approach	4th edition	Forsyth and PonceH	Pearson Education.
2	Introductory Techniques for 3D Computer Vision",		Emanuele Trucco and Alessandro Verri	Prentice Hall
3	Computer Vision Algorithms and Applications		Richard Szeliski	

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Robot Vision		B. K. P. Horn	MIT Press (Cambridge).
2	Trucco and Verri, Introductory Techniques for 3D Computer Vision, 1998			

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Artificial Intelligence and Data Science

VI Semester

AIDS2362 : PE-II : Natural Language Processing

OBJECTIVES	OUTCOMES
<ol style="list-style-type: none">To learn basic aspects of Natural languages used in processing, words.To get acquainted with the basic concepts and algorithmic description of the main language levels: morphology, syntax, semantics, and pragmatics.To understand the mathematical and linguistic foundations underlying approaches to the various areas in NLP	<p>Upon successful completion of the course, the student will be able to:</p> <ol style="list-style-type: none">Model linguistic phenomena with formal grammars.Design, implement and test algorithms for NLP problemsApply NLP techniques to design real world NLP applications

Unit No.	Contents	Max. Hrs.
1	Introduction: History of NLP, Generic NLP system, levels of NLP , Knowledge in language processing , Ambiguity in Natural language, stages in NLP, challenges of NLP, Applications of NLP	5
2	Morphology fundamentals: Morphological Diversity of Indian Languages, Morphology Paradigms, Shallow Parsing, Named Entities, Maximum Entropy Models, Random Fields. Word Level Analysis, Morphology analysis –survey of English and Indian language Morphology, Inflectional morphology & Derivational morphology, Lemmatization, Regular expression, finite automata, finite state transducers (FST) ,Morphological parsing with FST , Lexicon free FST Porter stemmer. N –Grams- N-gram language model, N-gram for spelling correction.	8
3	Structures : Theories of Parsing, Parsing Algorithms; Robust and Scalable Parsing on Noisy Text as in Web documents, Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution.	7
4	Meaning : Lexical Knowledge Networks, Wordnet Theory, Indian Language Wordnets and Multilingual Dictionaries, Semantic Roles, Word Sense Disambiguation, WSD and Multilinguality Semantic Analysis: Lexical Semantics, Attachment for fragment of English- sentences, noun phrases, Verb phrases, prepositional phrases, Relations among lexemes & their senses – Homonymy, Polysemy, Synonymy, Hyponymy, Robust Word Sense Disambiguation (WSD), Dictionary based approach	8
5	Pragmatics Discourse : Coreferences, reference resolution, reference phenomenon , syntactic & semantic constraints on co reference	7

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6	Natural language Processing applications (preferably for Indian regional languages) : Sentiment Analysis, Text Entailment, Robust and Scalable Machine Translation, Question Answering in Multilingual Setting, Cross Lingual Information Retrieval (CLIR)	7
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Text Books				
SN	Title	Edition	Authors	Publisher
1	Speech and Language Processing: An Introduction to Natural Language Processing, Speech Recognition, and Computational Linguistics		Jurafsky, Daniel, and James H. Martin,	PrenticeHall, 2000
2	Foundations of Statistical Natural Language Processing	1999	Christopher D. Manning and Hinrich Schütze,	Cambridge, MIT Press,.

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Natural Language Understanding	2 nd , 1995.	James Allen	Benjamin/Cummings
2	Statistical Language Learning	1996	Eugene Charniak	MIT Press
3	Harald Clahsen, Andrew Redford, Linguistics	1999	Martin Atkinson, David Britain,	Cambridge University Press

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VI Semester

AIDS2365: PE-II : Social Media Analytics

OBJECTIVES	OUTCOMES
<ol style="list-style-type: none">1. Familiarize the learners with the concept of social media analytics and understand its significance.2. Familiarize the learners with the tools of social media analytics.3. Enable the learners to develop skills required for analyzing the effectiveness of social media for business purposes	<ol style="list-style-type: none">1. Familiarize the learners with the concept of social media analytics and understand its significance.2. Familiarize the learners with the tools of social media analytics.3. Enable the learners to develop skills required for analyzing the effectiveness of social media for business purposes

Unit No.	Contents	Max. Hrs.
1.	Introduction to Social Media Analytics (SMA): Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas	6
2.	Network fundamentals and models: The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization	6
3.	Making connections: Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity.	6
4.	Web analytics tools: Clickstream analysis, A/B testing, online surveys, Web crawling and Indexing. Natural Language Processing Techniques for Micro-text Analysis	6
5.	Facebook Analytics: Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on FB. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. (LinkedIn, Instagram, YouTube Twitter etc. Google analytics. Introduction. (Websites)6	6
6.	Processing and Visualizing Data, Influence Maximization, Link Prediction, Collective Classification, Applications in Advertising and Game Analytics Introduction to Python Programming, Collecting and analyzing social media data; visualization and exploration	6

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1. Reference Books:

