BOARD OF STUDIES MEETING – 2022-23

K.S.R.M COLLEGE OF ENGINEERING

AUTONOMOUS

Minutes of the Meeting

Date	**04.08.2022**	**Day**	**Thursday**
Time	**1:00PM**	**Venue**	**Virtual meeting:** http://meet.google.com/kyt-zpit-tey
Dept./SS	**CSE**	**Convener**	**Dr. V. Lokeswara Reddy**

Members Present:13 **MembersAbsent: 00**

S.No	Name	Designation	Signature	S.No	Name	Designation
1.	Dr. V. Lokeswara Reddy	Prof., & HOD CSE, KSRMCE.				
2.	Dr. R.B.V. Subramanyam	Prof., & HOD CSE, NIT Warangal.				
3.	Dr. O.B.V. Ramanaiah	Prof., in CSE, JNTUH, Hyderabad.				
4.	Dr. A. Suresh Babu	Prof., in CSE and Controller of Examinations(UG) JNTU, Ananthapuramu.				
5.	Dr. G. Varaprasad	Alumni, Prof., BMS College of Engg., Bangalore				
6.	Dr. M. Sreenivasulu	Prof., KSRMCE				
7	Dr. N. Ramanjaneya Reddy	Associate Prof., KSRMCE				
8	Dr. G. Nagendra Babu	Associate Prof., KSRMCE				

9	Dr. S. M. Farooq	Associate Prof., KSRMCE	S.M. Farooq			
10	Dr. S. Nageswara Rao	Associate Prof., KSRMCE				
11	Dr. V. Venkata Ramana	Associate Prof., KSRMCE				
12	Mrs. B. Manorama Devi	Assistant Prof., KSRMCE				
13	Mr. S. Suresh Babu	Industry, Senior Principal Consultant, Application Software Technology Office 702, Pune.				

Dr. V. Lokeswara Reddy, welcomed all the members to the meeting and presented the agenda of the meeting.

The resolutions are:

	Todo item	**Discussion**	**Resolution**	**Coordinator/in-charge**
1	To finalize the curriculum and syllabus for V sem & VI sem B.Tech (CSE) under R20 UG Regulations.	The Head of the Department has presented the curriculum and the syllabus designed by the faculty after taking the feedback from all stakeholders and comparing with premier institutes syllabus.	The committee has approved curriculum and syllabus for V sem and VI sem B.Tech CSE under R-20 Regulations which also includes New Courses, Open Electives and Professional Electives. The suggestions provided by the expert team are considered and modifications will be done respectively.	Dr. V. Lokeswara Reddy
2	To finalize the curriculum and syllabus for I sem to IV sem M.Tech (AI&DS) under R22 PG Regulations.	The Head of the Department has presented the curriculum and the syllabus designed by the faculty after taking the feedback from all	The committee has approved curriculum and syllabus for I sem to IV sem M.Tech AI&DS under R22 PG regulations which also includes new courses, Open Electives and Professional Electives/Program Electives. The suggestions provided by the expert team are considered and modifications will be done respectively.	Dr. M. Sreenivasulu

		stakeholders and comparing with premier institutes syllabus.		
3	To finalize the curriculum and syllabus for III sem and IV sem B.Tech (AI &ML) under R20UG Regulations.	The Head of the Department has presented the syllabus designed by the faculty after taking the feedback from all stakeholders and comparing with premier institutes syllabus.	The committee has approved curriculum and syllabus for III sem and IV sem B.Tech AI&ML under R20UG regulations which also includes new courses. The suggestions provided by the expert team are considered and modifications will be done respectively.	Dr. K. Srinivasa Rao
4	To finalize the curriculum and syllabus for B.Tech Minor & Honor Degree (CSE) under R20UG Regulations.	The Head of the Department has presented the syllabus designed by the faculty after taking the feedback from all stakeholders and comparing with premier institutes syllabus.	The committee has approved curriculum and syllabus for B.Tech Minor & Honor Degree (CSE) under R20 UG Regulations.. The suggestions provided by the expert team are considered and modifications will be done respectively.	Dr. N. Ramanjaneya Reddy
5.	To finalize and approve the syllabus for Value Added Courses/Skill Courses/Employability Courses/Entrepreneurship.	The Head of the Department has presented the syllabus for Value Added Courses and Skill Courses, designed by the faculty after taking the feedback from all stakeholders.	The committee appreciated the value added courses to be offered by department and approved the content for offering Value Added Courses/Skill Courses/Employability Courses/Entrepreneurship.	Dr. S. Nageswara Rao
6	Department Review Committee Report.	The head of the department presented Department Review Committee report.	The committee taken into the consideration of Department Review Committee report presented by the Head of Department while approving the curriculum and syllabus.	Dr. M. Sreenivasulu

7	Feedback/suggestions from stake holders and action taken report.	The Head of the Department presented Feedback and suggestions collected from stakeholders and also presented the action taken report in the department.	The committee approved action taken report on suggestions and feedback given by stakeholders.	Smt. B. Manorama Devi

The Head of the Department have proposed the vote of thanks and concluded the meeting.

Convener

Dr. V. LOKESWARA REDDY
M.Tech., Ph.D.,
Professor & HOD CSE
K.S.R.M. College of Engineering (Autonomous)
KADAPA - 516 005.

B.Tech & M.Tech Curriculum finalization-Regarding.

External

HOD CSE

Sir, As per your suggestions in the BoS meeting for finalization of B.Tech (CSE R20 UG) V and VI Sen

Dr. Ramanaiah,OBV

to me

Dear Sir,

Regards.

Thank you for communicating the following:

1) course structure of R20 B. Tech, Vth and VIth semesters along with courses for Honors and Minor

2) course structure of R20 B. Tech Artificial Intelligence & Machine Learning

3) M Tech (AI & DS) complete course structure.

I have gone through and found it to be OK.

Hence, the above course structures are approved. This is for your kind information and necessary acti

Sincerely

--

Dr. O. B. V. RAMANAIAH,

Professor, Department of Computer Science & Engineering (CSE),

Jawaharlal Nehru Technological University Hyderabad (JNTUH) College of Engineering,

KUKATPALLY HYDERABAD 500085

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B.Tech & M.Tech Curriculum finalization-Regarding. External

HOD CSE
Sir, As per your suggestions in the BoS meeting for finalization of B.Tech (CSE R20 UG) V and VI Sen

HOD CSE
Sir, As per your suggestions in the BoS meeting for finalization of B.Tech (CSE R20 UG) V and VI Sen

Dr.Varaprasad G
to me

Dear Sir,

Thanks for your

With Kind Regar

Dr.Varaprasad G
drvaraprasad@gmail.com

Open detailed view

me. Please ask other

Suresh Babu
to me, Dr.Varaprasad

Compose

Mail

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Spaces

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Suresh Babu
to me, Dr.Varaprasad

Hi Sir,

I have gone through the documents and here by approving the same.

Thanks,
Suresh Babu S | Managing Principal Consultant
Applications Software Technology LLC
4343 Commerce Court #701. Lisle, IL 60532
Mobile: +91-9916763416

Thanks a lot. Thank you for your response. Thank you.

Reply Reply all Forward

rbvsub@nitw.ac.in

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Labels

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R20UG.docx

Prof RBV Subramanyam
to me

Dear Prof Lokeswara Reddy
I have looked at the documents and I hereby approve the same
Thank you
RBV Subramanyam

--

Prof.R.Bala Venkata Subramanyam
M.Tech.(IIT, Kgp), Ph.D.(IIT,Kgp),

Professor, Department of Computer Science & Engg.
and
Chief Investigator, Electronics & ICT Academy (set up MeitY, GoI)

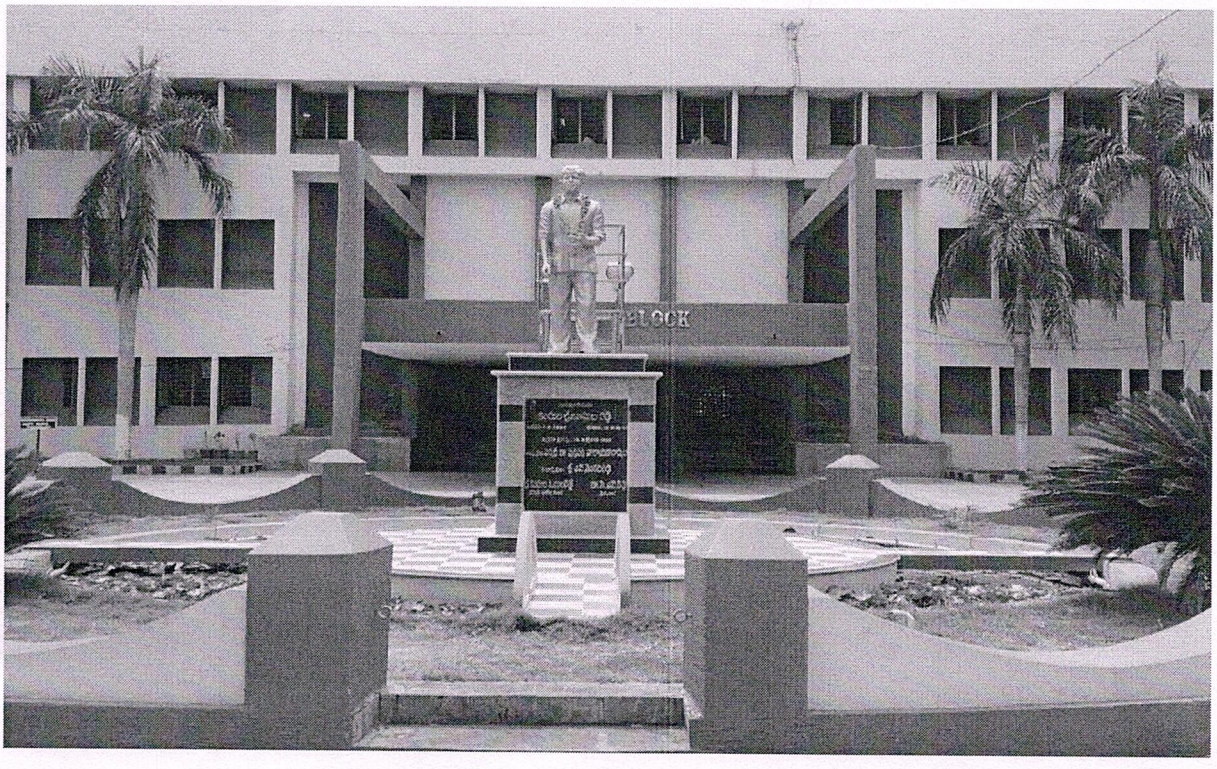
National Institute of Technology,
WARANGAL - 506 004,
Telangana State, India.

Contact: +91 949 134 6969 (Personal),
0870- 246 2 736 (Faculty Room), 0870 246 2700 (Head, CSE), 0870 246 2750 (e&ict)

UG Programs in Engineering (R20UG)
Curriculum and Syllabus for

I - VIII Sem B.Tech

Department of Computer Science and Engineering



Kandula Srinivasa Reddy Memorial College of Engineering (Autonomous)
Kadapa 516003 AP
(Approved by AICTE, Affiliated to JNTUA, Ananthapuramu, Accredited by NAAC) (An ISO 9001-2008 Certified Institution)

COMPUTER SCIENCE AND ENGINEERING

Approved Course Structure

Semester-0(Theory-8, Lab-7) Induction Program

S.No.	Course Name	Category	L	T	P	C
1	Physical Activities-Sports, Yoga & Meditation, plantation	MC	0	0	6	0
2	Career Counseling	MC	2	0	2	0
3	Orientation to all branches-career options, tools etc.	ESC	3	0	0	0
4	Orientation on admitted branch-corresponding labs, tools & platforms	EC	2	0	3	0
5	Proficiency Modules & Productivity Tools	ES	2	1	2	0
6	Assessment on basic aptitude and mathematical skills	MC	2	0	3	0
7	Remedial Training in foundation courses	MC	2	1	2	0
8	Human values & Professional ethics	MC	3	0	0	0
9	Communication skills-focus on listening, speaking, reading, writing skills	BS	2	1	2	0
10	Concepts of programming	ES	2	0	2	0

L-Lecture, T-Tutorial, P-Practical

I Semester (Theory– 5, Labs–04)

S.No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2021101	Linear Algebra and Calculus	BSC	3	0	0	40	60	3
2	2023102	Chemistry	BSC	3	0	0	40	60	3
3	2005103	C-Programming & Data Structure	ESC	3	0	0	40	60	3
4	2014104	Basic Electrical & Electronics Engineering	ESC	3	0	0	40	60	3
5	20EW105	Engineering Workshop	ESC	0	0	3	40	60	1.5
6	2005106	IT Workshop	ESC	0	0	3	40	60	1.5
7	2023107	Chemistry Lab	BSC	0	0	3	40	60	1.5
8	2005108	C-Programming & Data Structures Lab	ESC	0	0	3	40	60	1.5
9	2014109	Basic Electrical & Electronics Engineering Lab	ESC	0	0	3	40	60	1.5
Total				**12**	**00**	**15**	**360**	**540**	**19.5**

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II Semester (Theory–05, Lab–04)

S.No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2021201	Differential Equations & Vector Calculus	BSC	3	0	0	40	60	3
2	20AP202	Applied Physics	BSC	3	0	0	40	60	3
3	2024203	Communicative English	HS MC	3	0	0	40	60	3
4	2005204	Python Programming	ESC	3	0	0	40	60	3
5	2003205	Engineering Drawing	ESC	1	0	2	40	60	2
6	2003206	Engineering Drawing Lab	ESC	0	0	2	40	60	1
7	20AP207	Applied Physics Lab	BSC	0	0	3	40	60	1.5
8	2024208	Communicative English Lab	HS MC	0	0	3	40	60	1.5
9	2005209	Python Programming Lab	ESC	0	0	3	40	60	1.5
10	20MC210	Environmental Science	MC	3	0	0	40	00	0.0
Total				**16**	**00**	**13**	**390**	**540**	**19.5**

III Semester (Theory-05, Lab-03)

S.No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2024301	Business Economics and Accounting for Engineers	HSMC	3	0	0	40	60	3
2	2005302	Advanced Data Structures	PCC	3	0	0	40	60	3
3	2005303	Formal Languages & Automata Theory	PCC	3	0	0	40	60	3
4	2005304	Object Oriented Programming through JAVA	PCC	3	0	0	40	60	3
5	2005305	Data Base Management Systems	PCC	3	0	0	40	60	3
6	2005306	Advanced Data Structures Lab	PCC	0	0	3	40	60	1.5
7	2005307	JAVA Lab	PCC	0	0	3	40	60	1.5
8	2005308	Data Base Management Systems Lab	PCC	0	0	3	40	60	1.5
9	2005309	Skill Oriented Course Exploring Data Analysis with R/ NASSCOM Courses	SC	0	0	4	40	60	2.0
Total				**15**	**00**	**13**	**400**	**540**	**21.5**

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IV Semester (Theory-05, Lab-03)

S.No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2005401	Principles of Operating Systems	PCC	3	0	0	40	60	3
2	2005402	Computer Organization	PCC	3	0	0	40	60	3
3	2004403	Microprocessors & Microcontrollers	ESC	3	0	0	40	60	3
4	2005404	Digital Logic Circuits & Design	PCC	3	0	0	40	60	3
5	2021405	Probability Theory & Statistical Methods	BSC	3	0	0	40	60	3
6	2014406	Microprocessors & Microcontrollers Lab	ESC	0	0	3	40	60	1.5
7	2005407	Principles of Operating Systems Lab	PCC	0	0	3	40	60	1.5
8	2005408	Digital Logic Design Lab	PCC	0	0	3	40	60	1.5
9	2005409	Skill Oriented Course Advanced Python Programming/ NASSCOM Courses	SC	0	0	4	40	60	2.0
10	2024410	Universal Human Values	HSMC	3	0	0	40	60	3.0
Total				**18**	**00**	**13**	**400**	**600**	**24.5**

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V Semester (Theory-05, Lab-02)

S.No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2005501	Software Engineering	PCC	3	0	0	40	60	3
2	2005502	Design and Analysis of Algorithms	PCC	3	0	0	40	60	3
3	2005503	Computer Networks	PCC	3	0	0	40	60	3
		Open Elective Course-I(OEC-I)							
4	20OE501	Data Structures	OEC	3	0	0	40	60	3
	20OE502	Database Management Systems	OEC	3	0	0	40	60	3
		Professional Elective Course –I (PEC-I)							
5	2005504	Web Technologies	PEC	3	0	0	40	60	3
	2005505	Multimedia Systems	PEC	3	0	0	40	60	3
	2005506	Distributed Systems	PEC	3	0	0	40	60	3
6	2005507	DAA Lab	PCC	0	0	3	40	60	1.5
7	2005508	Professional Elective Course -I Lab	PCC	0	0	3	40	60	1.5
8	20245SC	Soft Skill Oriented Course Advanced English & Communication Lab/Professional Communication Lab	SC	0	0	4	40	60	2.0
9	2005510	Community Service Project	PROJ	0	0	0	100		1.5
10	20MC509	Constitution of India	MC	2	0	0	40	00	00
Total				**17**	**00**	**10**	**420**	**480**	**21.5**

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VI Semester (Theory-05, Lab-03)

S.No.	Subject Code	SUBJECT	SC	L	T	P	IM	E M	CR
1	2005601	Internet of Things	PCC	3	0	0	40	60	3
2	2005602	Data Mining	PCC	3	0	0	40	60	3
3	2005603	Cryptography & Network Security	PCC	3	0	0	40	60	3
		Open Elective Course -II(OEC-II)							
4	20OE503	Java Programming	OEC	3	0	0	40	60	3
	20OE504	Web Designing	OEC	3	0	0	40	60	3
		Professional Elective Course – II (PEC-II)							
5	2005604	Artificial Intelligence	PEC	3	0	0	40	60	3
	2005605	Software Testing	PEC	3	0	0	40	60	3
	2005606	Adhoc & Sensor Networks	PEC	3	0	0	40	60	3
6	2005607	IOT Lab	PCC	0	0	3	40	60	1.5
7	2005608	Data Mining Lab	PCC	0	0	3	40	60	1.5
8	2005609	Network Security Lab	PCC	0	0	3	40	60	1.5
9	2005610	Skill Oriented Course Mobile Application Development/ NASSCOM Courses	SC	0	0	4	40	60	2.0
10	20MC612	Management Organizational Behavior	MC	2	0	0	40	00	00
Total				**17**	**00**	**13**	**440**	**540**	**21.5**