Sr. No.	Author	Name of the Book	Publisher	Year of Publication
1	Matthew Ganis, Avinash Kohirkar	Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media	Pearson	2016
2	Jim Sterne	Social Media Metrics: How to Measure and Optimize Your Marketing Investment	Wiley	Latest edition
3	Oliver Blanchard	Social Media ROI: Managing and Measuring Social	Que Publishing	Latest edition
		Media Efforts in Your Organization (Que Biz-Tech)		
4	Marshall Sponder	Social Media Analytics	McGraw Hill	Latest edition
5	Tracy L. Tuten, Michael R. Solomon	Social Media Marketing	Sage	Latest edition

2. List of Journals / Periodicals / Magazines / Newspapers, etc.

1. Indian Journal of Marketing
2. The Journal of Social Media in Society
3. Social Networks
4. Journal of Digital and Social Media Marketing
5. Social Media Marketing (Magazine)
6. Brand Equity – Economic Times

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VI Semester

AIDS2366 : PE-II : Optimization Techniques

OBJECTIVES	OUTCOMES
<ol style="list-style-type: none">Students will be able to understand basic theoretical principles for formulation of optimization models and its solution.Students will be able to learn the unified and exact mathematical basis as well as the general principles of various soft computing techniques.Students should be able to apply detailed theoretical and practical aspects of intelligent modeling, optimization and control of linear and non-linear Systems.	<ol style="list-style-type: none">Students will be able to understand basic theoretical principles for formulation of optimization models and its solution.Students will be able to learn the unified and exact mathematical basis as well as the general principles of various soft computing techniques.Students should be able to apply detailed theoretical and practical aspects of intelligent modeling, optimization and control of linear and non-linear Systems.

Unit No.	Contents	Max. Hrs.
1	Unconstrained Optimization: Optimizing Single-Variable Functions, conditions for Local Minimum and Maximum, Optimizing Multi-Variable Functions.	
2	Constrained Optimization: Optimizing Multivariable Functions with Equality Constraint: Direct Search Method, Lagrange Multipliers Method, Constrained Multivariable Optimization with inequality constrained: KuhnTucker Necessary conditions, Kuhn –Tucker Sufficient Conditions.	
3	Optimization: Quasi-Newton Methods and line search, least squares optimization, Gauss-Newton, Levenberg- Marquardt, Extensions of LP to Mixed Integer Linear Programming (MILP),	
4	Non-Linear Programming, The Newton Algorithm, Non-Linear Least Squares, Sequential Quadratics Programming (SQP), Constrained Optimization, SQP Implementation, Multi-Objective Optimization, Branch and Bound Approaches, Genetic Algorithms and Genetic Programming,	
5	Optimization in Operation Research: Dynamic Programming, Transportation – Linear Optimization Simplex and Hitchcock Algorithms, Algorithms, Minimax and Maximum Algorithm, Discrete Simulation	
6	Integer Programming – Cutting Plane Methods, Separable Programming, Stochastic Programming, Goal Programming, Integer Linear Programming, Pure and Mixed Strategy in theory of Games, Transshipment Problems, Heuristic Methods	

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Text Books				
SN	Title	Edition	Authors	Publisher
1	Operations Research: Applications and Algorithms	Latest	Winston W L	<u>Cengage Learning</u>
2	Optimization: Theory and Applications	Latest	<u>L. Cesari</u>	Springer
	Model Building in Mathematics Programming	March 2013	H. Paul Williams	Wiley

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Integer and Combinatorial Optimization	Latest	G.L. Nemhauser and L.A. Wolsey.	Wiley
2	Discrete Optimization	Latest	R.G. Parker and R.L. Rardin.	

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VI Semester

AIDS2367 : PE II: Internet of Things

Objective	Course Outcome
At the end of the course, the students will be able to- 1. Get acquainted with various IOT environments. 2. Study IOT architecture and its enabling technologies. 3. Acquire hands on laboratory experience, utilizing IOT kit.	 1. Design and evaluate various IOT environments. 2. Describe IOT architecture and its enabling technologies. 3. Analyze IOT environments using various communication technologies 4. Apply various IOT enabling technologies for creation of IOT environments.

Unit No.	Contents	Max. Hrs.
1	Introduction: Concepts behind the Internet of Things, Characteristics of IoT, IoT enabling technologies, IoT Communication Model, IoT architecture, Applications of IoT, Transducers, Sensors, Sensor classes, Sensor types, Actuators and its types	5
2	IOT Protocols: Application layer: MQTT, COAP, XMPP, AMQP, Network Layer: IPv4, IPv6, 6LoWPAN, IoT Communication protocols: IEEE802.15.4, ZigBee, Wireless HART, Zwave, Bluetooth, NFC, RFID .	7
3	Wireless Sensor networks: Components of sensor nodes, Node Behavior in WSNs, Applications, WSN Coverage, OGDC algorithm, Stationary and Mobile Wireless Sensor Networks.	6
4	Cloud Computing: Recent Trends in Computing, Characteristics, Components of Cloud Computing, Service Models, Deployment Models, Service Management, Cloud Security, IoT Data analytics, Case studies, Middleware for IoT.	6
5	Machine to Machine Communication: Node types, IP and Non-IP based M2M network Interoperability in Internet of Things: Current Challenges in IoT, Interoperability, Types of Interoperability	6
6	Software-Defined Networking: Current Network to SDN, SDN Architecture, Challenges, OpenFlow Protocol, APIs in SDN, Controller Placement, Recent Advances of SDN in IoT, Industrial internet of things, Case studies .	6