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VII Semester (Theory-06)

S.No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
		Professional Elective Course-III (PEC-III)							
1	2005701	Compiler Design	PEC	3	0	0	40	60	3
	2005702	Computer Graphics	PEC	3	0	0	40	60	3
	2005703	Cyber Security	PEC	3	0	0	40	60	3
		Professional Elective Course-IV (PEC-IV)							
2	2005704	Machine Learning	PEC	3	0	0	40	60	3
	2005705	Object Oriented Analysis & Design	PEC	3	0	0	40	60	3
	2005706	Natural Language Processing	PEC	3	0	0	40	60	3
		Professional Elective Course-V (PEC-V)							
3	2005707	Cloud Computing	PEC	3	0	0	40	60	3
	2005708	Deep Learning	PEC	3	0	0	40	60	3
	2005709	Computer Vision	PEC	3	0	0	40	60	3
		Open Elective Course-III(OEC-III)							
4	20OE505	Operating System	OEC	3	0	0	40	60	3
	20OE506	R Programming	OEC	3	0	0	40	60	3
		Open Elective Course-IV(OEC-IV)							
5	20OE508	Python Programming	OEC	3	0	0	40	60	3
	20OE509	Cloud Computing	OEC	3	0	0	40	60	3
		Humanities & Social Science Elective							
6	2006701	Human Resource Development	HSMC	3	0	0	40	60	3
	2006702	Digital Marketing	HSMC	3	0	0	40	60	3
	2006703	Project Management	HSMC	3	0	0	40	60	3
7	2005710	Skill Oriented Course Big Data Technologies/ NASSCOM Courses	SC	0	0	4	40	60	2
8	2005711	Internship	INT	0	0	0	100	0	3
Total				**18**	**00**	**4**	**380**	**420**	**23**

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VIII Semester

S.No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2005801	Major Project/ Internship (6Months)	PROJ	0	0	24	40	60	12
Total									**12**

Structure of the Undergraduate Engineering Program:

S.No.	Category	Code	Credits	APSCHE Suggested Credits
1	Humanities &Social Sciences including Management Sciences	HSMC	10.5	10
2	Basic Science Courses	BSC	18	21
3	Engineering Science Courses	ESC	24	24
4	Professional Core Courses	PCC	54	51
5	Open Elective Courses	OEC	12	12
6	Professional Elective Courses	PEC	15	15
7	Internship & Project Work	PROJ	16.5	17
8	Mandatory Courses	MC	03	Non-Credit
9	Skill Oriented Courses	SC	10	10
	Total Credits		163	160

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Course Title	Software Engineering				B.Tech V Sem (R20) CSE		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
		L	T	P	C	Continuous Internal Assessment	End Exams	Total
2005501	PCC	3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- Knowledge of basic Software engineering methods and practices, and their appropriate application also the software engineering layered technology and Process frame work.
- A general understanding of software process models such as the waterfall and evolutionary models.
- Understanding of the role of project management including planning, scheduling, risk management, etc.
- Understanding of data models, object models, context models and behavioural models also different software architectural styles.
- Understanding of software testing approaches such as unit testing and integration testing other testing strategies and Risk management.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Ability to apply software engineering principles and techniques.
CO 2	Ability to develop, maintain and evaluate large-scale software systems.
CO 3	To produce efficient, reliable, robust and cost-effective software solutions.
CO 4	To manage time, processes and resources effectively by prioritising competing demands to achieve personal and team goals Identify and analyzes the common threats in each domain.

UNIT - I

Software and Software Engineering: The Nature of Software, Software Engineering, Software Process Software Myths. Process Models: A Generic Process Model, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models.

UNIT - II

Understanding Requirements: Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Building the Requirements Model, Negotiating Requirements, Validating Requirements.

Requirements Modeling: Requirements Analysis, Scenario-Based Modeling, Data Modeling Concepts, Class-Based Modeling.

UNIT - III

Design Concepts: Design within the Context of Software Engineering, Design Process, Design Concepts, The Design Model.

Architectural Design: Software Architecture, Architectural Genres, Architectural Styles, Architectural Design.

UNIT - IV

User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

Coding and Testing: Testing, Testing in the Large versus Testing in the Small, Unit Testing, Integration Testing, Black-Box Testing, White-Box Testing, Debugging, System Testing.

UNIT - V

Software Project Management: Project Planning, Metrics for Project Size Estimation, Project Estimation Techniques, Empirical Estimation Techniques, COCOMO-A Heuristic Estimation Technique, Halstead's Software Science-An Analytical Technique, Risk Management.

Text Books:

1. Software Engineering: A practitioner's Approach, Roger S. Pressman, Seventh Edition, 2010, McGrawHill International Edition.
2. Fundamentals of Software Engineering, Rajib Mall, 4th Edition, 2014, PHI.
3. Software Engineering, Ian Sommerville, Ninth edition, Pearson education.
4. Software Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008

Reference Books:

1. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
3. Software Engineering1: Abstraction and modeling, Diner Bjorner, Springer International edition, 2006.
4. Software Engineering2: Specification of systems and languages, Diner Bjorner, Springer International edition , 2006.
5. Software Engineering Foundations, Yingxu Wang, Auerbach Publications,2008.

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Course Title	Design And Analysis of Algorithms				B.Tech CSE V Sem (R20)		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2005502	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- To understand and apply the algorithm analysis techniques.
- To critically analyze the efficiency of alternative algorithmic solutions for the same problem.
- To understand different algorithm design techniques.
- To understand the limitations of Algorithmic power.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Prove the correctness and analyze space and time complexity of an algorithm.
CO 2	Understand different algorithm design strategies.
CO 3	Analyze & Apply standard algorithms.
CO 4	Understand Graph/Tree bases applications and appropriate techniques.
CO 5	Current trends in Non Deterministic concepts.

UNIT-I

Introduction: What is an algorithm? Algorithm Specification, **Performance Analysis**: Space complexity, Time Complexity. **Asymptotic Notations**: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), **Brute Force Method:** Sequential Search, Selection Sort, Bubble Sort.

UNIT-II

Divide and Conquer: General method, Binary search, Merge sort, Quick sort, Strassen's Matrix multiplication.

Greedy Method: General method, Knapsack Problem, Job sequencing with deadlines. **Minimum cost spanning trees:** Prim's Algorithm, Kruskal's Algorithm.

UNIT-III

Dynamic Programming: General method, Multistage Graphs, All Pairs Shortest Paths, Single Source Shortest Path, Optimal Binary Search Trees,0/1Knapsack problem, Travelling Sales Person problem .

UNIT-IV

Search and Traversal techniques: Techniques for Binary tree, Technique for Graphs, connected components and spanning tree, Bi connected components.

Backtracking: General method, N-Queens problem, Sum of sub sets problem, Graph coloring, Hamiltonian cycles.

UNIT-V

Branch and Bound: Travelling Sales Person problem, 0/1Knapsack problem: LC Branch and Bound solution, FIFO Branch and Bound solution.

NP-Complete and NP-Hard problems: Basic concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes.

Text Books:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran,"Fundamentals of Computer Algorithms", Galgotia Publications.
2. Levitin, Anany." Introduction to the design & analysis of algorithms" Pearson Education, 2008.
3. Udit Agarwal," Algorithms Design and Analysis",Dhanpath Rai & Co,2017.
4. Sedgewick Robert and Kevin Wayne, "Algorithms" , Pearson Education, Fourth Edition.
5. Parag H.Dave Himanshu B.Dave "Design and Analysis of Algorithms" Pearson Education 2008.

Reference Books:

1. Aho, Hopcroft, Ulman,"the Design and Analysis of Computer Algorithms" Pearson Education, 2000.
2. Steven S.Skiena," The Algorithm Design Mannual", Spingers, Third Edition.
3. R.L.Rivest and C.Stein" Introduction to Algorithms",Second Edition, Pearson Education
4. M.T.Goodrich and R.Tomassia, John Wiley and sons," Algorithm Design: Foundations, Analysis and Internet examples".
5. Sanjoy Dasgupta, Christos H Papadimitriou, Umesh Virkumar Vazirani, "Algorithms" , McGraw-Hill Higher Education, 2008.

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Course Title	Computer Networks				B.Tech V Sem (R20) CSE		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
		L	T	P	C	Continuous Internal Assessment	End Exams	Total
2005503	PCC	3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- Study the evolution of computer networks and future direction.
- Study the concepts of computer networks from layered.
- Perspective study the issues open for research in computer networks.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the terminology and concepts of the OSI reference model and TCP-IP.
CO 2	Describe the functions of Data link layer and its protocols.
CO 3	Classifying the different routing algorithms and IP addressing with network layer
CO 4	Understand connection establishment and services provides by TCP and UDP.
CO 5	Explain the working of DNS and World Wide Web.

UNIT - I

Introduction: Uses of Computer Networks, Network Hardware, Reference Models: OSI, TCP/IP, Comparison of OSI & TCP/IP reference models.

Introduction to physical layer: Data and Signals, Transmission impairment, Datarate limits, Performance.

Transmission media: Introduction, Guided Media, Unguided Media.

Switching: Introduction, Circuit Switched Networks, Packet Switching.

UNIT - II

The Data Link Layer: Data Link Layer design issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols.

The Medium Access Control sublayer : Multiple Access protocols, Ethernet, Data Link Layer Switching.

UNIT - III

The Network Layer: Network layer design issues, Routing algorithms : The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Anycast Routing,

Congestion control algorithms, Quality of service, IP Addresses, IPv4,IPv6,Tunneling, Fragmentation.

UNIT - IV

The Transport Layer: The Transport Service, Elements of Transport Protocols, Congestion Control, The internet transport protocols: UDP, TCP: Introduction to TCP, Service Model, Protocol, Segment Header, Connection Establishment, Connection Release.

UNIT - V

The Application layer: Domain Name System (DNS), World Wide Web (WWW), E-mail.

Text Books:

1. "Computer Networks", Andrew S. Tanenbaum, David J.Wetherall, Pearson, 5th edition, 2010.
2. "Data communications and networking", Behrouz A. Forouzan, TMH, 5th edition, 2012.
3. "Internetworking with TCP/IP – Principles, protocols, and architecture- Volume 1, Douglas E. Comer,
5th edition, PHI
4. "Computer Networks", 5E, Peterson, Davie, Elsevier.

Reference Books:

1. "Introduction to Computer Networks and Cyber Security", Chawan- Hwa Wu, Irwin, CRC Publications.
2. "Computer Networks and Internets with Internet Applications", Comer.
3. Computer Networks, A Top-Down Approach, James F. Kurose, Keith W. Ross, 3rd Edition, Pearson.
4. Computer Networks, A Top-Down Approach, Behrouz A. Forouzan, Firoz Mosharraf, Special Indian Edition, McGraw Hill.

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Course Title	Data Structures (Open Elective Course-I)				B.Tech V Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
20OE501	OEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- To develop skills and analyze linear and nonlinear data structures.
- To understand basic concepts about linked lists, stacks, queues.
- To study algorithms as they apply to trees and graphs.
- To study in detail about sorting.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the variety of abstract data types and data structures.
CO 2	Analyze data structures such as linked list, Stacks and Queues.
CO 3	Apply and analyze tree traversal algorithms and graph traversal algorithms.
CO 4	Organize data in order using various sorting algorithms.

UNIT - I

Introduction: Data structures, Primitive & Non Primitive data structures, Linear & Non Linear data structures, **Linear Lists:** Definition, **Arrays:** Definition, **Linked Lists:** Single Linked List- Definition, Insertion and Deletion operations, Doubly Linked List- Definition, Insertion and Deletion operations. **Stacks:** Definition, Array & Linked representations, Operations, Applications.

UNIT – II

Queues: Definition, Array & Linked representations, Operations, Circular Queues & Dequeues.

Trees: Basic terminology, **Binary Trees** - Definition, Properties, Representation, Complete and Full Binary Tree, **Tree Traversal Algorithm:** Inorder, Preorder and Postorder.

UNIT – III

Binary Search Tree (BST): Definition, Operations & Implementations, Indexed BST.

Balanced Search Trees: AVL trees, Red-Black trees & Splay trees.

UNIT - IV

Graphs: Terminology, Representations, **Graph Traversal:** Depth First Search (DFS), Breadth First Search (BFS), Applications of graphs.

UNIT - V

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

Searching: Linear and Binary search.

Hashing: Introduction, Hash Table representation, Hash Functions.

Text Books:

1. An Introduction to Data Structures with applications, Jean Paul Trembley and Paul G.Sorenson, McGraw Hill.
2. Fundamentals of Data Structures in C, Horowitz, Sahni, Anderson Freed, Universities press.
3. Data Structures using C++, Varsha H.Patil, Oxford University Press.
4. Data Structures, Seymour Lipschutz, Schaum's Outlines, McGraw Hill.
5. Data Structures and Algorithms, G.A.V.Pai, Tata McGraw Hill.

Reference Books:

1. Data Structures, Algorithms and Applications in C++, AnandaRao Akepogu and Radhika Raju Palagiri, Pearson Education.
2. Data Structures and Algorithms in C++, S.Sahni, University Press (India) Private Limited, Second Edition.
3. Data Structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.

Web links:

1. **https://nptel.ac.in/courses/106102064**
2. **https://nptel.ac.in/courses/106103069**

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Course Title	Database Management Systems (Open Elective Course – I)				B.Tech CSE Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
20OE502	OEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- To study the physical and logical database designs, database modeling, relational hierarchical, and network models.
- To understand and use data manipulation language to query, update, and managing the database.
- To develop an understanding of essential DBMS concepts such as: database secur integrity and concurrency.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	To understand the basic concepts and the application of Database systems.
CO 2	To understand the basics of SQL and construct queries using SQL.
CO 3	To understand the Relational Database design principles.
CO 4	To apply various Normalization techniques for database design improvement.
CO 5	To apply concurrency control and recovery techniques during transactionexecution.

UNIT-I

Introduction - Database-System Applications, View of Data, Database languages, Database architecture, Database Users and Administrators.

E-R Model - The Entity Relationship Model, Constraints, Entity Relationship Diagrams, and Extended E-R features.

UNIT-II

Relational Model - Structure of Relational Databases, Database Schema, Keys, Query Languages, Fundamental Relational Algebra Operations, Additional Relational Algebra Operations, Extended Relational Algebra Operations, Modification of Database.

UNIT-III

Introduction to SQL - Data Definition, Basic Structure of SQL Queries, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Complex queries, views, Modification of the Database.

Advanced SQL -Integrity Constraints, Dynamic SQL, Functions and Procedures.

Other Relational Query Languages - Tuple Relational Calculus, Domain Relational calculus.

UNIT-IV

Normal Forms – Atomic domain and First Normal Form, Keys and Functional Dependencies, Second Normal Form, BCNF, BCNF and Dependency Preservation, Third Normal Form, Lossless Decomposition, Dependency- preserving, Multi valued Dependencies, Fourth Normal Form, Join Dependencies, Fifth Normal Form, and Inclusion dependencies.

UNIT-V

Transactions -Transaction Concept, Transaction State, Implementation of Transaction Atomicity and Durability, Concurrent Executions, Serializability.

Concurrency Control -Lock-Based Protocols, Timestamp-Based Protocols. **Recovery System** - Failure Classification, Storage, Recovery and Atomicity, Log based recovery.

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database system Concepts", 5th Edition, McGrawhill.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamental Database Systems", Pearson Education, 3rd Edition, 2003
3. C.J.Date, "Introduction to Database", 8 Th Edition, 2003, Addison-Wesley publication.
4. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, "Database System Implementation", Pearson Education, United States 1st Edition, 2000

Reference Books:

1. Raghurama Krishnan, Johannes Gehrke, Data base Management Systems.3rd Edition, Tata McGrawHill.
2. Peter Rob, Ananda Rao and Carlos Corone, Database Management Systems, Cengage Learning, 1st Edition, 2011
3. Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to Design, Implementation and Management,6th Edition,2012.
4. S.K.Singh, "Database Systems Concepts, Design and Applications", First Edition, Pearson Education, 2006

Reference Links:

1. https://nptel.ac.in/courses/106/105/106105175/ (IIT KHARAGPUR)
2. https://nptel.ac.in/courses/106/106/106106095/ (IIT MADRAS)

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Course Title	Web Technologies (Professional Elective Course-I)`				B.Tech V Sem (R20) CSE		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2005504	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- Familiarize the tags of HTML.
- Write backend code in PHP language and Writing optimized front end code HTML and JavaScript.
- Understand, create and debug database related queries and Create test code to validate the applications against client requirement.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Enumerate the Basic Concepts of Markup Languages.
CO 2	Develop web Applications using Scripting Languages & Frameworks.
CO 3	Make use of Express JS frameworks.
CO 4	Develop server side programs using PHP.
CO 5	Accessing database through PHP.

UNIT - I

HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, HTML styles, Elements, Attributes, Heading, Layouts, HTML media, Iframes Images, Hypertext Links, Lists, Tables, Forms, GET and POST method, HTML 5, Dynamic HTML.

CSS: Cascading style sheets, Levels of Style Sheets, Style Specification Formats,

UNIT - II

JavaScript: Introduction to JavaScript, Objects, Primitives Operations and Expressions, Control Statements, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions,

UNIT - III

Fundamentals of Angular JS and NODE JS Angular Java Script- Introduction to Angular JS. **Expressions:** ARRAY, Objects, Strings, Angular JS Form Validation & Form Submission.