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Artificial Intelligence and Data Science

Text Books

SN	Title	Edition	Authors	Publisher
1	Internet of Things A hands on approach	First Edition	Arshdeep Bahga and Vijay K. Madiseti	Orient Blackswan Private Limited - New Delhi

Reference Books

SN	Title	Edition	Authors	Publisher
1	NPTEL course material on Introduction to Internet of Things			

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(Department of Computer Technology)

Artificial Intelligence and Data Science

VI Semester

AIDS2371 : OE III: Introduction to Data Science

Objective	Course Outcome
1. To understand the fundamentals of data analysis of data analysis	1. To interpret the data analysis task
2. To understand the data preparation and representation of data for analysis	2. To use the statistical techniques to prepare and present the data for analysis
3. To learn the fundamentals of probability theory and probability distribution	3. To use the probability theory to handle uncertainty in the applications
4. To comprehend the application domains of data analysis	4. To interpret the applications of data analysis

Unit No.	Contents	Max. Hrs.
1	Introduction to Data Science; role of data scientist, Types of Data, tool boxes for data scientists, introduction to R studio	7
2	Understanding different data sets Introduction to Data analysis, Types of Data analysis, Applications. Technologies involved in the data analysis	7
3	Preparing data for analysis: reading data from files, web, databases, Grouping and Displaying Data to Convey Meaning. Measure of central tendency, dispersion	7
4	Probability theory: basic concepts, applications, types. Bayes theorem	7
5	Probability distribution, Binomial distribution, Poisson distribution, Normal distribution. random variable.	7
6	Application domains of data analysis. Case studies in various application domains.	7

Textbooks:

1. "Statistics for Management", Richard I. Levin & David S. Rubin, 7th Edition, Pearson Education.

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Artificial Intelligence and Data Science

Reference Books:

- | | |
|----|---|
| 1. | "Practical Statistics for Data Scientists, 50 Essential Concepts", Peter Bruce & Andrew Bruce, O'Reilly Media |
| 2. | "An Introduction to Statistical Learning with Applications in R", Gareth James, Daniela Witten, Trevor Hastie & Robert Tibshirani, Springer Press |

MOOCs Links and additional reading, learning, video material

- | | |
|----|---|
| 1. | https://nptel.ac.in/courses/106106179 |
| 2. | https://www.youtube.com/watch?v=wrIvuzi56oQ |

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Artificial Intelligence and Data Science

VI Semester

AIDS2381 : OE IV: Foundations of AI

Objective	Course Outcome
1. To understand challenges involved in designing intelligent systems.	1. Understand the fundamentals of artificial intelligence and identify performance measure for given intelligent agent
2. To represent given problem using state space representation and solve it by using different search techniques.	2. Apply searching techniques for problem solving
3. To understand knowledge representation methods using logic programming.	3. Apply the concept of knowledge representation and transform real life information in different representations
4. To understand uncertainty theory in designing AI systems.	4. Solve AI problems using the techniques of uncertainty

Unit No.	Contents	Max. Hrs.
1	Introduction: Intelligent Agents, Agents and Environments, Rationality, Nature of Environments, Structure of Agents, Problem solving agents, Problem Formulation	6
2	Uninformed search strategies : Depth, Breadth, Uniform Cost, Depth Limited, Iterative deepening DFS, Bidirectional Search	6
3	Informed search strategies : Heuristic Search and Exploration, Greedy best first search, A* search, Memory bounded heuristic search, Heuristic functions, inventing admissible Heuristic functions, Local Search algorithms, Hill-climbing, Simulated Annealing	7
4	Constraint Satisfaction Problems, Backtracking Search, variable and value ordering, constraint propagation, intelligent backtracking, local search for CSPs, Adversarial Search, Games, The minimax algorithm, Alpha-Beta pruning, Imperfect Real-Time Decisions	8
5	Knowledge Based Agents, Logic, Propositional Logic: Inference, Equivalence, Validity and Satisfiability, Resolution, Forward and Backward Chaining, First Order Logic: Models for first order logic, Symbols and Interpretations, Atomic sentences, complex sentences, Quantifiers, Inference in FOL, Unification, Forward Chaining, Backward Chaining, Resolution	8
6	Uncertainty, Handling uncertain knowledge, rational decisions, basics of probability, axioms of probability, inference using full joint distributions, independence, Baye's Rule and conditional independence, Bayesian networks, Semantics of Bayesian networks, Exact inference in Bayesian Networks	7

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Artificial Intelligence and Data Science

Textbooks:

- | | | | | |
|----|---|-------|--------------------------|--------------------|
| 1. | Artificial Intelligence A Modern Approach | Third | s. Russell and P. Norvig | Pearson Education. |
|----|---|-------|--------------------------|--------------------|

Reference Books:

- | | | | | |
|----|---|--------|--|-------------|
| 1. | Artificial Intelligence | Second | E. Rich and K. Knight and Shivashankar B. Nair | McGraw Hill |
| 2. | Introduction to Artificial Intelligence and Expert System | Third | D. W. Patterson | PHI |