UNIT - IV

PHP Programming: Introduction to PHP, Creating PHP script, Running PHP script. Working with variables and constants: Using variables, Using constants, Data types, Operators. Controlling program flow: Conditional statements, Control statements, Arrays, functions. PHP Advanced Concepts: Using Cookies, Using HTTP Headers, Using Sessions, Authenticating users.

UNIT - V

Database connectivity – Basic Database Concepts, Connecting to a MYSQL database, JSP, PHP, Practice of SQL Queries. Introduction to Mongo DB and JQuery.

Text Books:

1. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.
2. Web Technologies, 1st Edition 7th impression, Uttam K Roy, Oxford, 2012.
3. Pro Mean Stack Development, 1st Edition, ELad Elrom, Apress O'Reilly, 2016
4. Java Script & jQuery the missing manual, 2nd Edition, David sawyer mcfarland, O'Reilly, 2011.
5. Beginning PHP and MySQL, 5th Edition, Jason Gilmore, Apress Publications (Dream tech.)

Reference Books:

1. Ruby on Rails Up and Running, Lightning fast Web development, 1st Edition, Bruce Tate, Curt Hibbs, Oreilly, 2006.
2. Programming Perl, 4th Edition, Tom Christiansen, Jonathan Orwant, O'Reilly, 2012.
3. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, 1st Edition, Dream Tech, 2009.

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Course Title	Multimedia Systems (Professional Elective Course-I)				B.Tech V Sem (R20) CSE		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2005505	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- To adapt the architecture for design of multimedia system.
- To solve issues related to multimedia file handling.
- To adopt hypermedia standards in developing multimedia applications.
- Know the basics of creating multimedia applications.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Analyze and synthesis the key components of multimedia technologies including text, audio and graphics.
CO 2	Understand the key components of multimedia technologies including video, animation and compression techniques.
CO 3	Examine various process scheduling techniques.
CO 4	Recall the data storage and retrieval methods.
CO 5	Interpret reference model for multimedia synchronization and summarize applications of multimedia.

UNIT - I

Multimedia: Definition, Where to use multimedia, Medium, Main properties of multimedia system, Traditional data stream characteristics, Data stream characteristics for continuous media, Information units.

Sound/Audio: Basic sound concepts, Music, Speech**. Images/Graphics:** Basic concepts, Computer image processing.

UNIT - II

Video and Animation: Basic concepts, Television, Computer based animation**.**

Data Compression: Storage space, Coding requirements, Source, Entropy and Hybrid coding, Some basic compression techniques, JPEG, H.261,(Px64), MPEG, DVI.

UNIT - III

Computer Technology: Communication Architecture, Multimedia Workstation.

Multimedia Operating Systems: Introduction, Real time, Resource management, Process management.

Multimedia Communication systems: Application Subsystem, Transport subsystem.

UNIT - IV

Database Systems: Multimedia Database Management System, Characteristics of an MDBMS, Data Analysis, Data Structure, Operations on data, Integration in a Database model.

Documents, Hypertext and MHEG: Documents, Hypertext and Hypermedia, Document Architecture ODA, MHEG.

UNIT - V

Synchronization: Introduction, Notion of Synchronization, Presentation requirements, Reference model for multimedia synchronization, Synchronization specifications.

Multimedia Applications: Introduction, Media Presentation, Media Composition, Media Integration, Media Communication, Media Consumption, and Media Entertainment.

Text Books:

1. "Multimedia: Computing, Communications and Applications", Ralf Steinmetz and KlaraNahrstedt, Pearson Education.
2. "Multimedia: Making It work:, Tay Vaughan, Pearson Education.
3. " Multimedia Systems", Koegel Buford, Pearson Education
4. "Fundamentals of Multimedia , Ze-Nian Li, Mark.S.Drew, Springer.

Reference Books:

1. " Multimedia System design ", Prabhat K. Andheigh, Kiran Thakrar, THM
2. " Multimedia Communication Systems: Techniques, standards and networks, K.R.Rao, D.Milovanovic.
3. Introduction to Multimedia, Ramesh Bangia, Firewall Media.
4. Principles of Multimedia, 2nd Edition, Ranjan Parekh, MAT Lab examples.

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Course Title	Distributed Systems (Professional Elective Course-I)					B.Tech V Sem (R20) CSE		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2005506	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes						End Exam Duration: 3Hrs		

Course Objectives:

- To make the student to understand the features of distributed systems.
- Creating awareness among students on processes and synchronization among processes.
- Learn the concepts of consistency models, replication and fault tolerance in distributed systems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Identify the core concepts of distributed systems.
CO 2	Understand the concepts of threads and communication mechanisms for processes.
CO 3	Develop the clock synchronization, mutual exclusion and election algorithms.
CO 4	Analyze the consistency and replication models.
CO 5	Understand the fault tolerance mechanisms in distributed systems.

UNIT - I

Introduction: Definition of a distributed system, Goals, Types of distributed systems.

Architectures: Architecture styles, System architectures.

UNIT - II

Processes: Threads, virtualization, clients, servers, code migration.

Communication: Fundamentals, Remote Procedure Call, Message oriented communication, Stream oriented communication, Multicast communication.

UNIT - III

Synchronization: Clock synchronization, Logical clocks, Mutual exclusion, Election Algorithms.

UNIT - IV

Consistency and Replication: Introduction, Data centric consistency models, Client centric consistency models, Replica management, Consistency protocols.

UNIT - V

Fault Tolerance: Introduction to fault tolerance, Process resilience, Reliable client server communication, Reliable group communication, Distributed commit, Recovery.

Text Books:

1. Andrew S. Tanenbaum, Marteen Van Steen, "Distributed Systems: Principles and Paradigms", 2nd Edition, PHI.
2. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems – Concepts and Design", Fourth Edition, Pearson Education.
3. Andrew S. Tanenbaum, "Distributed Operating System", Pearson Education.
4. Pradeep K. Sinha, "Distributed Operating Systems – Concepts and Design", PHI publications.

Reference Books:

1. Distributed Systems and Algorithm Analysis, Randy Chew, Theodove Johnson, Pearson.
2. Distributed Systems and Paradigms, Andrew. S. Tanenbaum, Maarten Van Steen, 2nd Edition, Pearson.
3. Distributed Systems: Computing over Network, Joel M. Crichlow, 2nd Edition, PHI.

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Course Title	Design And Analysis of Algorithms Lab				B.Tech CSE V Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2005507	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	3	1.5	40	60	100
					End Exam Duration: 3Hrs		

Course Objectives:

- Learn how to analyze a problem and design the solution for the problem.
- Design and implement efficient algorithms for a specified application.
- Strengthen the ability to identify and apply the suitable algorithm for the given real world problem.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Design algorithms using appropriate design techniques (divide and conquer, greedy, dynamic programming, etc.,).
CO 2	Implement variety of algorithms such as sorting, searching, graph related, etc., ina high level language.
CO 3	Analyze and compare the performance of algorithms using language features.

Experiments:

1. Write a program to perform Selection sort for any given list of numbers.
2. Write a program to perform Bubble sort for any given list of numbers.
3. Write a program to perform Sequential Search for any given list of numbers.
4. Write a Program to perform Merge Sort on the given two lists of integer values
5. Write a program to perform Quick Sort for the given list of integer values.
6. Write a program to find solution for knapsack problem using greedy method.
7. Write a program to find minimum cost spanning tree using Prim's Algorithm.
8. Write a program to find minimum cost spanning tree using Kruskal's Algorithm.
9. Write a program to perform Dijkstra's algorithm.
10. Write a program to implement Floyd's algorithm.
11. Write a program to solve N-QUEENS problem.
12. Write a program to solve Sum of subsets problem for a given set of distinct numbers.

Text Books:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran,"Fundamentals of Computer Algorithms", Galgotia Publications.
2. Levitin, Anany." Introduction to the design & analysis of algorithms" Pearson Education, 2008.
3. Udit Agarwal," Algorithms Design and Analysis",Dhanpath Rai & Co,2017.
4. Sedgewick Robert and Kevin Wayne, "Algorithms" , Pearson Education, Forth Edition.
5. Parag H.Dave Himanshu B.Dave "Design and Analysis of Algorithms" Pearson Education 2008.

Reference Books:

1. Aho, Hopcroft, Ulman,"the Design and Analysis of Computer Algorithms" Pearson Education, 2000.
2. Steven S.Skiena," The Algorithm Design Mannual", Spingers, Third Edition.
3. R.L.Rivest and C.Stein" Introduction to Algorithms",Second Edition, Pearson Education
4. M.T.Goodrich and R.Tomassia, John Wiley and sons," Algorithm Design: Foundations, Analysis and Internet examples".
5. Sanjoy Dasgupta, Christos H Papadimitriou, Umesh Virkumar Vazirani, "Algorithms" , McGraw-Hill Higher Education,2008

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Course Title	Professional Elective Course-I Lab				B.Tech CSE V Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2005508	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	3	1.5	40	60	100
					End Exam Duration: 3Hrs		

List of Experiments

A Minimum of 10 Experiments shall be given from **Professional Elective Course-I.**

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Course Title	Advanced English & Communication Lab (Soft Skill Oriented Course)				B.Tech CSE V Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
20245SC	SC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	4	2	40	60	100
					End Exam Duration: 3Hrs		

Course Objectives:

- Interpret using language effectively in Group Discussions
- Develop the required skills for facing interviews and public speaking
- Analyze improving of language proficiency
- Build confidence by exposing to various situations and contexts for their successful professional career.
- Develop them industry – ready

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Interpret using language effectively in Group Discussions.
CO 2	Develop the required skills for facing interviews and public speaking.
CO 3	Analyze improving of language proficiency.
CO 4	Build confidence by exposing to various situations and contexts for their successful professional career.
CO 5	Develop them industry – ready.

1. Syllabus:

The following course content is prescribed for the Advanced English Communication Skills:

1.Functional English – Starting & Responding to a Conversation-- Social Etiquette, Formal and informal Conversation -- Role play – Body language in conversation—departing phrases.

2.Technical Report Writing --- Types of formats and styles, subject matter, organization, clarity, coherence and style, data-collection, tools, analysis, sample report.

3.Resume' Writing --- Structure, format and style, planning, defining the career, objective, projecting one's strengths and skills, creative self-marketing, cover letter.

4.Group Discussion--- Communicating views and opinions, discussing, intervening.Providing solutions on any given topic across a cross-section of individuals, (keeping an eye on modulation of voice, clarity, body language, relevance, fluency and coherence) in personal and professional lives.

5. Interview Skills --- Concept and process, pre-interview planning, mannerisms, body language, organizing, answering strategies, interview through tele and video-conferencing.

2. Minimum Requirements

The English Language Lab shall have two parts:

The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self-study by learners.

The Communication Skills Lab with movable chairs and audio-visual aids with a P.A System, a TV, A digital stereo-audio and video system, Camcorder etc.

System Requirement (Hardware Component):

Computer network with LAN with a minimum of 60 multimedia systems with the following specifications:

P-IV Processor, Speed-2.8 GHz, RAM_512 MB minimum, Hard Disk-80 GB, Headphones

Prescribed Software: Walden and K-Van Solutions.

Text Books:

1. Technical writing and professional communication, Huckin and Olsen Tata McGraw-Hil 2009.
2. Speaking about Science, A Manual for Creating Clear Presentations by Scott Morgan and Barrett Whitener, Cambridge University press, 2006.
3. Handbook for Technical Writing by David A McMurrey& Joanne Buckely CENGAGE Learomg 2008.
4. Technical Communication by Meenakshi Raman &Sangeeta Sharma, Oxford University Press 2009.
5. The ACE of Soft Skills by Gopal Ramesh and Mahadevan Ramesh, Pearson Education, 2010.
6. Cambridge English for Job-Hunting by ColmDownes, Cambridge Unicversity Press, 2008.
7. Resume's and Interviews by M. Ashraf Rizvi, Tata McGraw-Hill, 2008.
8. From Campus to Corporate by KK Ramachandran and KK Karthick, Macmillan Publishers India Ltd, 2010.
9. English Language Communication: A Reader cum Lab ManualDr A Ramakrishna Rao, Dr G Natanam& Prof SA Sankaranarayanan, Anuradha Publications, Chennai 2008.

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Course Title	Community Service Project				B.Tech V Sem (R20) CSE		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2005510	PROJ	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		-	-	-	1.5	100	-	100
Internal Evaluation							

Course Objectives:

The objective of the project is to enable the student to take up investigative study in rural areas/ Community in the field of Computer Science and Engineering.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand core concepts and research findings relative to human development, socialization, group dynamics and life course processes.
CO 2	Identify and transfer existing ideas into new contexts and applications.
CO 3	Apply and transfer academic knowledge into the real-world.
CO 4	Design a component or a product applying all the relevant standards and with realistic Constraints.

The following are the rules and regulation for **Community Service Project Projects:**

1. The student has to spend 50 to 60 Hrs in the semester on any Community Service Project and submit a report for evaluation.
2. The project is evaluated for 100 marks in the semester by a committee consisting of head of the department, project mentor and one senior faculty member of the department.
3. A student shall acquire 2 credits assigned, when he/she secures 50% or more marks from the total of 100 marks.
4. In case, if a student fails, he/she shall resubmit the report.
5. There is no external evaluation for the Community Service Project.

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Course Title	Constitution of India (Mandatory Course)				B.Tech V Sem (R20) CSE		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
		L	T	P	C	Continuous Internal Assessment	End Exams	Total
20MC509	HSMC	2	-	-	0	40	--	40
Mid Exam Duration: 90 Minutes								

Course Objectives:

- To realize the significance of the constitution of India to students from all walks of life and help them to understand the basic concepts of Indian constitution.
- To identify the importance of fundamental rights as well as fundamental duties.
- To understand the functioning of Union, State and Local Governments in the Indian federal system.
- To learn procedure and effects of emergency, composition and activities of election commission and amendment procedure.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Describe the historical background of the constitution making and its importance for building a democratic India.
CO 2	Explain the functioning of three wings of the government i.e., executive, legislative and judiciary.
CO 3	Explain the value of the fundamental rights and duties for becoming good citizen of India.
CO 4	Analyze the decentralization of power between central, state and local self-government.
CO 5	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy

UNIT - I

Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution Sources and constitutional history, Features Citizenship, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT - II

Union Government and its Administration Structure of the Indian Union: Center- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet an Central Secretariat, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions.

UNIT - III

State Government and its Administration Governor – Role and Position – CM and Council of ministers, State Secretariat: Organization, Structure and Functions.

UNIT - IV

Local Administration: District's Administration Head – Role and Importance, Municipalities –Mayor and role of Elected Representative – ZillaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy – (Different departments), Village level – Role of Elected and Appointed officials.

UNIT - V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissioner State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women.

Text Books:

1. M.V.Pylee, "Introduction to the Constitution of India",4th Edition, Vikas publication,2005.
2. Durga Das Basu(DD Basu) , "Introduction to the constitution of India",(Student Edition),19th edition,Prentice-Hall EEE, 2008.

Reference Books:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. Subhash Kashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Seervai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government andPolitics Hans
7. J. Raj IndianGovernment and Politics
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Ci vil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012.

E-Resources:

- nptel.ac.in/courses/109104074/8
- nptel.ac.in/courses/109104045/
- nptel.ac.in/courses/101104065/

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Course Title	Internet of Things				B.Tech VI Sem (R20) CSE		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2005601	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- Basic principles of IOT.
- Various IOT platforms and application development.
- To know about Arduino board.
- To know about Raspberry pi.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Demonstrate knowledge on Protocols, functional blocks and communication models of Internet of Things.
CO 2	Identify domain specific IoT's.
CO 3	Design appropriate solutions for IoT applications.
CO4	Working with Arduino board.
CO5	Design and develop applications using Raspberry pi device.

UNIT I

INTRODUCTION TO IoT:

Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels and Development Templates.

UNIT II

DOMAIN SPECIFIC IoTs

Introduction, Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle.

UNIT III

IOT and M2M:

Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT

IoT Platform Design Methodology:

Introduction, IoT Design Methodology, Case Study on IoT System for Weather Monitoring.

UNIT IV

Introduction to Arduino:

Introduction, The Arduino Way, The Arduino Platform, Getting started with Arudino, Advanced Input and Output, Sample Programs.

Sensors: Introduction to sensors, Transducer, Sensors characteristics.

UNIT V

IOT Physical Devices:

What is an IOT device, basic building blocks of an IOT device, Exemplary device: Raspberry Pi, about the board, linux on raspberry Pi, raspberry Pi interfaces, Programming Raspberry Pi with Python, Other IoT Devices.

Text Books:

1. Adrian McEwen,Hakin Cassimally "Designing the Internet of Things" Wiley India.
2. Getting Started with Arduino, 3rd Edition, Massimo Banzi and Michael Shiloh
3. Getting Started with Raspberry Pie, Matt Richardson & Shawn Wallace, O'Reilly-2014.
4. Arshdeep Bahga, Vijay Madisetti " Internet of Things(A hands on approach)" 1STedition, VPI publications,2014.

Reference Books:

1. Raj Kamal, "Internet of Things", McGraw Hill, 1st Edition, 2016.
2. Internet of Things, Surya Durbha, Jyothi Joglekar, Oxford Higher Education.
3. The Internet of Things, Michael Miller, Pearson.
4. The Internet of Things, Samuel Greengard, The MIT Press Ltd.

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Course Title	Data Mining				B.Tech VI Sem (R20) CSE		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2005602	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- To learn the concepts of database technology evolutionary path which has led tothe need for data mining and its applications
- To develop skills of using data mining techniques for solving practical problems.
- To learn Data mining algorithms to build analytical applications.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Understand the fundamentals of Data Mining and its Principles.
CO 2	Understand different steps followed in Data mining and pre-processing for Datamining.
CO 3	Apply appropriate data mining algorithms to find Frequent patterns , Associations, and Correlations.
CO4	Compare and evaluate data mining techniques classification, prediction.
CO5	Cluster the high dimensional data for better organization of the data and to detectthe Outliers in the high dimensional data.

UNIT - I

Introduction: Why Data Mining? What Is Data Mining? What Kinds of Data Can Be Mined? What Kinds of Patterns Can Be Mined? Major issues in Data Mining.

UNIT - II

Data Preprocessing:

Why Pre-process the Data? Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.

UNIT - III

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods: Basic Concepts, Frequent Itemset Mining Methods, From Association Analysis to Correlation Analysis, Pattern Mining in Multilevel, Multidimensional Space, Constraint- Based Frequent Pattern Mining.

UNIT - IV

Classification:

Basic Concepts, Decision Tree Induction, Baye's Classification Method, Rule-Based Classification.

Prediction: Basic concepts, Accuracy and Error measures, Evaluating the accuracy of a classifier or apredictor.

UNIT - V

Cluster Analysis: Cluster Analysis basic concepts, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods.

Outlier Detection - Outliers and Outlier Analysis, Outlier Detection Methods

Text Books:

1. Data Mining: Concepts and Techniques, Jiawei Han , MichelineKamber and Jian Pei, Morgan Kaufmann Publishers, Elsevier, Third Edition,2012.
2. Data Warehousing in the Real world, Sam Aanhory& Dennis Murray , Pearson Education, Asia.
3. Intelligent Data Mining, Da Raun.Guoquing Chen, Etienne E. Kerre. Geert Wets, Springer.
4. Data Mining & Data Warehousing: Principles and Practical Techniques, Parteek Bhatia, Cambridge.

Reference Books:

1.Data Mining Techniques, Arun K Pujari, Second Edition, Universities Press.

2.Insight into Data Mining, K.P.Soman, S.Diwakar , V.Ajay, PHI2008.

3.Data Mining: Introductory and Advanced Topics, Margaret H. Dunhan, Pearson.

4.Data Mining, Vikram Pudi, P. Radha Krishna, Oxford Higher Eduction.

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Course Title	Cryptography & Network Security				B. Tech. VI Sem CSE (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2005603	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Min					End Exam Duration: 3Hrs		

Course Objectives:

- Extensive, thorough and significant understanding of the concepts, issues, principles and theories of computer network security
- Identifying the suitable points for applying security features for network traffic
- Understanding the various cryptographic algorithms and implementation of the same.
- Understanding the various attacks, security mechanisms and services.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Identify information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory.
CO 2	Understand, compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication.
CO 3	Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
CO 4	Apply different digital signature algorithms to achieve authentication and create secure applications.
CO 5	Apply network security basics, analyze different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP.
CO 6	Apply the knowledge of cryptographic utilities and authentication mechanisms to design secure applications

UNIT I

Computer Security concepts, The OSI Security Architecture, Security attacks, Security services and Security mechanisms, A model for Network Security, Classical encryption techniques-symmetric cipher model, substitution ciphers, transposition ciphers, Steganography, Modern Stream ciphers.

UNIT II

Modern Block Ciphers: Block ciphers principles, Data encryption standard (DES), Strength of DES, Block cipher modes of operations, AES, RC4.

Introduction to Number theory : Integer Arithmetic, Modular Arithmetic,Linear Congruence, Algebraic Structures, GF(2n) Fields, Primes, Factorization, Chinese remainder Theorem, Quadratic Congruence.

UNIT III

Public-key cryptography : Principles of public-key cryptography, RSA Algorithm, Diffie-Hellman Key Exchange, ELGamal cryptographic system.

Cryptographic Hash functions: Applications of Cryptographic Hash functions, Requirements and security, Hash functions based on Cipher Block Chaining, Secure Hash Algorithm (SHA).

UNIT IV

Message Authentication Codes: Message authentication Requirements, Message authentication functions, Message authentication codes, security of MACs, HMAC.

Digital Signatures: Digital Signatures, Schnorr Digital Signature Scheme, Digital Signature Standard.

UNIT V

User Authentication: Remote user Authentication Principles, Kerberos

Electronic mail security: Pretty Good Privacy (PGP), S/MIME Worms, Viruses, Firewalls.

Text Books:

1. Cryptography and network Security by Fourth edition, Stallings, PHI/Pearson
2. Cryptography & Network Security by Behrouz A. Forouzan, TMH.
3. Network Security: The complete reference by Robert Bragg, Mark Rhodes, TMH
4. Computer Security Basics by Rick Lehtinen, Deborah Russell & G.T.Gangemi Sr., SPD O'REILLY.

Reference Books:

1. Cryptography and network Security by Atul Kahate, 4th Edition, Tata McGraw Hill.
2. Understanding Cryptography, Christof Paar. Jan Pelzl, Springer.
3. Introduction to Modern Cryptography, Jonathan Katz, Yehuda Lindell, 2nd Edition, CRC.

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Course Title	Java Programming (Open Elective Course-II)				B. Tech VI Sem (R20) CSE		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
20OE503	OEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Mins					End Exam Duration: 3Hrs		

Course Objectives:

- To give the students a firm foundation on Java concepts like Primitive data types, Java control flow, Methods, Object-oriented programming, Core Java classes, packages and interfaces, multithreading.
- To provide the students with an understanding of Java applets, Abstract Window, Toolkit and exception handling.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Solve problems using object oriented approach and implement them using Java.
CO 2	Develop efficient programs with multitasking ability and handle exceptions.
CO 3	Develop user friendly interface.
CO 4	Create AWT components.

UNIT - I

Object Oriented Programming basics: Need for OOP paradigm, Principles of OOP concepts

Java Basics: History of Java, Java buzzwords, Simple java program, classes and objects – concepts of classes, objects, constructors, methods, Introducing access control, **this** keyword, overloading methods and constructors.

UNIT - II

Inheritance: Hierarchical abstractions, Types of Inheritance, benefits of inheritance, **super** uses, using **final** with inheritance, polymorphism- method overriding, abstract classes.

Packages and Interfaces: Defining, Creating and Accessing a Package, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.

UNIT - III

Exception handling: Concepts of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, creating own exception sub classes.

UNIT - IV

Event Handling : Events, Event sources, Event classes, Event Listeners, The AWT class hierarchy, user interface components- Labels, Button, Scrollbars, Text Components, Check box, Choices, Layout manager types – Flow, Border, Grid, Card and Grid bag.

UNIT - V

Applets: Concepts of Applets, differences between applets and applications, life cycle of an Applet, creating applets, passing parameters to applets.

Swings: Icons and Labels, text fields, JButton class, Check boxes, Radio buttons, Combo boxes, and Tables.

Text Books:

1. Java; the complete reference, 7th editon, Herbert schildt, TMH.
2. Understanding OOP with Java, updated edition, T. Budd, Pearson Education.
3. An Introduction to programming and OO design using Java, J.Nino and F.A.Hosch, John wiley & sons.
4. An introduction to Java programming and object oriented application development, R.A. Johnson- Thomson.

Reference Books:

1. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, eighth Edition, Pearson Education.
2. Core Java 2, Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell, eighth Edition, Pearson Education.
3. Object Oriented Programming through Java, P. Radha Krishna, University Press.
4. Java and Object-Oriented programming Paradigm, Debasish Jana, PHI Learning Pvt. Ltd.

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Course Title	Web Designing (Open Elective Course-II)				B. Tech VI Sem (R20) CSE		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
20OE504	OEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Mins					End Exam Duration: 3Hrs		

Course Objectives:

- To learn the basic principles of Web page design.
- To learn the basic concepts of HTML.
- To introduce client side scripting with Java Script.
- To introduce the concepts of CSS and Web publishing.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Define the principle of Web page design and basics in web design.
CO 2	Visualize the basic concept of HTML and recognize the elements of HTML.
CO 3	Understand java Script and create static web pages.
CO 4	Introduce basics concept of CSS.
CO 5	Develop the concept of web publishing.

UNIT – I

Web Design Principles: Basic principles involved in developing a web site, Planning process, Five Golden rules of web designing, Designing navigation bar, Page design ,Home Page Layout, Design Concept.

Basics in Web Design: Brief History of Internet, What is World Wide Web, Why create a web site, Web Standards, Audience requirement.

UNIT – II

Introduction to HTML: What is HTML, HTML Documents, Basic structure of an HTML document, Creating an HTML document, Mark up Tags, Heading-Paragraphs, Line Breaks, HTML Tags.

Elements of HTML: Introduction to elements of HTML, Working with Text, Working with Lists, Tables and Frames, Working with Hyperlinks, Images and Multimedia, Working with Forms and controls.

UNIT – III

Java Script: Introduction, Basics of Java Script, Control Structures, Pop up Boxes, Functions, Arrays Events, Objects, Dynamic HTML.

UNIT – IV

Introduction to Cascading Style Sheets: Concept of CSS , Creating Style Sheet, CSS Properties, CSS Styling(Background, Text Format, Controlling Fonts) , Working with block elements and objects, Working with Lists and Tables, CSS Id and Class , Box Model(Introduction, Border properties, Padding Properties, Margin properties) , CSS Advanced(Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector), CSS Color , Creating page Layout and Site Designs.

UNIT – V

Introduction to Web Publishing or Hosting: Creating the Web Site, Saving the site, working on the web site, Creating web site structure, Creating Titles for web pages, Themes-Publishing web sites.

Text Books:

1. Creating a Web Page and Web Site College, 2002, Murray, Tom/Lynchburg.
2. HTML 5 in simple steps Dreamtech Press, Kogent Learning Solutions Inc.
3. A beginner's guide to HTML NCSA,14th May,2003.

Reference Books:

1. HTML, XHTML, and CSS Bible, 5ed, HTML, XHTML, and CSS Bible, 5ed, Wiley India.
2. Beginning HTML, XHTML, CSS, and JavaScript by John Duckett, Wiley India.
3. Beginning CSS: Cascading Style Sheets for Web Design by Ian Pouncey, Richard York, Wiley India.

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Course Title	Artificial Intelligence (Professional Elective Course-II)				B.Tech VI Sem (R20) CSE		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2005604	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- To understand how a computer making intelligent decisions.
- To understand the notions of state space representation, heuristic search methods.
- To learn different knowledge representation techniques
- To understand the applications of AI.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Given a search problem, analyze and formalize the problem (as a state space, graph, etc.).
CO 2	The ability defines admissible and consistent heuristics and completeness and optimality.
CO 3	Analyze and Apply knowledge representation technique.
CO4	Ability to understand uncertainty and Design appropriate Bayes Nets corresponding to the causal relationships and conditional independence of a real world situation
CO5	Design good evaluation functions and strategies for game playing and Understand concept of natural language processing.

UNIT-I:

Introduction to AI: AI Problems History what is an AI Technique. Problem, Problem Space and Search, Heuristic Search Techniques.

UNIT-II:

Knowledge Representation Issues, Predicate Logic, Knowledge Representation using rules.

UNIT –III:

Symbolic reasoning under Uncertainty, Bayesian Networks.

UNIT-IV:

Weak Slot Filler Structures, Strong Slot and Filler Structures, Knowledge Representation summary.

UNIT –V:

Game Playing, Planning, Natural Language processing.

Text Books:

1. Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition 2009.
2. Russell, Norvig: Artificial intelligence, A Modern Approach, Pearson Education, Second Edition. 2004.
3. *Philip C Jackson,* Introduction to Artificial Intelligence: Second, Enlarged Edition.
4. Saroj Kaushik. Artificial Intelligence. Cengage Learning, 2011.

Reference Books:

1. Charu C. Aggarwal,Artificial Intelligence,Springer,2021.
2. Adelyn Zhou, Mariya Yao and Marlene Jia Applied Artificial Intelligence: A Handbook for Business Leaders, 2017
3. Peter Norvig, Paradigms of Artificial Intelligence Programming: Case Studies in Common Lisp.
4. Dr. Dheeraj Mehrotra,Basics of Artificial Intelligence & Machine Learning
5. Chandra S.S.V,Artificial Intelligence and Machine Learning
6. Denis Rothman, Artificial Intelligence by Example

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Course Title	Software Testing (Professional Elective Course -II)				B.Tech VI Sem (R20) CSE		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2005605	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- Study the concepts of Software Testing objectives, Complications of bugs and Types of bugs.
- Learn various testing methodologies.
- Identify the techniques and skills on how to use modern software testing tools to support software testing projects.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Recall Software Testing.
CO 2	Compare various Terminologies used in Software Testing.
CO 3	Understand various testing methodologies like Path Testing, Domain Testing, Logic based Testing and Tools (Win-runner testing Tool).
CO 4	Construct various graphs useful in Software Testing like Flow Graph, State Graph.
CO 5	Examine various testing strategies and categorize them.

UNIT - I

Introduction: Purpose of testing, Dichotomies, Model for testing, Consequences of Bugs, Taxonomy of bugs.

Flow graphs and Path testing: Path testing basics, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Application of path testing.

UNIT - II

Transaction Flow Testing: Transaction Flows, Transaction Flow Testing Techniques.

Dataflow testing: Basics of dataflow testing, Strategies in dataflow testing, Application of dataflow testing.

UNIT - III

Domain Testing: Domains and Paths, Nice & Ugly Domains, Domain Testing, Domains and Interfaces Testing, Domains and Testability.

Paths, Path products and Regular expressions: Path products & Path expression, Reduction Procedure, Regular Expressions & Flow Anomaly Detection.

UNIT - IV

Logic Based Testing: Overview, Decision Tables, and Path Expressions and specifications.

State, State Graphs and Transition Testing: State Graphs, Good & Bad State Graphs, State Testing, Testability Tips.

UNIT - V

Graph Matrices and Application: Matrix of Graph, Power of a Matrix, Node Reduction Algorithm.

Text Books:

1. Software Testing techniques, Boris Beizer, Dreamtech, Second Edition.
2. Software Testing, N.Chauhan, Oxford University Press.
3. The craft of software testing - Brian Marick, Pearson Education.
4. Foundations of Software Testing, D.Graham and Others, Cengage Learning.

Reference Books:

1. Software Testing, Third Edition, P.C.Jorgensen, Aurbach Publications (Dist.by SPD).
2. Introduction to Software Testing, P.Ammann and J.Offutt, Cambridge Univ. Press.
3. Effective methods of Software Testing, Perry, John Wiley, Second Edition, 1999.
4. Software Testing Concepts and Tools, P.Nageswara Rao, Dreamtech Press.
5. Software Testing, M.G.Limaye, TMH.
6. Software Testing Tools, Dr.K.V.K.K.Prasad, Dreamtech.

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Course Title	Adhoc & Sensor Networks (Professional Elective course-II)				B.Tech VI Sem (R20) CSE		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exams	Total
2005606	PEC	3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs			

Course Objectives:

- Learn the different types of MAC protocols.
- Be familiar with different types of ad hoc routing protocols.
- Be expose to the TCP issues in ad hoc networks.
- Learn the architecture and protocols of wireless sensor networks.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the concepts, network architectures and applications of adhoc and wireless sensor networks.
CO 2	Analyze the protocol design issues of adhoc and sensor networks.
CO 3	Design routing protocols for adhoc systems.
CO4	Develop wireless sensor networks with respect to some protocol design issues.
CO 5	Evaluate the QoS related performance measurements of ad hoc and sensor networks.

UNIT - I

INTRODUCTION: Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.

UNIT - II

MAC PROTOCOLS FOR ADHOC WIRELESS NETWORKS:

Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols- Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11

UNIT – III

ROUTING PROTOCOLS AND TRANSPORT LAYER IN ADHOC WIRELESS NETWORKS 9:

Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

UNIT – IV

WIRELESS SENSOR NETWORKS (WSN) AND MAC PROTOCOLS 9

Single node architecture: hardware and software components of a sensor node – WSN

Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.

UNIT – V

WSN ROUTING, LOCALIZATION & QOS 9:

Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization- Transport Layer issues.

Text Books:

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks:Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2008.
2. Jing (Selina) He, Mr. Mr. Shouling Ji, Yingshu Li, Yi Pan, "Wireless Ad Hoc and Sensor Networks", CRC Press.
3. Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.

Reference Books:

1. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication – 2002.
2. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", "Wiley",2005

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Course Title	IOT Lab				B. Tech. VI Sem CSE (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2005607	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	3	1.5	40	60	100
					End Exam Duration: 3Hrs		

Course Objectives:

- Student should get the knowledge of Python and Eclipse background.
- Student should get the knowledge of Control statements in python
- Student should get the knowledge of Arduino.
- Student should get the knowledge of Raspberry Pi

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Student will be aware of Python and Eclipse background.
CO 2	Student will develop basic programs in python
CO 3	Student will get knowledge on Arduino IDE and Arduino Board
CO 4	Student will get knowledge on Raspberry Pi

IoT Experiments:-

1. Study and Install IDE of Arduino and different types of Arduino.
2. Digital Output (Blinking of LED)
3. Digital Input (Push Button)
4. Analog Output (Fading)
5. Communication between Computer and Arduino.
6. Displaying messages on LCD
7. Traffic Controller
8. Night Light Simulation using LDR and PVR
9. Fire Alert.
10. Study and Configure Raspberry Pi
11. Write a Program for LED blink using Raspberry Pi
12. Write a Program for LED blink using Switch with Raspberry Pi

Text Books:

1. Adrian McEwen, Hakin Cassimally "Designing the Internet of Things" Wiley India.
2. Getting Started with Arduino, 3rd Edition, Massimo Banzi and Michael Shiloh
3. Getting Started with Raspberry Pie, Matt Richardson & Shawn Wallace, O'Reilly-2014.
4. ArshdeepBahga, Vijay Madisetti " Internet of Things(A hands on approach)" 1STedition, VPI publications,2014.

Reference Books:

1. Raj Kamal, "Internet of Things", McGraw Hill, 1st Edition, 2016.
2. Internet of Things, Surya Durbha, Jyothi Joglekar, Oxford Higher Education.
3. The Internet of Things, Michael Miller, Pearson.
4. The Internet of Things, Samuel Greengard, The MIT Press Ltd.