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(Department of Computer Technology)

Artificial Intelligence and Data Science

VI Semester

Audit Course

AU2130 : YCCE Communication Aptitude Preparation (YCAP6.3)

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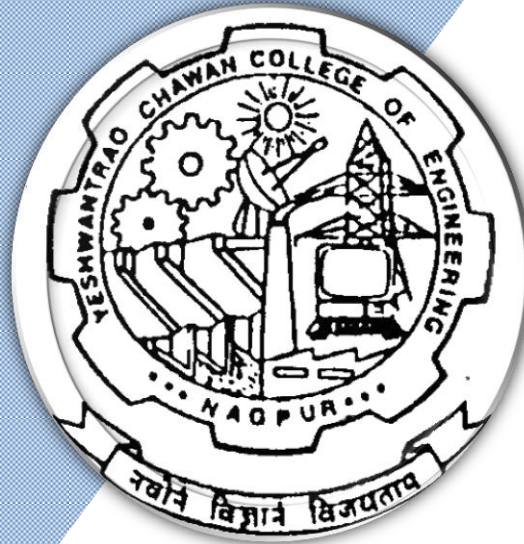
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Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of Technology

SoE & Syllabus 2021

7th & 8th Semester

(Department of Computer Technology)

Artificial Intelligence and Data Science



B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Technology)

Artificial Intelligence and Data Science

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester															
1	7	PC	CT	AIDS2401	Deep Learning	T	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	CT	AIDS2402	Lab : Deep Learning	P	0	0	2	2	1		60	40	
3	7	PC	CT	AIDS2403	Big Data and Hadoop	T	3	0	0	3	3	30	20	50	3 Hours
4	7	PC	CT	AIDS2404	Lab:Big Data and hadoop	P	0	0	2	2	1		60	40	
5	6	PC	CT	AIDS2405	Computational Logic	T	3	0	0	3	3	30	20	50	3 Hours
6	7	PE	CT		Professional Elective-III	T	3	0	0	3	3	30	20	50	3 Hours
7	7	PE	CT		Professional Elective-IV	T	3	0	0	3	3	30	20	50	3 Hours
8	7	PE	CT		Professional Elective-V	T	3	0	0	3	3	30	20	50	3 Hours
9	7	PC	CT	AIDS2406	Software Lab 4	P	0	0	2	2	1		60	40	
10	7	STR	CT	AIDS2407	Mini Project	P	0	0	4	4	2		100		
11	7	BES	CT	AIDS2408	Creativity, Innovation and Design Thinking	T	1	0	0	1	1		50	50	1.5 Hours
12	7	STR	CT	AIDS2409	Campus Recruitment Training (CRT)	P	0	0	0	0	1		100		
TOTAL SEVENTH SEM							19	0	10	29	25				

Professional Electives -III

1	7	PE-III	CT	AIDS2411	PE III: Data Modeling and Simulation
2	7	PE-III	CT	AIDS2412	PE III: Sensor Networks and Data Analysis
3	7	PE-III	CT	AIDS2413	PE III: Data Warehousing

Professional Electives -IV

1	7	PE-IV	CT	AIDS2421	PE IV: Data Visualization
2	7	PE-IV	CT	AIDS2422	PE IV: Cloud Computing
3	7	PE-IV	CT	AIDS2423	PE IV: AI for Medical Diagnosis
4	7	PE-IV	CT	AIDS2424	PE IV: Distributed Systems

Professional Electives -V

1	7	PE-V	CT	AIDS2431	PE V: Data Security
2	7	PE-V	CT	AIDS2432	PE V: Time series analysis and Forecasting
3	7	PE-V	CT	AIDS2433	PE V: Video Analytics

Eighth Semester																
1	8	STR		AIDS2451	Major Project	P	0	0	12	12	9		60	40		
2	8	STR		AIDS2452	Extra Curricular Activity Evaluation	P	0	0	0	0	1		100			
TOTAL EIGHTH SEM							0	0	12	12	10					
GRAND TOTAL							85	0	54	135	158					

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activities decided by course teacher, 4 marks on class attendance

TA** = for Practical : MSPA will be 15 marks each

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SoE No.
ADS-203.1

B.Tech in Artificial Intelligence and Data Science

VII SEMESTER AIDS2401 : Deep Learning

Course Outcomes:

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

1. Explain and apply the concept of deep learning and optimization
2. Explain and design neural network
3. Describe and design recurrent neural network
4. Interpret and construct convolutional neural network
5. Comprehend the concept of unsupervised learning

Unit I: Introduction: History of Deep Learning, Deep Learning Success Stories, Deep learning in current scenario, Deep learning Vs Machine Learning, Linear regression, Overfitting and underfitting problem, Hyperparameter and model validation, Estimators, Bias and Variance	7 Hrs.
Unit II: Introduction to optimization: Gradient Descent, Model regularization, Stochastic gradient descent, Minibatch gradient descent	7 Hrs.
Unit III: Introduction to neural network: McCulloch Pitts Neuron, Thresholding Logic, Perceptron's, Perceptron Learning Algorithm, Feedforward Neural Networks, Backpropagation, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons	8 Hrs.
Unit IV: Deep learning for sequences: Recurrent layers, Simple RNN and Backpropagation, Training RNN, dealing with vanishing and exploding gradients	7 Hrs.
Unit V: Deep Learning for images: CNN architecture, training CNN. Learning new tasks with pre-trained CNNs, data transformation using PCA, Deep learning for Computer vision	8 Hrs.
Unit VI: Unsupervised representation learning: Autoencoders, autoencoders applications, Word embeddings, Generative Models, Generative Adversarial Networks, Applications of Adversarial approach	8 Hrs.
Total Lecture	45 Hours