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Course Title	Data Mining Lab				B. Tech. VI Sem CSE (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2005608	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	3	1.5	40	60	100
					End Exam Duration: 3Hrs		

Course Objectives:

- The different data **mining models** and techniques will be discussed in this course.
- Data mining and data warehousing applications in bioinformatics will also be explored.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Understand the data mining process and important issues around data cleaning, pre-processing and integration.
CO 2	Understand the principle algorithms and techniques used in data mining, such as clustering, association mining, classification and prediction.

Credit Risk Assessment

Description: The business of banks is making loans. Assessing the credit worthiness of an applicant is of crucial importance. You have to develop a system to help a loan officer decide whether the credit of a customer is good, or bad. A bank's business rules regarding loans must consider two opposing factors. On the one hand, a bank wants to make as many loans as possible. Interest on these loans is the banks profit source. On the other hand, a bank cannot afford to make too many bad loans. Too many bad loans could lead to the collapse of the bank. The bank's loan policy must involve a compromise: not too strict, and not too lenient.

To do the assignment, you first and foremost need some knowledge about the world of credit. You can acquire such knowledge in a number of ways.

1. Knowledge Engineering. Find a loan officer who is willing to talk. Interview her and try to represent her knowledge in the form of production rules.
2. Books. Find some training manuals for loan officers or perhaps a suitable text book on finance. Translate this knowledge from text form to production rule form.
3. Common sense. Imagine yourself as a loan officer and make up reasonable rules which can be used to judge the credit worthiness of a loan applicant.
4. Case histories. Find records of actual cases where competent loan officers correctly judged when, and when not to, approve a loan application.

The German Credit Data:

Actual historical credit data is not always easy to come by because of confidentiality rules. Here is one such dataset, consisting of 1000 actual cases collected in Germany. credit dataset (original) Excel spreadsheet version of the German credit data (Down load from web).

In spite of the fact that the data is German, you should probably make use of it for this assignment. (Unless you really can consult a real loan officer !)

A few notes on the German dataset

- DM stands for Deutsche Mark, the cents Canadian (but looks and acts like a quarter).
- Owns telephone. German phone rat so fewer people own telephones.
- foreignhere_areworkermillionsofthese. Tin Germany (many from Turrkey). It is very hard to get German citizenship if you were not born of German parents.
- There are 20 attributes used in the classify the applicant into one of two categories, good or bad.

Subtasks : (Turn in your answers to the following tasks)

1. List all the categorical (or nominal) attributes and the real-valued attributes separately.
2. What attributes do you think might be crucial in making the credit assessment? Come up with some simple rules in plain English using your selected attributes.
3. One type of model that you can create is a Decision Tree - train a Decision Tree using the complete dataset as the training data. Report the model obtained after training.
4. Suppose you use your above model trained on the complete dataset, and classify credit good/bad for each of the examples in the dataset. What % of examples can you classify correctly ? (This is also called testing on the training set) Why do you think you cannot get 100 % training accuracy ?
5. Is testing on the training set as you did above a good idea ? Why or Why not ?
6. One approach for solving the problem encountered in the previous question is using cross validation ? Describe what is cross-validation briefly. Train a Decision Tree again using cross-validation and report your results. Does your accuracy increase/decrease ? Why ? (10 marks)

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Text Books:

1. Data Mining: Concepts and Techniques, Jiawei Han , MichelineKamber and Jian Pei, Morgan Kaufmann Publishers, Elsevier, Third Edition,2012.
2. Data Warehousing in the Real world, Sam Aanhory& Dennis Murray , Pearson Education, Asia.
3. Intelligent Data Mining, Da Raun.Guoquing Chen, Etienne E. Kerre. Geert Wets, Springer.
4. Data Mining & Data Warehousing: Principles and Practical Techniques, Parteek Bhatia, Cambridge.

Reference Books:

1. Data Mining Techniques, Arun K Pujari, Second Edition, Universities Press.
2. Insight into Data Mining, K.P.Soman, S.Diwakar , V.Ajay, PHI2008.
3. Data Mining: Introductory and Advanced Topics, Margaret H. Dunhan, Pearson.
4. Data Mining, Vikram Pudi, P. Radha Krishna, Oxford Higher Eduction.

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Course Title	Network Security Lab				B. Tech. VI Sem CSE (R20)		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2005609	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	3	1.5	40	60	100
					End Exam Duration: 3Hrs		

Course Objectives:

- To provide deeper understanding into cryptography, its application to network security, threats/vulnerabilities to networks and countermeasures.
- To Identify basic security attacks and services.
- To explain various approaches to Encryption techniques, Digital Signatures.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Identify the security issues in data transmission over computer network and resolve it.
CO 2	Implementation of various types of Encryption techniques.
CO 3	Implementation of Digital Signature schemes.
CO 4	Understanding functionality of Intrusion Detection System.

List of Experiments:

1. Perform encryption and Decryption using Substitution technique Caesar Cipher.
2. Perform encryption and Decryption using Substitution technique Playfair Cipher.
3. Perform encryption and Decryption using Substitution technique Hill Cipher.
4. Perform encryption and Decryption using Substitution technique Vigenere Cipher.
5. Perform encryption and Decryption using Transposition technique Railfence Cipher.
6. Perform encryption and Decryption using Transposition technique row-column transformation Cipher.
7. Perform encryption and Decryption using Block Cipher Data Encryption Standard.
8. Perform encryption and Decryption using Public Key Encryption technique RSA.
9. Implement the Key Exchange technique Diffie-Hellman Algorithm.
10. Implement Digital Signature technique MD5.
11. Demonstrate encryption and Decryption using Certificate Manager Kleopatra for GnuPG.
12. Demonstrate open source Intrusion Detection system.

Text Books:

1. Cryptography and network Security by Fourth edition, Stallings, PHI/Pearson
2. Cryptography & Network Security by Behrouz A. Forouzan, TMH.
3. Network Security: The complete reference by Robert Bragg, Mark Rhodes, TMH
4. Computer Security Basics by Rick Lehtinen, Deborah Russell & G.T.Gangemi Sr., SPD O'REILLY.

Reference Books:

1. Cryptography and network Security by Atul Kahate, 4th Edition, Tata McGraw Hill.
2. Understanding Cryptography, Christof Paar. Jan Pelzl, Springer.
3. Introduction to Modern Cryptography, Jonathan Katz, Yehuda Lindell, 2nd Edition, CRC Press.

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Course Title	Mobile Application Development / NASSCOM Courses				B.Tech VI Sem (R20) CSE		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2005610	Skill Oriented Course	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	4	2	40	60	100
					End Exam Duration: 3Hrs		

Course Objectives:

- To understand fundamentals of android operating systems.
- Illustrate the various components, layouts and views in creating android applications.
- To understand fundamentals of android programming.
- To understand Kotlin programming.
- Utilizing the android components by using Kotlin language.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Develop applications using services and publishing android applications.
CO 2	To demonstrate their skills of using Android software development tools.
CO 3	Implementing Android programming with java to develop basic applications.
CO4	Installing Kotlin Software and utilizing.
CO5	Developing applications with kotlin.

LIST OF EXPERIMENTS:

1. Setting up the Development Environment
   1.1 Installation of JDK and Setting path
   1.2 Downloading and Installing Android Studio
2. Creating "Hello World" Application and viewing the output through emulator.
3. Creating the Application by using Activity class
   i) onCreate()
   ii) onStart()
   iii) onResume()
   iv) onPause()
   v) onStop()
   vi) onDestroy()
   vii) onRestart()
4. Create the Application using the Edit Text control.

5. Create the Application Choosing options.
   i) CheckBox
   ii) RadioButton
   iii) Spinner

6. Create the applications using different layouts.
   i) Linear Layout
   ii) Relative Layout
   iii) Absolute Layout
   iv) Table Layout

7. Create the application for doing arithmetic operations. (Calculator)

8. Create the application to play the audio and video clips.

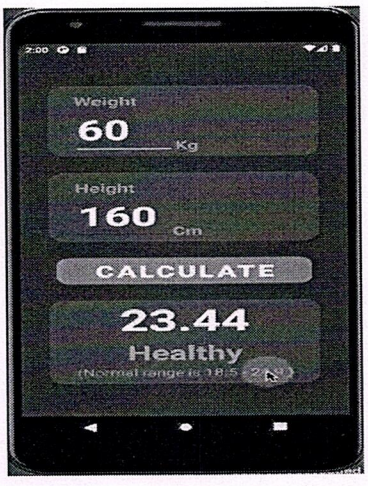
9. Create the application by using menus and action bar.

10. Sample Android applications using SQLite Database as a backend.

11. Installing Kotlin software.

12. Creating an android application in kotlin using EditText and Button controls.

13. Create an android app in Kotlin to find the health condition of the person.



Text Books:

1. Android Programming by B.M Harwani, Pearson Education, 2013.
2. T1. Lauren Darcey and Shane Conder, "Android Wireless ApplicationDevelopment", Pearson Education, 2nd ed. (2011)
3. Android application Development for Java Programmers, James C Sheusi, CengageLearning 4. Android In Action by W.Frank Ableson, Robi Sen, Chris King, C. Enrique Ortiz.,Dreamtech.

Reference Books:

1. Beginning Android 4 Application Development, by Wei-Meng Lee , Wiley India.
2. Android Programming for Beginners, John Horton, 2nd Edition, Packt.
3. Android App Development for Dummies, Michael Burton, 3rd Edition, Wiley.

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Course Title	Management Organizational Behaviour (Mandatory Course)				B.Tech VI Sem (R20) CSE		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
20MC612	MC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
						End Exam Duration: 3Hrs		

Course Objectives:

- To aid students in understanding human behavior in organizations,
- To provide students with a comprehensive exposure to organizational behavior theories, research and workplace issues.
- The course also provides an overview of the theories and practices of management in organizational contexts.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Explain the Importance & Role of Management in the Organizations.
CO 2	Evaluate the different aspects related to Decision Making and Controlling Process
CO 3	Describe the different theories related to Individual behavior in the Organization
CO4	Analyze Group Behavioral influence in the Organization.
CO5	Evaluate the process and climate effects in Organization Behavior.

UNIT-I

Role of Management: Concept – Significance – Functions – Principles of Management - Patterns of Management: Scientific – Behavioural – Systems – Contingency.

UNIT-II

Decision Making & Controlling – Process – Techniques. Planning – Process – Problems — Making It Effective. Controlling - System of Controlling – Controlling Techniques – Making Controlling Effective.

UNIT-III

Individual Behaviour& Motivation – Understanding Individual Behaviour – Perception – Learning – Personality Types – Johari window- Transactional Analysis- Motivation – Concept of Motivation - Motivational Theories of Maslow, Herzberg, David McClelland, and Porter and Lawler.

UNIT-IV

Group Behavior & Leadership: Benefits of Groups – Types of Groups – Group Formation and Development. Leadership and Organizational Culture and Climate: Leadership – Traits Theory – Managerial Grid – Transactional Vs Transformational Leadership – Qualities of good leader- Women Leadership in India.

UNIT-V

Organisational Behaviour: Organizing Process – Departmentation Types – Making Organizing Effective – Organisational culture- Types of culture – Organisational Culture VsOrganisational climate - Conflict management - Change Management .

Text Books:

1. Organisational Behaviour, Stephen P. Robbins, Pearson Education
2. Management and Organisational Behaviour, Subbarao P, Himalaya Publishing House
3. Principles of Management, Koonz,Weihrich and Aryasri, Tata McGraw Hill.

Reference Books:

1. Organisational Behaviour ,S.S.Khanka, S.Chand
2. OrganisationalBehaviour , Mishra .M.N ,Vikas
3. Management and Organisational behaviour, Pierce Gordner, Cengage.
4. Behaviour in Organizations, Hiriyappa .B.New Age Publications
5. Organisational Behaviour, Sarma, Jaico Publications.
6. Principles of Management ,Murugesan ,Laxmi Publications

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PG Programs in Engineering (R22PG)

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M.Tech - Artificial Intelligence & Data Science (Computer Science & Engineering)

Semester - I

S. No.	Course codes	Course Name	Category	Hours per week			IM	EM	Credits
				L	T	P			
1.	2298101	Machine Learning	PCC	3	0	0	40	60	3
2.	2298102	Artificial Intelligence	PCC	3	0	0	40	60	3
3.	2298103 2298104 2298105	**Program Elective Course – I** 1. Big Data Analytics 2. Information retrieval 3. Natural Language Processing	PEC	3	0	0	40	60	3
4.	2298106 2298107 2298108	**Program Elective Course - II** 1. Data Visualization Techniques 2. Distributed Systems 3. Medical Image Processing	PEC	3	0	0	40	60	3
5.	2298109	AI & ML Lab	PCC	0	0	4	50	50	2
6.	2298110	Advanced Python Programming Lab	PCC	0	0	4	50	50	2
7.	2284103	Research Methodology & IPR	MC	2	0	0	40	60	2
8.	2270AXX	**Audit Course – I**	AC	2	0	0	40	0	0
Total							**340**	**400**	**18**

Semester - II

S. No.	Course codes	Course Name	Category	Hours per			IM	EM	Credits
				L	T	P			
1.	2298201	Data Science	PCC	3	0	0	40	60	3
2.	2298202	Deep Learning	PCC	3	0	0	40	60	3
3.	2298203 2298204 2298205	**Program Elective Course - III** 1. Block Chain Technology 2. Exploratory Data Analysis using R 3. Video Analytics	PEC	3	0	0	40	60	3
4.	2298206 2298207 2298208	**Program Elective Course – IV** 1. Text Mining & Time Series Data Analysis 2. Social Media Analysis 3. Artificial Intelligence in Cyber Security	PEC	3	0	0	40	60	3
5.	2298209	Deep Learning Lab	PCC	0	0	4	50	50	2
6.	2298210	Program Elective Course Lab	PEC	0	0	4	50	50	2
7.	2298211	Technical seminar	PROJ	0	0	4	100	0	2
8.	2270AXX	**Audit Course – II**	AC	2	0	0	40	0	0
Total							**400**	**420**	**18**

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Semester - III

S. No.	Course codes	Course Name	Category	Hours per			IM	EM	Credits
				L	T	P			
1.	2298301 2298302 2298303	**Program Elective Course – V** 1. Reinforcement Learning 2. Federated Machine Learning 3. Intrusion Detection Systems	PEC	3	0	0	40	60	3
2.	22OE98X	**Open Elective**	OEC	3	0	0	40	60	3
3.	2298307	Dissertation Phase – I	PROJ	0	0	20	100	0	10
4.	2298308	Co-curricular Activities							2
		Total					**180**	**120**	**18**

Semester - IV

S. No.	Course codes	Course Name	Category	Hours per			IM	EM	Credits
				L	T	P			
1.	2298401	Dissertation Phase – II	PROJ	0	0	32	50	50	16
Total									**16**

AUDIT COURSES

S.No	Subject Code	Subject
	AUDIT COURSE - I	
1	2270A01	English for Research Paper Writing
2	2270A02	Disaster Management
3	2270A03	Sanskrit for Technical Knowledge
4	2270A04	Values for Professional Ethics
5	2270A05	Constitution of India
6	2270A06	Pedagogy Studies
7	2270A07	Stress Management by Yoga
8	2270A08	Personality Development through Life Management Skills

OPEN ELECTIVES

S.No	Subject Code	Subject
1	22OE981	Knowledge Engineering and Data Science
2	22OE982	Cloud Data Management
3	22OE983	Soft Computing

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Annexure – 1 Curriculum

M.Tech - Artificial Intelligence & Data Science (Computer Science & Engineering)

1st Semester

S. No.	Course codes	Course Name	Category	Hours per week			IM	EM	Credits
				L	T	P			
1.	2298101	Machine Learning	PCC	3	0	0	40	60	3
2.	2298102	Artificial Intelligence	PCC	3	0	0	40	60	3
3.	2298103 2298104 2298105	**Program Elective Course – I** 1. Big Data Analytics 2. Information retrieval 3. Natural Language Processing	PEC	3	0	0	40	60	3
4.	2298106 2298107 2298108	**Program Elective Course – II** 1. Data Visualization Techniques 2. Distributed Systems 3. Medical Image Processing	PEC	3	0	0	40	60	3
5.	2298109	AI & ML Lab	PCC	0	0	4	50	50	2
6.	2298110	Advanced Python Programming Lab	PCC	0	0	4	50	50	2
7.	2284103	Research Methodology & IPR	MC	2	0	0	40	60	2
8.	2270AXX	**Audit Course – I**	AC	2	0	0	40	0	0
Total							**340**	**400**	**18**

2nd Semester

S. No.	Course codes	Course Name	Category	Hours per			IM	EM	Credits
				L	T	P			
1.	2298201	Data Science	PCC	3	0	0	40	60	3
2.	2298202	Deep Learning	PCC	3	0	0	40	60	3
3.	2298203 2298204 2298205	**Program Elective Course - III** 1. Block Chain Technology 2. Exploratory Data Analysis using R 3. Video Analytics	PEC	3	0	0	40	60	3
4.	2298206 2298207 2298208	**Program Elective Course - IV** 1. Text Mining & Time Series Data Analysis 2. Social Media Analysis 3. Artificial Intelligence in Cyber Security	PEC	3	0	0	40	60	3
5.	2298209	Deep Learning Lab	PCC	0	0	4	50	50	2
6.	2298210	Program Elective Course Lab	PEC	0	0	4	50	50	2
7.	2298211	Technical seminar	PROJ	0	0	4	100	0	2
8.	2270AXX	**Audit Course – II**	AC	2	0	0	40	0	0
Total							**400**	**420**	**18**

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3rd Semester

S. No.	Course codes	Course Name	Category	Hours per			IM	EM	Credits
				L	T	P			
1.	2298301 2298302 2298303	**Program Elective Course – V** 1. Reinforcement Learning 2. Federated Machine Learning 3. Intrusion Detection Systems	PEC	3	0	0	40	60	3
2.	22OE98X	**Open Elective**	OEC	3	0	0	40	60	3
3.	2298307	Dissertation Phase – I	PROJ	0	0	20	100	0	10
4.	2298308	Co-curricular Activities							2
		Total					**180**	**120**	**18**

4th Semester

S. No.	Course codes	Course Name	Category	Hours per			IM	EM	Credits
				L	T	P			
1.	2298401	Dissertation Phase – II	PROJ	0	0	32	50	50	16
Total									**16**

Audit Courses

S.No	Subject Code	Subject
		AUDIT COURSE-I
1	2270A01	English for Research Paper Writing
2	2270A02	Disaster Management
3	2270A03	Sanskrit for Technical Knowledge
4	2270A04	Values for Professional Ethics
5	2270A05	Constitution of India
6	2270A06	Pedagogy Studies
7	2270A07	Stress Management by Yoga
8	2270A08	Personality Development through Life Management Skills

Open Electives

S.No	Subject Code	Subject
1	22OE981	Knowledge Engineering and Data Science
2	22OE982	Cloud Data Management
3	22OE983	Soft Computing

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1st Semester

Course Title	Machine Learning					M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2298101	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours						End Exam Duration: 3Hrs		

Course Objectives:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques.
- To study the various probability-based and generalized learning techniques.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the machine learning concepts that are suitable for developing real t applications.
CO 2	Develop Decision tree learning models for given problem.
CO 3	Understand neural network representation for solving a problem.
CO 4	Understand Bayesian learning to developing models to solve real time problem.
CO 5	Apply instance based learning methods for solving real time problems.