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Textbooks:

1.	Introduction to Deep learning	3rd Edition	Eugene Charniak	MIT Press, 2019
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Reference Books:

1.	Deep Learning	GoodFellow, YoshuaBengio, Aaron Courville
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YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

1	

MOOCs Links and additional reading, learning, video material

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B.Tech in Artificial Intelligence and Data Science

VII SEMESTER

AIDS2402 : Deep Learning Lab

Deep Learning Laboratory

Sr. No.	List of Experiment
1	Implementation of basic machine learning algorithms.
2	Implementation and analysis of simple linear regression
3	Implementation and analysis of linear regression with gradient descent
4	Implementation of neural network
5	Implementation of Simple RNN using python
6	Implementation of CNN using python
7	Implementation of CNN for image classification
8	Implementation and analysis of PCA
9	Implementation of basic machine learning algorithms.

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B.Tech in Artificial Intelligence and Data Science

VII SEMESTER

AIDS2403 : Big Data and Hadoop

Course Outcomes:

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

- Work with big data platform and explore the big data analytics techniques business applications.
- Design efficient algorithms for mining the data from large volumes.
- Analyze the HADOOP and Map Reduce technologies associated with big data analytics.
- Explore on Big Data applications Using Pig and Hive.

Unit 1: Introduction To Big Data And Hadoop

7 Hrs.

Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analyzing Data with Unix tools, Analyzing Data with Hadoop, Hadoop Streaming,

Unit II: HDFS (Hadoop Distributed File System)

7 Hrs.

Data Storage :The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Name-nodes and Data-nodes, Blocks, Data Replication, Fault Tolerance, Data Integrity, Namespaces. Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

Unit III: Data Processing

8 Hrs.

Map-Reduce, The fundamentals: map() and reduce(), Data Locality, Architecture of the Map-Reduce framework. Phases of a Map-Reduce Job, Custom types and Composite Keys, Custom Comparators .Input Formats and Output Formats, Distributed Cache, Map-Reduce Design Patterns. Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

Unit IV: Data Integration

7 Hrs.

Integrating Hadoop into your existing enterprise. Introduction to Sqoop

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<p>Unit V: Hadoop Eco System</p> <p>Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.</p> <p>Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.</p> <p>Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.</p> <p>Big SQL : Introduction</p>	<p>8 Hrs.</p>
<p>Unit VI: Data Analytics with R</p> <p>Machine Learning : Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering.</p> <p>Big Data Analytics with BigR.</p>	<p>8 Hrs.</p>
<p>Total Lecture</p>	<p>45 Hours</p>

Textbooks:

1.	Introduction to Deep learning Definitive Guide	3rd Edition Tom White	Eugene Charniak O'reily Media, 2012.	MIT Press, 2019	Hadoop: The
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Reference Books:

1.	, "Big Data and Business Analytics" Auerbach Publications, Jay Liebowitz CRC press (2013)
2.	Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop Tom Plunkett, Mark Hornick McGraw-Hill/Osborne Media (2013), Oracle press.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

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MOOCs Links and additional reading, learning, video material

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VII SEMESTER

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B.Tech in Artificial Intelligence and Data Science

AIDS2405: Computational Logic

Course Outcomes:

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

1. Understand the basics of Propositional logic
2. Acquire skills on natural deduction rules to handle Propositional logic
3. Acquire skills on derived rules to handle Propositional logic
4. Understand the First order Logic

Unit I: Introduction to Logic

7 Hrs.

Overview of logic and its importance in computer science. Propositional logic: syntax, semantics, and truth tables, Equivalence of two Propositional Logic Statements, Application of propositional logic in circuit design and Boolean algebra.

Unit II: Introduction to Propositional Logic

7 Hrs.

Unique Parsing, Determining Proper Propositions, Interpretation of Propositional Logic Statement, Natural Deduction rules, Validating Sequent using Natural Deduction, Derived Rules and Its proof, Examples of Derived rules, Sequent with Nil LHS.

Unit III: First order logic

8 Hrs.

Relations and predicates, Formulas, Interpretations, Logical Equivalence, Semantic tableaux, Algorithm for semantic tableaux, Soundness Theorem, Completeness Theorem.

Unit IV: Introduction to Predicate Logic

7 Hrs.

Introduction to Predicate Logic, Syntax and semantics of predicate logic, Quantifiers and their properties, Rules of inference and proofs in predicate logic. Use of predicate logic in formalizing mathematical reasoning. Term in Predicate Logic, Model in Predicate Logic, Parse Tree, Free and Bounded variables.

Unit V: Logical Programming with Prolog

8 Hrs.

Introduction to Prolog and its syntax. Use of facts, rules, and queries in Prolog. Recursion and backtracking in Prolog programming. Application of Prolog in natural language processing and expert systems

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Unit VI: Temporal logic

8 Hrs.

Syntax and Semantics , Modal of time, Semantic Tableaux , Binary Temporal Operators , Branching Time Temporal Logic , Binary Decision Diagram, Algorithms for BDD , Ordered Binary Decision Diagram.

Total Lecture

**45
Hours**

Textbooks:

1.	I.M.Copi, D.Cohen, P.Jetli, M.Prabakar, "Introduction to Logic", Pearson Education,2006
2.	Mordechai Ben-Ari,"Mathematical Logic for Computer Science" ,III Edition,Springer ,2012
3.	Jean H. Gallier"Logic for Computer Science: Foundations of Automatic Theorem Proving", Second Edition, Dover Publications,2014
4.	"Principles of Model Checking" by Christel Baier and Joost-Pieter Katoen:

Reference Books:

1.	Huth M and Ryan M ,” Logic in Computer Science : Modeling and Reasoning about systems”, Cambridge University Press, 2005
2.	Automated Reasoning: Introduction and Applications" by Hantao Zhang

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

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MOOCs Links and additional reading, learning, video material

1.	https://www.udemy.com/course/introduction-to-computational-logic/?couponCode=LEADERSALE24B

Advanced Topics

Applications of computational logic in knowledge representation and reasoning.

VII SEMESTER

AIDS2411 : PE III: Data Modeling and Simulation

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B.Tech in Artificial Intelligence and Data Science

Course Outcomes:

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

- Understand the concepts of relational database modelling, multidimensional data modelling, unstructured data modeling.
- Apply the knowledge of database modelling concepts for structured data to create the database model.
- Apply the knowledge of database modelling concepts for un-structured data to create the database model.
- Analyze the data to find the suitable data modelling approach.

Unit 1: Introduction: Concepts of Data Modelling, Data Modelling Types, Data Model Standards, Business Requirements. Relational data base modeling concepts. Creation logical data model, creation physical data model, implementation of data models into databases. ER approach (subtypes and supertypes, Extensions and Alternatives), advanced Normalization concepts .	7 Hrs.
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Unit II: Multidimensional Data Model: OLAP and OLTP Concepts, Multidimensional Data Modelling, Concepts of facts, dimension, Types of facts and dimensions, types of schemas. Time dependant data, Data Cube Technology, Modelling for Data Warehouses and Data Marts.	7 Hrs.
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Unit III: Enterprise Data Models and Data Management, aggregate data models, More details on data models, Relationships, Graphs databases, schemaless databases, Materialized views, modelling for data access. Data Models for GIS (Geographical Information System)	8 Hrs.
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Unit IV: Modelling Unstructured data: Introduction to NoSQL databases, Basic Map Reduce, Partitioning and Combining, Composing Map Reduce Calculations, Key – Value databases. What is Key – Value Store?, Key – Value store features, transactions, structure of data, case studies based on actual data bases	7 Hrs.
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B.Tech in Artificial Intelligence and Data Science

Unit V: Document Databases: Introduction, Features, Consistency, Transactions, availability, Query Features, scaling, suitable use cases	8 Hrs.
Unit VI: Graph Databases: Introduction of the graph databases, features, consistency, Transactions, Availability, Query Features, suitable use cases	8 Hrs.
Total Lecture	45 Hours

Textbooks:

1.	Data Modelling Essentials	3rd Edition	Graeme C. Simsion, Graham C. Witt	MORGAN KAUFMANN PUB.
2.	Data Mining Concepts and Techniques	Latest	Jiawei Han, Micheline Kamber, Jian Pei	MORGAN KAUFMANN PUB.
3.	NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence	NA	Sadalage, P. & Fowler	Wiley Publications, 1st Edition, 2019

Reference Books:

1.	Fundamentals of Business Analytics	Latest	R. N. Prasad, Seema Acharya	Wiley India
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YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

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MOOCs Links and additional reading, learning, video material

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B.Tech in Artificial Intelligence and Data Science

VII SEMESTER

AIDS2412 : Sensor Networks and Data Analysis

Course Outcomes :

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

1. Understand the architecture and components of sensor networks
2. Learn about various types of sensors and their applications
3. Acquire skills in data collection and preprocessing from sensor networks
4. Apply data analysis techniques to sensor data
5. Develop proficiency in using software tools for data analysis

Unit I:

6 Hrs.

Introduction to Sensor Networks: Overview of sensor networks, Applications of sensor networks, Types of sensors and their characteristics. Sensor network architecture, Communication protocols in sensor networks, Energy management and optimization in sensor networks.

Unit II:

6 Hrs.

Data Collection and Management: Data collection methods, Data aggregation techniques, Data storage and retrieval.

Unit III:

6 Hrs.

Preprocessing Sensor Data: Data cleaning and preprocessing, Noise reduction techniques, Data normalization and transformation.