UNIT-I

Introduction to Machine Learning: Introduction, well posed learning problems, Designing a learning system, Perspective and issues in machine learning, Types of Machine Learning, Applications o machine learning.

UNIT-II

Decision Tree Learning – Introduction, Decision Tree Representation, Appropriate Problems for decision tree learning, Hypothesis search space in Decision Tree Learning, Inductive bias in Decision Tree Learning, Issues in Decision Tree Learning.

UNIT-III

Artificial Neural Networks: Introduction, Artificial Neural networks representation, Appropriate Problems for neural network learning, perceptrons, Multilayer Networks and the back propagation Algorithm, Example: Face recognition.

UNIT-IV

Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and Concept Learning, Maximum

UNIT - V

Instance Based Learning: Introduction, K-Nearest Neighborhood Learning, Locally Weighted representation, Radial Basis Fuctions, Case based reasoning,

Text Books:

1. Machine Learning, Tom M.Mitchell, McGraw-Hill.
2. Introduction to Machine Learning, Ethem Alpaydin, Third Edition, MIT Press
3. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis
4. Machine Learning: A Probabilistic Perspective, KevinMurphy,MITPress,2012.

Reference Books:

1. Artificial Neural Network, Robert J. Schalkoff, McGraw Hill.
2. Bayesian Reasoning & Machine Learning, David Barber, Cambridge University Press.
3. Tree-Based Machine Learning, Clinton Sheppard, Create Space Independent Publishing.

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Course Title	Artificial Intelligence					M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2298102	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs			

Course Objectives:

- To impart knowledge about Artificial Intelligence.
- To give understanding of the main abstractions and reasoning for intelligent systems.
- To enable the students to understand the basic principles of Artificial Intelligence in various applications.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Solve basic AI based problems.
CO 2	Define the concept of Artificial Intelligence.
CO 3	Apply AI techniques to real-world problems to develop intelligent systems.
CO 4	Select appropriately from a range of techniques when implementing intelligent systems.

UNIT - I:

Introduction: The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art. **Intelligent Agents**: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

UNIT - II:

Solving Problems by Searching: Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.

UNIT – III:

Knowledge representation and reasoning: propositional and predicate logic, Resolution and theorem proving, Temporal and spatial reasoning. Probabilistic reasoning, Bayes theorem.

UNIT – IV:

Learning: Learning from example, Learning by advice, Explanation based learning, Learning in problem solving, Classification, Inductive learning, Naive Bayesian Classifier, decision trees.

UNIT – V:

Intelligent Systems: Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition. Key Application Areas: Expert system, decision support systems, Speech and vision, Natural language processing, Information Retrieval, Semantic Web.

Text books:

1. Artificial Intelligence: A Modern Approach by S. Russell and P. Norvig, Prentice Hall
2. Artificial Intelligence by Elaine Rich, Kevin Knight and Shivashankar B Nair, Tata McGraw Hill.
3. Introduction to Artificial Intelligence and Expert Systems by Dan W. Patterson, Pearson Education.
4. Artificial Intelligence: A New Sythesis" by Nils J Nilsson, Kindle Edition.

Reference Books:

1. SarojKaushik. Artificial Intelligence. Cengage Learning, 2011.
2. Artificial Intelligence, George F Luger, 6th Edition, Pearson
3. Artificial Intelligence, ELA Kumar, Wiley.
4. Artificial Intelligence: A Guide to Intelligent Systems, Michael Negnevitsky, Pearson.

Websites:

https://www.youtube.com/watch?v=pKeVMlkFpRc
www.digimat.in/nptel/courses/video/106106126/L01.html

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Course Title	Big Data Analytics (Professional Elective Course-I)				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2298103	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- To familiarize the Big Data Platform and its use cases.
- To provide an overview of Apache Hadoop.
- To provide HDFS Concepts and Interfacing with HDFS.
- To familiarise Map Reduce analytics using Hadoop and related tools like Pig, Hive etc.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Describe big data and use cases from selected business domains.
CO 2	Explain the big data with industrial examples.
CO 3	Install, configure, and run Hadoop and HDFS.
CO 4	Perform map-reduce analytics using Hadoop.
CO 5	Use Hadoop related tools such as HBase, Pig, and Hive for big data analytics.

UNIT-I

Introduction to big data: Introduction to Big Data Platform, Challenges of Conventional Systems - Intelligent data analysis, Nature of Data - Analytic Processes and Tools - Analysis vs Reporting.

UNIT-II

Industry Examples of Big Data, Big Data Technology, Information Management, Business Analyti Data Privacy and Ethics.

UNIT-III

Hadoop: Meet Hadoop, Map Reduce, The Hadoop Distributed File System, YARN, Hadoop I/O

Map Reduce: The Configuration API, Setting up the development environment, Writing a Unit Test with MRI Unit, Running locally on Test Data, Running on a cluster, Tuning a job, MapReduce workflows.

UNIT-IV

Introduction to Pig: Installing and running pig, Comparison with databases, User defined functions, Data processing operators, Pig in practice.

UNIT-V

Hive: Installing Hive, Running Hive, Comparison with traditional databases, HiveQL, Tables, Querying Data and user defined functions.

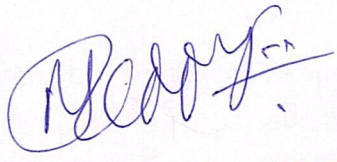
HBase: Hbasics concepts, Installations, Clients, Building an online query applications, HBase versus RDBMS, Praxis.

Text Books:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley,2013.
2. P.J. Sadalage and M. Flower, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistance", Addision-Wesley Professionals, 2012.
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley,2012. Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.
4. Eric Sammer, "Hadoop Operations", O'Reilley,2012.

Reference Books:

1. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley,2012.
2. Lars George, "HBase: The Definitive Guide", O'Reilley,2011.
3. Alan Gates, "Programming Pig", O'Reilley,2011.
4. Chris Eaton, Dirk De Roos, Tom Deutsch, George Lapis, Paul Zikopoulos,"Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.



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Course Title	Information Retrieval (Professional Elective Course-I)				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298104	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- To use different information retrieval techniques in various application areas.
- To apply IR principles to locate relevant information in large collections of data.
- To analyze the performance of retrieval systems when dealing with unmanaged data sources.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the basic concepts of the information retrieval.
CO 2	Analyze the involvement of the information retrieval in different applications.
CO 3	Apply data pre-processing, indexing, retrieval methods and concepts.
CO 4	Evaluate the effectiveness and efficiency of different information retrieval systems.

UNIT-I

Boolean retrieval, The term vocabulary and postings lists: Document delineation and character sequence decoding, Determining the vocabulary of terms, Faster postings list intersection via skip pointers, Positional postings and phrase queries, Dictionaries and tolerant retrieval: Search structures for dictionaries, Wildcard queries, Spelling correction, Phonetic correction.

UNIT-II

Index construction, Index compression: Statistical properties of terms in information retrieval, Dictionary compression, Postings file compression, Scoring, term weighting, and the vector space model: Parametric and zone indexes, Term frequency and weighting, The vector space model for scoring, Variant tf-idf functions.

UNIT-III

Computing scores in a complete search system: Efficient scoring and ranking, Components of an information retrieval system, Vector space scoring and query operator interaction, Evaluation in information retrieval: Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results.

UNIT-IV

Relevance feedback and query expansion: The Rocchio algorithm for relevance feedback, Probabilistic relevance feedback, Evaluation of relevance feedback strategies, XML retrieval, Language models, The query likelihood model, Language modeling versus other approaches in IR, Extended language modeling approaches.Text classification: The text classification problem, Naive Baye's text classification, The Bernoulli model.

UNIT-V

Vector space classification: Document representations and measures of relatedness in vector spaces, Rocchio classification, k nearest neighbor, Linear versus nonlinear classifiers. Web search basics, Web crawling and indexes.

Text Books:

1. Introduction to Information Retrieval , Christopher D. Manning and Prabhakar Raghavan and Hinrich Schütze, Cambridge University Press, 2009.
2. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald.
3. Mark T Maybury, Springer. Modern Information Retrieval, Ricardo Baeza-Yates, Pearson Education, 2007.

Reference Books:

1. Information Retrieval: Algorithms and Heuristics, David A Grossman and Ophir Frieder, 2nd Edition, Springer, 2004.
2. Information Retrieval Data Structures and Algorithms, William B Frakes, Ricardo BaezaYates, Pearson Education, 1992.
3. Information Storage & Retrieval, Robert Korfhage, John Wiley & Sons.

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Course Title	Natural Language Processing (Professional Elective Course-I)				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298105	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- To introduce the fundamental concepts and theory of Natural Language Processing (NLP) and its practical applications
- To explore Linguistic and statistical approaches to language processing in the three major subfields of NLP

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand approaches to syntax and semantics in NLP
CO 2	Understand approaches to generate, dialogue and summarisation within NLP
CO 3	Understand current methods for statistical approaches to machine translation
CO 4	Understand machine learning techniques used in NLP, including hidden Markov models and unsupervised methods

UNIT-I

Introduction – What is Natural Language Processing (NLP) - Syntax, semantics, pragmatics, and ambiguity in NLP, Regular Expressions, Text Normalisation, Edit Distance.

N-gram Language Models-N-Grams, Evaluating Language Models, Generalisation and Zeros, Smoothing, Kneser-Ney Smoothing, The Web and Stupid Backoff, Perplexity's Relation to Entropy.

UNIT-II

Neural Networks and Neural Language Models-Units, Feed-Forward Neural Networks, Training Neural Nets, Neural Language Models.

Vector Semantics and Embeddings-Lexical Semantics, Vector Semantics, Words and Vectors, Cosine for measuring similarity, TF-IDF: Weighing terms in the vector, Applications of the tf-idf vector model,Word2vec, Visualizing Embeddings ,Semantic properties of embeddings, Bias and Embeddings, Evaluating Vector Models.

UNIT-III

Sentiment Classification – What is sentiment classification. Machine Learning for Sentiment Classification - Training the Classifier (Naive Bayes, Logistic Regression, Support Vector Machine, Decision Tree, Random Forest), Optimising for Sentiment Analysis - Other text classification tasks – Evaluation of classification models: Precision, Recall, F-measure, Test sets and Cross-validation, Statistical Significance Testing.

UNIT - IV

Part-of-Speech Tagging-English Word Classes, The Penn Treebank Part-of-Speech Tagset, Part-of-Speech Tagging, HMM Part-of-Speech Tagging, Maximum Entropy Markov Models, Bi-directionality, Part-of- Speech Tagging for Morphological Rich Languages. Information Extraction-Named Entity Recognition, Relation Extraction, Extracting Times, Extracting Events and their Times, Template Filling.

UNIT-V

Sequence Processing with Recurrent Networks-Simple Recurrent Neural Networks, Applications of Recurrent Neural Networks, Deep Networks: Stacked and Bidirectional RNNs, Managing Context in RNNs: LSTMs and GRUs, Words, Subwords and Characters
Neural Language Models and Generation Revisited, Encoder-Decoder Networks, Attention, Applications of Encoder-Decoder Networks. Case study: Machine translation, Question Answering.

Text Books:

1. Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed).
2. James Allen, "Natural Language Understanding", 2/E, Addison-Wesley, 1994
3. Steven Bird, Natural Language Processing with Python, 1st Edition, O'Reilly, 2009
4. Jacob Perkins, Python Text Processing with NLTK 2.0 Cookbook, Packt Publishing, 2010

Reference Books:

1. Manning C, Schuetze H. Foundations of Statistical Natural Language Processing, MIT Press
2. Natural Language: A Machine Learning Perspective, Yue Zhang, Zhiyang Teng, Cam Bridge University Press.
3. Natural Language Processing in Action Understanding, Analyzing, Generation Text with Python, Hobson Lane, Cole Howard, Hannes Max-Haple, Manning Publications

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Course Title	Data Visualization Techniques (Professional Elective Course-II)				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298106	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- Familiarise how data can be presented to various stakeholders.
- Identify peculiarities in data with the help of visualisation.
- Design dashboards for easy understanding of underlying data.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the necessity of visualisation in data management.
CO 2	Apply visual analytics principles to appropriately preprocess data for visualization
CO 3	Use R functions to generate plots for given data
CO 4	Perform validation of visualisations based on type and purpose of data.
CO 5	Create dashboards and drill-down methods for data visualisation.

UNIT-I

Introduction to visualization - the visualization pipeline, The Value of Visualization, Data - Why Do Data Semantics and Types Matter, Data Types, Dataset Types, Attribute Types, Semantics

UNIT-II

Plotting in R - plot() function, Displaying multivariate data, Using graphics parameters, Matrix plo Exporting graphs.

Visual Analytics - Optimal visualization types, Binning values, Calculated fields, Table calculations, Level of Detail calculations.

UNIT-III

Validation - Four Levels of Design, Angles of Attack, Threats and Validation Approaches, Validation Examples, Defining Marks and Channels, Using Marks and Channels, Channel Effectiveness, Relative vs. Absolute Judgments.

UNIT-IV

Presenting results to stakeholders, ggplot library in R - layers, geoms, stats, positioning, annotations, scales, axes and legends, facetting, autoplot and fortify (atleast one example of each case to be done).

UNIT-V

Dashboard development - Dashboard design principles, Dashboard interactivity, connected "drill-down" dashboards. Visualization case studies - Textual data, Temporal data.

Text Books:

1. Exploratory Data Analysis Using R, Ronald K. Pearson, CRC Press

2.Data Visualization using power BI, Orange and Excel, Dr. Shirshendu Roy

3.Data Visualization: Charts, Maps & Interactive Graphics, Robert Grant, CRC Press.

Reference Books:

1. Handbook of Data Visualization, C. Chen, W. Hardle, A. Unwin, Springer.

2. Data Visualization Principles & Practice, Alexandru C. Telea, 2nd Edition, CRC Press.

3. Interactive Data Visualization, Foundations, Techniques & Applications, Matthew O. Ward, Georges Gainstein and Daniel Keins, CRC Press.

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Course Title	Distributed Systems (Professional Elective Course-II)				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298107	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- To make the student to understand the features of distributed systems.
- Creating awareness among students on processes and synchronization among processes.
- Learn the concepts of consistency models, replication and fault tolerance in distributed systems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Identify the core concepts of distributed systems.
CO 2	Understand the concepts of threads and communication mechanisms for processes.
CO 3	Develop the clock synchronization, mutual exclusion and election algorithms.
CO 4	Analyze the consistency and replication models.
CO 5	Understand the fault tolerance mechanisms in distributed systems.

UNIT - I

Introduction: Definition of a distributed system, Goals, Types of distributed systems.

Architectures: Architecture styles, System architectures.

UNIT - II

Processes: Threads, virtualization, clients, servers, code migration.

Communication: Fundamentals, Remote Procedure Call, Message oriented communication, Stream oriented communication, Multicast communication.

UNIT - III

Synchronization: Clock synchronization, Logical clocks, Mutual exclusion, Election Algorithms.

UNIT - IV

Consistency and Replication: Introduction, Data centric consistency models, Client centric consistency models, Replica management, Consistency protocols.

UNIT - V

Fault Tolerance: Introduction to fault tolerance, Process resilience, Reliable client server communication, Reliable group communication, Distributed commit, Recovery.

Text Books:

1. Andrew S. Tanenbaum, Marteen Van Steen, "Distributed Systems: Principles and Paradigms", 2nd Edition, PHI.
2. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems – Concepts and Design", Fourth Edition, Pearson Education.
3. Andrew S. Tanenbaum, "Distributed Operating System", Pearson Education.
4. Pradeep K. Sinha, "Distributed Operating Systems – Concepts and Design", PHI publications.

Reference Books:

1. Distributed Systems and Algorithm Analysis, Randy Chew, Theodove Johnson, Pearson.
2. Distributed Systems and Paradigms, Andrew. S. Tanenbaum, Maarten Van Steen, 2nd Edition, Pearson.
3. Distributed Systems: Computing over Network, Joel M. Crichlow, 2nd Edition, PHI.

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Course Title	Medical Image Processing (Professional Elective Course-II)				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298108	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- Learn the fundamental Image Processing techniques and Characteristics of medical images.
- Study the different types of filters for medical images.
- Understand future extraction and statistical measurements for images.
- Study Image restoration and Image Segmentation.
- Understand Soft computing techniques for image processing

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Recall the fundamental Image Processing Techniques and Understand Characteristics of different types of medical Images.
CO 2	Analyse different types of noise reduction filters for medical image processing.
CO 3	Apply statistical measurements on images and extract related information.
CO 4	Understand image restoration and Segmentation techniques.
CO 5	Apply Soft Computing Techniques for Images.

UNIT-I

Introduction: What is image? Digital Image, Image resolution and aspect ratio, Components of Digital image processing, Sampling and Quantisation, Applications areas, Vision Fundamentals.

Biomedical image processing: Various modalities of medical imaging, Problems with medical images, Image enhancement and other modalities of medical imaging.

UNIT-II

Noise reduction filters for medical images: Sources of noise and filters used for noise reduction, Spatial domain filters: Low pass filter, High Pass filter, High boost filter, Frost filter, Variance filter, Median filter. Frequency Domain filters: Convolution Theorem, Smoothing Domain filters, Sharpening Domain filters, Homomorphic filtering.

UNIT-III

Feature extraction & Statistical measurement: Selection of features, Shape related features, Fourier Descriptors, Texture Analysis, Breast Tissue Detection.

UNIT – IV

Medical Image restoration: Image restoration, Degradation model, Estimation of degradation function, Blur model, Medical image restoration, Blur identification, Super-resolution model, Applications of image restoration.

Biomedical Image Segmentation: Image Segmentation, Points detection, Line detection, Edge detection methods, Histogram-Based image segmentation, Segmentation using Split and Merge method, Region Growing Method, Watershed method, K-means clustering method.

UNIT-V

Soft Computing Techniques: Fuzzy-Based Techniques, Neural Network based techniques, Genetic Algorithm-Based Techniques.

Content-Based Medical Image Retrieval: Content-Based Image Retrieval, Content-Based Medical Image Retrieval.

Text Books:

1. Medical Image Processing- Concepts and Applications, G.R. Sinha, Bhawati Charan Patel, PHI Learning Pvt Ltd.
2. Medical Image Processing Reconstruction and Analysis-Concepts and Methods, Jiri Jan, 2nd Edition, CRC Press.
3. Hand Book of Medical Image Processing and Analysis, Issac N. Bankman, Academic Press.

Reference Books:

1. Guide to Medical Image Analysis-Methods and Algorithms, Klaus D. Toennies, Springer.

2. Digital Image Processing for Medical Applications, Geoff Dougherty, Cambridge University Press.

3. Medical Image Systems- An Introductory Guide, Andreas Maier. Stefan Steidl,Vincent Christlein, Joachim Hornegger, Springer.

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Course Title	AI & ML Lab				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298109	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	4	2	50	50	100
					End Exam Duration: 3Hrs		

Course Objectives:

- To understand state-space search algorithms, and choose the appropriate algorithm.
- To analyse a problem so that appropriate problem solving techniques may be applied.
- To understand Decision tree algorithm for solving real time problems.
- To understand Artificial Neural network and Probability based machine learning algorithms.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Solve basic AI based problems.
CO 2	To understand and implement control strategy.
CO 3	To implement Classification based machine learning algorithms.
CO 4	To implement Instants based and Neural networks machine learning algorithms.

List of Lab Experiments

1. Write a python program to implement tic-tac-toe game.
2. Write a python program to implement water jug problem.
3. Write a python program to implement Hill Climbing.
4. Write a python program to implement A* algorithm.
5. Write a python program to implement Constraint Satisfactory Problem.
6. Implement the following Data Preprocessing tasks using python.

a. Importing the Data set
b. Missing Data
c. Splitting the dataset into the Training set and Test set
d. Feature Scaling

7. Implement decision tree algorithm using python.
8. Implement Naive Bayes using python.
9. Implement k-nearest neighbor's classification using python.
10. Implement Artificial Neural networks algorithm using python.

Text Books:

1. Machine Learning, Tom M.Mitchell, McGraw-Hill
2. A Complete Introduction to the Python Language, Mark Summer Field, 2ndEdition
3. Python The Complete Reference, Martin C.Brown, Brandon A.Nordin
4. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis

Reference Books:

1. Artificial Neural Network, Robert J. Schalkoff, McGraw Hill.
2. Bayesian Reasoning & Machine Learning, David Barber, Cambridge University Press.
3. Tree-Based Machine Learning, Clinton Sheppard, Create Space Independent Publishing.

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Course Title	Advanced Python Programming				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298110	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	4	2	50	50	100
					End Exam Duration: 3Hrs		

List of Experiments:

Week-1: Study and implementation of various Basic Slicing and Advanced Indexing operations of NumPy arrays using Python over example data series?

Week-2: Implement the program using python Aggregations like Min, Max, and etc.?
Example: Consider the heights of all US presidents and find the Average Height of prime ministers of America? This data is available in the file "*president_heights.csv*".

Week-3: Write a python Program using Numpy Comparisons, Masks, and Boolean Logic?
Example: Consider the series of data that represents the amount of precipitation each day for a year in a given city and count the Rainy Days.

Week-4: Write a python Program using Numpy Fancy Indexing in single and multiple dimensions by selecting Random Points?

Week-5: Study and implementation of various Pandas operations on

i) Data sets ii) Data Frames iii) Crosstab iv) Group by

v) Filter vi) Missing values

Week-6: Implement the python program using pandas

i) Program to Combining Datasets using Merge.

ii) Program to Combining Datasets using joins.

Week-7: Implement the python program using pandas

i) Program using Pandas on Pivot Tables.

ii) Program using Pandas to Vectorized String Operations.

Week-8: Program using Pandas to Working with Time Series
Example: Visualizing Seattle Bicycle Counts data set.

Week-9: Implement the python program for the following matplotlib features

i) Color bars.

ii) Annotation

iii) Matplotlib to Text.

iv) Histograms

v) Scatter Plots

vi) Box plot

vii)

Week 10: Write the python program to implement various sub packages of Scipy.

Week11: Write a Python program to create a parent class and child class along with their own methods. Access parent class members in child class to implement the following sceneries.

a) Constructors & destructors

b) Polymorphism

Example:

Create a class ATM and define ATM operations to create account, deposit, check_balance, withdraw and delete account. Use constructor to initialize members.

Week-12: Implement the various data cleaning steps of example data sets using python nympy and pandas

Week13: Implement the feature selection of data set using appropriate sklearn libraries.

Text Books:

1. Robert Johansson, "Numerical Python: A Practical Techniques Approach for Industry" published by Apress.
2. Daniel Y. Chen, "Pandas for Everyone: Python Data Analysis", First Edition by Addison-Wesley Professional
3. Alvaro Fuentes, "Become a Python Data Analyst" by Packt publishing
4. Paul Barry, "Head First Python a Brain Friendly Guide", O'Reilly, 2nd Edition, 2016.

Reference Books:

1. Advanced Python Programming By Dr. Gabriele Lanaro, Quan Nguyen, SakisKasampalis by Packt publishing
2. Advanced Python Development: Using Powerful Language Features in Real World Applications By Matthew Wilkes ApressJuly 2020
3. Expert Python Programming - Fourth Edition By Michal Jaworski and Tarek ZiadePackt PublishingMay 2021
4. Modern Python Cookbook - Second Edition By Steven F. Lott Packt PublishingJuly 2020.

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Course Title	Research Methodology & IPR				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2284103	MC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	2	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- Understand research technology.
- Be aware of the technical principles of research, ethical challenges and approval processes.
- Describe quantitative, qualitative and mixed methods approaches to research
- Identifying the components of a literature review process.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand research problem formulation
CO 2	Analyze research related information
CO 3	Follow research ethics
CO 4	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
CO 5	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
CO 6	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits

UNIT I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT II

Effective literature studies approaches, analysis Plagiarism, Research ethics.

UNIT III

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT IV

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT V

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. atent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs

Text Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students".
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction".
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners".
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.

Reference Books:

1. Mayall , "Industrial Design", McGraw Hill, 1992.
2. Niebel , "Product Design", McGraw Hill, 1974.
3. Asimov , "Introduction to Design", Prentice Hall, 1962.
4. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

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2nd Semester

Course Title	Deep Learning				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298202	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- To introduce students to the basic concepts and techniques of Deep Learning
- To understand the theoretical foundations, algorithms, and methodologies of Neural Networks.
- To design and develop deep learning models for solving real-time problems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand neural network representation for solving a real-time problem
CO 2	Develop Convolutional Neural Networks models to solve real-world problems
CO 3	Develop Recurrent Neural Network models for solving the given problems.
CO 4	Apply Autoencoders for analyzing and finding the solution for the given problem.
CO 5	Apply RBM models for solving real-time problems.

UNIT-I

Fundamentals of Neural Networks: Introduction, Types of Machine Learning: Classification problem, The regression problem, overfitting and underfitting, Bias and variance, Overview of Artificial Neural Networks: Biological Neuron, Types of Artificial Neural Networks, Optimization Techniques, What is Deep Learning?

UNIT-II

Convolutional Neural Networks: Introduction, Components of CNN Architecture: Convolutional Layer, Pooling or Downsampling Layer, Flattening Layer, Fully Connected Layer, Rectified Linear Unit(ReLU) Layer, Exponential Linear Unit, Architectures of CNN, Applications of CNN.

UNIT-III

Recurrent Neural Network: **Basic Concepts**: Introduction: RNN versus CNN, Feedforward Neural Network versus RNN, Simple Recurrent Neural Network: Training RNN, Backpropagation through Time, RNN Topology, Bidirectional and Stateful RNNs, Long Short-Term Memory (LSTM), LSTM Implementation, Gated Recurrent Unit (GRU), Deep Recurrent Neural Network.

UNIT III

Data Visualization and Fraud Detection: Data Visualization History, What Is Data Science, Redux? A Sample of Data Visualization Projects, Mark's Data Visualization Projects, Data Science and Risk, Data Visualization at Square, Ian's Thought Experiment Data Visualization for the Rest of Us.

UNIT IV

R-Programming : What is R? Why use R for analytics? How to run R? First R example, functions a short Programming example, some important R data structures, vectors, matrices, lists, R programming structures.

UNIT V

Social Networks and Data Journalism: Social Network Analysis at Morning Analytics, Social Network Analysis, Terminology from Social Networks, Thought Experiment Morningside Analytics, More Background on Social Network Analysis from a Statistical Point of View, Data Journalism.

Text Books:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.

2. Norman matloff ,"The art of R programming". No Starch Press, 2009.

3. Thomas A. Runkler, "Data Analytics: Models and Algorithms for Intelligent Data Analysis", Springer Science & Business Media, 2012.

4. Mark Gardener, "Beginning R- The Statistical Programming Language", John Wiley & Sons, Inc.,

Reference Books:

1. Data Science, John D. Kelleher, Brendan Tierney, MIT Press.

2. R in Action Data Analysis and Graphics with R, Robert I. Kabacoff, Manning Publications, 2011.

3. Practical Statistics for Data Scientists, Peter Bruce, Andrew Bruce, O'Reilly Meida.

UNIT-IV

Autoencoder: Introduction: Features of Autoencoder, Types of Autoencoder: Vanilla autoencoder, Multilayer autoencoder, Stacked autoencoder, Deep autoencoder, Denoising autoencoder, Convolutional autoencoder, Regularized autoencoder.

UNIT - V

Restricted Boltzmann Machine: Boltzmann Machine, RBM Architecture, Example, Types of RBM.

Open Source Frameworks for Deep Learning: Frameworks: Tensor Flow, Keras, Py Torch.

Text Books:

1. Dr. S. Lovelyn Rose, Dr. L. Ashok Kumar, Dr. D. Karthika Renuka, "Deep Learning Using Python", Wiley India Pvt Ltd, 2019

2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning" , Second edition,

MIT Press, 2016.

3. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media,2017

4. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" Apress, 2018.

Reference Books:

1. Introduction to Machine Learning, Ethem Alpaydin, Third Edition, MIT Press
2. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis

3. Machine Learning: A Probabilistic Perspective, KevinMurphy, MITPress,2012

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Course Title	Blockchain Technology (Professional Elective Course - III)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298203	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- Gain knowledge on Blockchain Fundamentals and Working Principle
- Understand the basic concept of Cryptographic Hash Functions, Hash Pointers
- Learn Elliptic Curve Digital Signature Algorithm.
- Get an insight into the working of the Bitcoin network, wallet, Bitcoin mining and distributed consensus for reliability.
- Gain knowledge about Bitcoin storage, Transaction and Usage
- Be familiar with Bitcoin Mining Hardware, Pools, strategies and basics of Anonymity.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Learn Blockchain Fundamentals and Working Principle.
CO 2	Apply Cryptographic Hash Functions, Hash Pointers.
CO 3	Implement Elliptic Curve Digital Signature Algorithm.
CO 4	Work on Bitcoin network, wallet, Bitcoin mining and distributed consensus for reliability.
CO 5	Use Bitcoin Transaction, Payment Services and Exchange Market Services.
CO 6	Design Bitcoin Mining Hardware, Pools and strategies

UNIT-I

Block Chain Fundamentals: Tracing Blockchain's Origin, Revolutionizing the Traditional Business Network, How Blockchain Works, What Makes a Blockchain Suitable for Business? Introduction to Cryptography: Cryptographic Hash Functions, SHA256, Hash Pointers and Data Structures, Merkle tree.

UNIT-II

Digital Signatures: Elliptic Curve Digital Signature Algorithm (ECDSA), Public Keys as Identities, A Simple Crypto currency. Learning

UNIT-III

Centralization vs. Decentralization, Distributed Consensus, Consensus without identity using a block chain, Incentives and proof of work. Mechanics of Bitcoin: Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bitcoin network.

UNIT-IV

Storage of and Usage of Bitcoins: Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.

UNIT-V

Bitcoin Mining: The Task of Bitcoin miners, Mining Hardware, Mining pools, Mining incentives and strategies. Bitcoin and Anonymity: Anonymity Basics, Mixing, Zerocoin and

Text Books:

1. Blockchain for dummies, Manav Gupta, 2nd IBM Limited Edition, Published by John Wiley & Sons, Inc, 2018.
2. Bitcoin and Cryptocurrency Technologies, Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, 2016.

Reference Books:

1. Blockchain: Blueprint for a New Economy, Melanie Swan, O'Reilly Media, 1/e, 2015.
2. Mastering Bitcoin: Programming the Open Blockchain, Andreas M. Antonopoulos, O'Reilly, 2/e, 2017.

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Course Title	Exploratory Data Analysis using R (Professional Elective Course - III)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298204	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- Learn how to create graphical and numerical summaries of two categorical variables.
- Learn how to graphically summarize numerical data.
- Learn to explore and summarize a real world dataset.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand Exploratory Data Analysis.
CO 2	Implement Graphics using R.
CO 3	Exploring a new dataset.
CO 4	Understand working process with External Data.
CO 5	Understand Linear Regression Models.

UNIT-I

Data, Exploratory Analysis, and R:

Why do we analyze data?, The view from data, exploratory analysis, Computer software, and R, Representative R session.

UNIT-II

Graphics in R:

Exploratory vs. explanatory graphics, Graphics systems in R, The plot function, Adding details to plots, A few different plot types.

UNIT-III

Exploratory Data Analysis: A First Look:

Exploring a new dataset, Summarizing numerical data, Anomalies in numerical data, Visualizing relations between variables.

UNIT – IV

Working with External Data:

File management in R, Manual data entry, interacting with the Internet, Working with CSV files, working with other file types, Merging data from different sources.

UNIT-V

Linear Regression Models:

Modeling the whiteside data, Over fitting and data splitting, Regression with multiple predictors, Using categorical predictors, Interactions in linear regression models regression.

Text Books:

1. Ronald K. Pearson, "Exploratory Data Analysis using R" CRC Press.
2. Nathan Yau, "Visualize This: The Flowing Data Guide to Design, Visualization and Statistics", Wiley, 2011
3. W. N. Venables. D. M. Smith and the R Core Team, "An Introduction to R", 2013
4. Robert I. Kabacoff ,"R in Action Data analysis and graphics with R" Manning Publications Co 2011.

Reference Books:

1. Aczel–Sounderpandian: "*Complete Business Statistics*" 7th Edition Complete Business Statistics, Seventh Edition McGraw–Hill Primis.
2. Pierre Lafaye de Micheaux, Remy Drouilhet and Benoit Liquet – " The R Software Fundamentals of Programming and Statistical Analysis", Springer.
3. Seema Acharya - *"Data Analytics Using R"* ,Jan 01, 2018, Seema Acharya-MC GRAW HILL INDIA (2018)

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Course Title	Video Analytics (Program Elective Course - III)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298205	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- To understand the need for video Analytics
- To understand the basic configuration of video analytics
- To understand the functional blocks of a video analytic system
- To get exposed to the various applications of video analytics

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Design video analytic algorithms for security applications
CO 2	Design video analytic algorithms for business intelligence
CO 3	Design custom made video analytics system for the given target application

UNIT-I

VIDEO ANALYTIC COMPONENTS

Need for Video Analytics-Overview of video Analytics- Foreground extraction- Feature extraction- classifier - Preprocessing- edge detection- smoothening- Feature space-PCA-FLD-SIFT features

UNIT-II

FOREGROUND EXTRACTION

Background estimation- Averaging- Gaussian Mixture Model- Optical Flow based- Image Segmentation- Region growing- Region splitting-Morphological operations- erosion-Dilation- Tracking in a multiple camera environment

UNIT-III

CLASSIFIERS

Neural networks (back propagation) - Deep learning networks- Fuzzy Classifier- Bayesian classifier-HMM based classifier

UNIT-IV

VIDEO ANALYTICS FOR SECURITY

Abandoned object detection- human behavioral analysis -human action recognition- perimeter security- crowd analysis and prediction of crowd congestion

UNIT-V

VIDEO ANALYTICS FOR BUSINESS INTELLIGENCE & TRAFFIC MONITIRING AND ASSISTANCE

Customer behavior analysis - people counting- Traffic rule violation detection- traffic congestion identification for route planning- driver assistance- lane change warning

Reference Books:

1. Graeme A. Jones (Editor), Nikos Paragios (Editor), Carlo S. Regazzoni (Editor) Video-Based Surveillance Systems: Computer Vision and Distributed Processing , Kluwer academic publisher, 2001

2. Nilanjan Dey (Editor), Amira Ashour (Editor) and Suvojit Acharjee (Editor), Applied Video Processing in Surveillance and Monitoring Systems (IGI global) 2016

3. Zhihao Chen (Author), Ye Yang (Author), Jingyu Xue (Author), Liping Ye (Author), Feng Guo (Author), The Next Generation of Video Surveillance and Video Analytics: The Unified Intelligent Video Analytics Suite, CreateSpace Independent Publishing Platform, 2014

4. Caifeng Shan (Editor), Fatih Porikli (Editor), Tao Xiang (Editor), Shaogang Gong (Editor) Video Analytics for Business Intelligence, Springer, 2012

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Course Title	Text Mining & Time Series Data Analysis (Program Elective Course - IV)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298206	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- Understand the basics of text mining and time series analysis.
- Learn how to preprocess and clean text data.
- Become familiar with various text mining techniques such as tokenization, stemming, and sentiment analysis.
- Understand time series data and its properties.
- Learn how to perform time series analysis techniques such as trend analysis, forecasting, and anomaly detection.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Analyze unstructured textual data and perform pre-processing techniques such tokenization, part of speech tagging and chunking.
CO 2	Build and apply various text categorization techniques, clustering techniques, sentiment analysis and topic modelling.
CO 3	Build and apply various classification techniques.
CO 4	Model and Analyze time series data using various statistical techniques such as ARIMA and SARIMA models.
CO 5	Understand the challenges of time series analysis and apply appropriate techniques for dealing with missing data and outliers.