Unit IV:

6 Hrs.

Data Analysis Techniques: Statistical methods for sensor data analysis, Machine learning techniques for sensor data, Time series analysis. **Advanced Topics:** Sensor fusion, Distributed data processing, Security and privacy in sensor networks

Unit V:

6 Hrs.

Case Studies and Applications: Environmental monitoring, Healthcare applications, Industrial applications.

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Unit VI:	6 Hrs.
Project Presentations: Student project presentations, Discussion and feedback	
	Total Lecture 36 Hours

Textbooks:	
1.	"Wireless Sensor Networks" by Kazem Sohraby, Daniel Minoli, and Taieb Znati
2.	"Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications" by Nitaigour P. Mahalik

Reference Books:	
1.	
2.	

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MOOCs Links and additional reading, learning, video material	
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VII SEMESTER

AIDS2413 : PE III: Data Warehousing

Course Outcomes:

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

- Identify the key processes of data mining, data warehousing and knowledge discovery process.
- Understand the basic principles and algorithms used in practical data mining and their strengths and weaknesses.
- Apply data mining techniques to solve problems in other disciplines in a mathematical way.

Unit 1: Data Warehousing: Introduction to data warehousing, real time applications, scope of mining and warehousing for various applications. Data warehousing Various schema, three-tier architecture, design issues, multidimensional model. Data warehouse development life cycle Data Warehouse Design - Massive denormalisation, STAR schema design, Data ware house Architecture, OLAP, ROLAP and MOLAP , concepts of Fact and dimension table.

7 Hrs.

Unit II: System Processes: Extract and Load process, Clean and transform data, Backup and Archive, Query management process. Process Architecture: Load, Warehouse, and Query Manager, Detailed and summary information, Metadata, Data marts.

7 Hrs.

Unit III: Aggregations, Data warehouse analysis and statistical queries, CUBE, ROLL UP and STAR queries.

8 Hrs.

Unit IV:

Space Management in Data warehouse - Schemas for storing data in warehouse using different storage structures, B-tree index, hash index, clusters, Bitmap index functional index, domain index, Data partitions.

7 Hrs.

Unit V: Performance and Tuning- Query optimization, memory management, process management. I/o management for Data warehouse.

8 Hrs.

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Unit VI: Handling BIG data, NO sql database, Columnar database.	8 Hrs.
Total Lecture	45 Hours

Textbooks:

1.	Data Warehousing, Data Mining &OLAP Fourteenth reprint 2008 Alex Berson, Stephen Smith Tata McGraw-Hill
2.	Sam Anahony, "Data Warehousing in the real world: A practical guide for building decision support systems", John Wiley
3.	W.H.Inmon, C.Kelly, Developing the Data Warehouse", John Wiley & Sons

Reference Books:

1.	W. H. Inmon, "Building the operational data store", 2nd Ed., John Wiley
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VII SEMESTER

AIDS2424: PE-IV: Distributed Systems

Course Outcomes:

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

- Identify the advantages and challenges in designing distributed algorithms for different primitives like mutual exclusion, deadlock detection, agreement, etc.
- Design and develop distributed programs using sockets and RPC/RMI.
- Differentiate between different types of faults and fault handling techniques in order to implement fault tolerant systems.
- Analyze different algorithms and techniques for the
- design and development of distributed systems subject to specific design and performance constrain

Unit 1: Architecture of Distributed Systems:

7 Hrs.

Characteristics of Distributed System, Motivation, challenges /Issues in the design & development of Distributed System.

System Models: Architecture Model, System Architecture, Types of Architectural Model: Client server model, Search engine, Proxy server & caches, Variation on client server model: mobile code, mobile agents. Fundamental Models: Interaction model, failure model, Security model.

Distributed Objects & Distributed file system :

Inter-process communication, Sockets, middle ware, Group communication, and Remote procedure calls. CORBA, RMI, Distributed file system, Name services, Directory services, File Service types, download/upload model, File sharing semantics, session semantics, Server design: stateless & stateful server, Cache update policies.

Unit II: Theoretical Foundations:

7 Hrs.

Inherent limitations of distributed systems, Timing issues, clock synchronization, Network time protocol, Lamport's logical clocks, Vector clocks, Casual ordering of messages, Global state, Cuts of Distributed computation, Termination detection.

Unit III: Distributed Mutual Exclusion:

8 Hrs.

Leader election: Chang Robert Ring based leader election algorithm, Bully algorithm. Classification of mutual exclusion algorithms, Requirements and performance measures of mutual exclusion algorithms, Non Token Based Algorithms: Lamport's Algorithm, The Ricart-Agrawala Algorithm, Maekawa's Algorithm. Token Based Algorithms: Suzuki- Kasami's Algorithm, Raymond's Algorithm, Comparative performance analysis.

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Unit IV: Distributed Deadlock Detection: Resource vs Communication deadlocks, graph theoretic model, deadlock prevention, avoidance, detection, Issues in deadlock detection and resolution, Centralized deadlock detection algorithms, distributed deadlock detection algorithms	7 Hrs.
Unit V: Agreement Protocols: Synchronous vs. asynchronous computations, model of process failures, authenticated vs. non-authenticated messages. A classification of Agreement problems, Solutions to Byzantine Agreement problem, Applications of Agreement algorithms.	8 Hrs.
Unit VI: Failure recovery and Fault Tolerance: Classification of failures. Backward and forward error recovery, Basic approaches of backward error recovery, recovery in concurrent systems, consistent set of checkpoints, synchronous check pointing and recovery, asynchronous check pointing and recovery. Fault Tolerance: Atomic actions and committing, commit protocols, non-blocking commit protocols, Voting protocols, Dynamic voting protocols, Dynamic Vote Reassignment Protocols.	8 Hrs.
Total Lecture	45 Hours

Textbooks:

- Advanced Concepts In Operating Systems: Distributed, Multiprocessor and Database
Operating Systems Mukesh Singhal and Niranjan G. Shivaratri McGraw Hill
- Distributed Operating Systems Concepts and Design G Coulouris, Jean Dollimore, Tim Kindberg
Addison Wesley

Reference Books:

- Distributed Algorithms Nancy Lynch Morgan Kaufman
- Modern Operating Systems Andrew S. Tanenbaum Pearson Education
- Distributed Operating Systems: Concepts and Design Pradeep K. Sinha Prentice-Hall of India
Pvt.Ltd

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VII SEMESTER

AIDS2413 : PE III: Data Warehousing

Course Outcomes:

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

- Understand deeper knowledge of statistical theory and methods particularly common problems in economical social sciences especially economics.
- Able to estimate models for time-series data.
- Able to interpret the results of an implemented statistical analysis
- Limitations and possible sources of errors in the analysis

Unit I: Time series and their components: decomposition , trend , seasonality adjusted data , cyclical and irregular variations	7 Hrs.
Unit II: Exploring time series data patterns: exploring data patterns with autocorrelation analysis, choosing a forecasting technique, measuring forecasting error , determining adequacy of a forecasting technique	7 Hrs.
Unit III: Moving averages and Smoothing methods: Naïve models, forecasting methods based on averaging, exponential smoothing methods adjusted for trend: Holts method , and exponential smoothing methods adjusted for trend and seasonal variation -Winters method	8 Hrs.
Unit IV: Regression with time series data : simple and multiple regression analysis , time series data and problem of autocorrelation, Durbin Watson test for serial correlation, problem of heteroscedasticity, using regression to forecast seasonal data	7 Hrs.
Unit V: Box Jenkins (ARIMA) methodology: Autoregressive models, moving average models, Autoregressive moving average models, implementing the model building strategy: model identification, estimation, checking, forecasting with model , advantages and disadvantages of ARIMA models.	8 Hrs.
Unit VI: Multivariate Time Series Models And Forecasting : Multivariate Time Series Models and Forecasting - Multivariate Stationary Process- Vector ARIMA Models - Vector AR (VAR) Models - Neural Networks and Forecasting -Spectral Analysis - Bayesian Methods in Forecasting.	8 Hrs.
Total Lecture	45 Hours

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Textbooks:

1.	Business forecasting , 8th edition	John Hanke, Dean Wichern	PHI
2.	Introduction To Time Series Analysis And Forecasting, 2nd Edition, https://b-ok.cc/book/2542456/2fa941	Douglas C. Montgomery, Cheryl L. Jen(2015)	Wiley Series In Probability And Statistics,
3.			

Reference Books:

1.	Introduction To Time Series And Forecasting Third Edition.(2016) https://b-ok.cc/book/2802612/149485	Peter J. Brockwell Richard A. Davis
2.		

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VIII SEMESTER AIDS2451 – Major Project

COURSE OBJECTIVES	COURSE OUTCOME
<ol style="list-style-type: none">To apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning.To design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data.To work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively.To apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices.	<p>On successful completion of the course students will be able to:</p> <ol style="list-style-type: none">Understand the knowledge gained from the various courses undergone in earlier years.Able to work in team and adapt professional ethics and practice and how to write technical documents in professional style, and to demonstrate the product/software to technical audience.able to evaluate and analyze critically evaluate and analyze different sources of data available in the literature.able to learn and to apply the knowledge of tools/Technology.

Mapped Program Outcomes : 1,2,3,4,5,6,7,8,9,10,11,12 **PSO :** i,ii

The students will appear for the entrance examination of industry for Internship. After selection, students will join industry for a semester as a intern and will continue the project allotted by the industry and also will submit a project report based on their studies. Evaluation will be done continuously and viva voce conducted at the end of the semester.

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VIII SEMESTER

AIDS2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
<ol style="list-style-type: none">To organize co-curricular activities to make competitive spirit, cooperation, leadership, diligence, punctuality, team spirits.To develop creative talent, self-confidence, sense of achievement.To be able to design process on environmental, social, political, ethical, health and safety.To develop broad education to understand the impact of engineering solution in a global economic, environmental, society.	<ol style="list-style-type: none">An ability to work initially as well as part of team to achieve set goals.An ability to work to serve society and for betterment of society.An ability to communicate with people at large.

Mapped Program Outcomes : 1,2,3,4,5,6,7,9,10,11

Due credits will be given to the students based on their performance and involvement in different extra and co-curricular activities conducted within the college or by other organizations/ institutions. Due credit will also be given to the student if they are successful in different competitive examinations conducted by different organizations. The guidelines as given in academic regulations will be followed for evaluation.

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