UNIT-I

Basic techniques in natural language processing - tokenziation, part-of-speech tagging, chunking, syntax parsing, named entity recognition. Case study: Public NLP toolkits.

Document representation - representing unstructured text documents with appropriate format and structure, automated text mining algorithms.

Text categorization - supervised text categorization algorithms, Naive Bayes, kNN, Logistic Regression, SVM, Decision Trees.

Text clustering - connectivity-based (or hierarchical) clustering, centroid-based (k-means) clustering.

UNIT-II

Topic modeling - general idea of topic modeling, basic topic models, Probabilistic Latent Semantic Indexing, Latent Dirichlet Allocation (LDA). Applications - classification, imagine annotation, collaborative filtering, and hierarchical topical structure modeling.

Document summarization - Extraction- based summarization methods.

Sentiment analysis - concept, sentiment polarity prediction, review mining, aspect identification.

UNIT-III

Characteristics of Time Series: Introduction, The nature of time series data, Time series statistical models, Measure of Correlation: Autocorrelation and Cross-correlation, Stationary time series, Estimation of correlation.

Time Series Regression and Exploratory Data Analysis: Classical Regression in the time series context, Exploratory Data Analysis, Smoothing in the time series context.

UNIT-IV

ARIMA Models: Introduction, Autoregressive moving average models, Difference equation, Autocorrelation and partial autocorrelation, Forecasting, Estimation, Integrated models for nonstationary data, Building ARIMA models, Multiplicative Seasonal ARIMA models.

UNIT- V

Spectral Analysis and Filtering: Introduction, Cyclical behaviour and periodicity, The spectral density, Periodogram and Discrete Fourier transform, Nonparametric spectral estimation, Multiple series and Cross-Spectra, Linear filters, Dynamic Fourier Analysis and wavelets, Lagged Regression models, Spectral analysis of multidimensional dseris.

Text Books:

1. Charu C. Aggarwal and Cheng Xiang Zhai, "Mining Text Data", Springer, 2012.
2. Daniel Jurafsky and James H Martin, "Speech & Language Processing", Pearson Education India, 2000.
3. Robert H. Shumway and David S. Stoffer, "Time series Analysis and Its Applications with R Examples", 3rd edition, Springer.

Reference Books:

1. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schuetze, "Introduction to Information Retrieval". Cambridge University Press, 2007.
2. Michael W. Berry, Jacob Kogan ,"Text Mining: Applications and Theory" , Wiley.

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Course Title	Social Media Analysis (Program Elective Course - IV)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298207	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- Understand Social Media Ecosystem: Provide students with an in-depth understanding of the social media landscape, including popular platforms, user behaviors, and emerging trends.
- Data Collection and Preprocessing: Teach students how to collect and preprocess social media data from various sources, including text, images, and videos.
- Sentiment Analysis: Familiarize students with sentiment analysis techniques to gauge public opinion and sentiment trends on social media.
- Network Analysis: Introduce students to social network analysis, helping them understand the structure of online communities, identify influencers, and detect trends.
- Topic Modeling and Text Mining: Equip students with the skills to perform topic modeling and text mining on social media data to discover prevalent topics and trends.
- Image and Video Analysis: Teach students how to analyze and extract insights from images and videos shared on social media platforms.
- Social Media Analytics Tools: Provide hands-on experience with popular social media analytics tools and platforms.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand and analyze social media platforms, Types of data available on social media and preprocess social media data from various sources, including text, images, and videos.
CO 2	Analyze the sentiment analysis techniques to gauge public opinion, sentiment trends on social media and structure of social networks.
CO 3	Equip students with the skills to perform topic modeling and text mining on social media data to discover prevalent topics and trends.
CO 4	Analyze and extract insights from images and videos shared on social media platforms.
CO 5	Apply popular social media analytics tools and platforms.

UNIT-I

Introduction to Social Media Analysis:

Overview of social media platforms and their importance, Ethical considerations in social media data analysis, Types of data available on social media.

Data Collection and Preprocessing: Web scraping techniques for collecting social media data, Handling different data formats (text, images, videos), Data cleaning, normalization, and text preprocessing.

UNIT-II

Sentiment Analysis:

Understanding sentiment analysis, Text classification techniques for sentiment analysis, Practical applications of sentiment analysis in marketing and brand management.

Network Analysis: Introduction to social network analysis, Analyzing the structure of social networks, Identifying influencers and communities on social media.

UNIT-III

Topic Modeling and Text Mining:

Introduction to topic modeling, Latent Dirichlet Allocation (LDA) and other topic modeling algorithms, Extracting and visualizing topics from social media text data.

UNIT-IV

Image and Video Analysis:

Analyzing images and videos from social media, Object detection, image classification, and video summarization, Applications in content moderation and recommendation systems.

UNIT-V

Social Media Analytics Tools and Platforms: Overview of popular social media analytics tools and platforms, Hands-on experience with tools like R, Python libraries (e.g., tweepy, textblob), and social media APIs, Building custom dashboards for social media data visualization

Emerging Trends and Ethical Considerations: Exploring emerging trends in social media analysis (e.g., deep learning for social media, real-time analytics), Discussing ethical considerations, privacy issues, and responsible data use in social media analysis.

Text Books:

1. "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Instagram, GitHub, and More" by Matthew A. Russell.

2. "Social Media Mining: An Introduction" by Reza Zafarani, Mohammad Ali Abbasi, and Huan Liu.

3. "Sentiment Analysis: Mining Opinions, Sentiments, and Emotions" by Bing Liu.

Reference Books:

1. "Text Mining and Analysis: Practical Methods, Examples, and Case Studies Using SAS" by Goutam Chakraborty, Murali Pagolu, and Satish Garla.

2. "Python for Data Analysis" by Wes McKinney.

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Course Title	Artificial Intelligence in Cyber Security (Program Elective Course - IV)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298208	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- To equip students realise the scope of artificial intelligence in preventing security threats.
- To automate the process of detection using artificial intelligence tools
- To give an overview to the intrusion techniques

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Deploy artificial intelligence based solutions for preventing cyber attacks
CO 2	Understand the basic underlying architecture used for intrusion detection
CO 3	Understand the heuristic methods used for cyber security

UNIT-I

Time series analysis, Stochastic time series model, ANN time series model, Support Vector time series models, Time series decomposition, Time series analysis in cybersecurity.

Time series trends and seasonal spikes, Predicting DDoS attacks - ARMA, ARIMA, ARFIMA. Voting ensemble.

UNIT-II

Using data science to catch email fraud and spam, **Anomaly detection** using K-means, Using windows logs and active directory data. Decision tree and Context-based malicious event detection.

Statistical and machine learning approaches to detection of attacks on computers - Techniques for studying the Internet and estimating the number and severity of attacks, network based attacks, host based attacks. Statistical pattern recognition for detection and classification of attacks, and techniques for visualizing network data, etc.

UNIT-III

Using **heuristics** to detect malicious pages, Using machine learning, logistic regression, and SVM to detect malicious URLs. Multiclass classification to detect malicious URLs.

Levenshtein distance to differentiate malicious URLs from others. Using TensorFlow for intrusion detection. Machine learning to detect financial fraud - imbalanced data and credit card frauds, managing under- sampled data for logistic regression. Adam gradient optimiser for deep learning. Feature extraction and cosine similarity to quantify bad passwords.

UNIT-IV

Overview of intrusions, system intrusion process, dangers of system intrusions, history and state of the art of intrusion detection systems (IDSs): anomaly detection, misuse detection, types of IDS: Network- Based IDS. Host-Based IDS, Hybrid IDS,

UNIT- V

Intrusion Prevention Systems (IPS): Network-Based IPS, Host-Based IPS, Intrusion Detection Tools, the limitations and open problems of intrusion detection systems, advanced persistent threats, case studies of intrusion detection systems against real-world threats and malware.

Text Books:

1. Soma Halder, Sinan Ozdemir, "Hands-on Machine Learning for Cybersecurity", Packt Publishing.
2. Roberto Di Pietro, Luigi V. Mancini, Intrusion Detection System, Springer ,2008
3. Anderson, Ross (2001). Security Engineering: A Guide to Building Dependable Distributed Systems. New York: John Wiley & Sons. pp. 387–388. ISBN 978-0-471-38922-4.
4. Anderson, James P., "Computer Security Threat Monitoring and Surveillance," Washing, PA, James P. Anderson Co., 1980.

Reference Books:

1. Artificial Intelligence and Cyber Security: Advances and Innovations, Ishaani Priyadarshini, Rohith Sharma, CRC Press.

2. Artificial Intelligence for Cyber Security: Methods, Issues and Possible Horizons or Opportunities, Sanjay Misra, Amit Kumar Tyagi, Springer.

3. Hans on Artificial Intelligence for Cyber Security, Alessandro Parisi, Packt Publisher.

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Course Title	Deep Learning Lab				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298209	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	4	2	50	50	100
					End Exam Duration: 3Hrs		

Course Objectives:

- Implement the various deep learning algorithms in Python.
- Learn to work with different deep learning frameworks like Keras, Tensor flow, PyTorch, etc..

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Build Artificial Neural models to solve real time problems.
CO 2	Build and Analyze the CNN , RNN and LSTM models.
CO 3	Implement Auto-encoder and Boltzmann model for solving real time applications.

List of Experiments

1. Implement Perceptron Algorithm using Python.
2. Implement Multi Layer Perceptron(MLP) using Python.
3. Implement Artificial Neural Network (ANN) using Python.
4. Implement CNN for classification of images.
5. Implement RNN using python.
6. Implement LSTM using python.
7. Implement auto-encoder using python.
8. Implement Boltzmann machine algorithm using python.
9. Implement logistic regression using python.
10. Implement K-means clustering using python.

References:

1. Dr. S. Lovelyn Rose, Dr. L. Ashok kumar, Dr. D. Karthika Renuka, Deep Learning using Python", Wiley India Pvt. Ltd.

2. Francois Chollet, "Deep learning with Python" – Manning Publications.

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Course Title	Program Elective Course Lab - II				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298210	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	4	2	50	50	100
						End Exam Duration: 3Hrs		

List of Experiments

A minimum of 10 experiments shall be given from Professional Elective-III/ Professional Elective-IV.

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Course Title	Technical Seminar				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298211	PR	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	4	2	100	-	100
Internal Assessment:								

Course Objectives:

- Identify and compare technical and practical issues related to the area of course specialization.
- Outline annotated bibliography of research demonstrating scholarly skills.
- Prepare a well-organized report employing elements of technical writing and critical thinking.
- Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Establish motivation for any topic of interest and develop a thought process for technical presentation.
CO 2	Organize a detailed literature survey and build a document with respect to technical publications.
CO 3	Analysis and comprehension of proof-of-concept and related data.
CO 4	Effective presentation and improve soft skills.
CO 5	Make use of new and recent technology for creating technical reports.

GUIDELINES FOR TECHNICAL SEMINAR

Seminar is an important component of learning in an Engineering College, where the student gets acquainted with preparing a report & presentation on a topic.

PARAMETERS OF EVALUATION:

1. The seminar shall have topic approved by the faculty.
2. The seminar is evaluated for 100 marks for internal.
3. The students shall be required to submit the rough drafts of the seminar.
4. Faculty shall make suggestions for modification in the rough draft. The final draft shall be presented by the student.
5. Presentation schedules will be prepared by Department in line with the academic calendar.

The Seminars shall be evaluated as follows:

Rough Draft:

In this stage, the student should collect the information from various sources on the topic and collate them in a systematic manner. He/ She may take the help of the concerned faculty.

The report should be typed in "MS-Word" file with "Times New Roman" font, with font size of 16 for main heading, 14 for sub-headings and 12 for the body text. The seminar report contains relevant diagrams, pictures and illustrations. It should normally contain 10 to 15 pages.

1.	Topic, name of the student & faculty	1 Page
2.	List of contents	1 Page
3.	Introduction	1 Page
4.	Descriptions of the topic (point-wise)	5 – 10 Pages
5.	Conclusion	1 Page
6.	References/Bibliography	1 Page

The soft copy of the rough draft of the seminar presentation in MS Power Point format along with the draft report should be submitted to the concerned faculty, within stipulated time.

The evaluation of the technical seminar report shall generally be based upon the following: Within one week of the submission of the rough draft, the students are to submit the final draft incorporating the suggestions made by the faculty.

Presentation:

After finalization of the final draft, the students shall be allotted dates for presentation (in the designated seminar classes) and they shall then present it in presence of students, Faculty & Technical Seminar In- charge.

The student shall submit 3 copies of the Report neatly bound. The students shall also distribute the title and abstract of the seminar in hard copy to the Technical Seminar In-charge. The final presentation has to be delivered with 18-25 slides. The time duration for presentation is 15 to 20 minutes.

The evaluation of the Presentation shall generally be based upon the following.

1.	Punctuality in submission of Seminar Report	20 Marks
2.	Reports and Contents of Presentation	20 Marks
3.	Depth of the students' knowledge in the subject	20 Marks
4.	Relevance and interest the topic creates	15 Marks
5.	Ability to involve the spectators	15 Marks
6.	Question answer session	10 Marks
	Total	**100 Marks**

WHO WILL EVALUATE?

The presentation of the seminar topics shall be made before an internal evaluation committee comprising the Head of the Department or his/her nominee, seminar in-charge and a senior faculty of the department.

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3rd Semester

Course Title	Reinforcement Learning (Program Elective Course - V)				M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298301	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- Learn the theoretical foundations of reinforcement learning (Markov decision processes & dynamic programming).
- Learn the algorithmic foundations of reinforcement learning (temporal difference and Monte- Carlo learning).
- Gain experience in framing low-dimensional problems and implementing solutions using tabular reinforcement learning.
- Learn about the motivation behind deep reinforcement learning and its relevance to high- dimensional applications, such as playing video games, and robotics.
- Discover the state-of-the-art deep reinforcement learning algorithms such as Deep Q Networks (DQN), Proximal Policy Optimisation (PPO), and Soft Actor Critic (SAC)

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Describe the core principles of autonomous systems learning.
CO 2	Calculate mathematical solutions to problems using reinforcement learning theory.
CO 3	Compare and contrast a range of reinforcement learning approaches.
CO 4	Propose solutions to decision making problems using knowledge of the state-of-the-art.
CO 5	Evaluate the performance of a range of methods and propose appropriate improvements.

UNIT – I

Introduction to Reinforcement Learning and its Mathematical Foundations, The Markov Decision Process Framework, Markov Reward Processes, The Policy, Markov Decision Processes

UNIT – II

Dynamic Programming, Model-Free Learning & Control, Monte-Carlo Learning, Temporal Difference Learning

UNIT – III

Motivation for function approximation, High-dimensional state and action spaces, Continuous state and action spaces

UNIT – IV

Deep Q-learning, Q update through back propagation, Experience replay buffer, Target and Q networks

UNIT – V

Policy gradients: The REINFORCE algorithm, Policy update through back propagation, Proximal Policy Optimization Advanced topics: Soft Actor Critic, Learning from demonstration, Model-based reinforcement learning

Text Books:

1. Optimal Control, Linear Quadratic Methods, Anderson and Moore. (1989).
2. Optimal control and reinforcement learning, Bertsekas. (2019)
3. Predictive control for linear and hybrid systems, Borrelli, Bemporad, and Morari. (2017).

Reference Books:

1. Reinforcement Learning, Sutton and Barto (2018).
2. Adaptive Filtering Prediction and Control, Goodwin and Kwai. (1984).

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Course Title	Federated Machine Learning (Program Elective Course - V)					M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2298302	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs			

Course Objectives:

- Understanding of the fundamental concepts, principles of federated machine learning & Basics of Privacy and Security in Federated Learning.
- Familiarize students with key FedML algorithms, including federated averaging, federated learning with deep neural networks, and federated transfer learning.
- Introduce students to popular FedML frameworks and tools like TensorFlow Federated (TFF), PySyft, and Google's FLoC.
- Expose students to various real-world applications of federated learning, with a focus on domains such as healthcare, finance, and edge computing.
- Encourage critical thinking and research skills by exploring open problems and emerging trends in the FedML field.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Recall machine learning concepts and Techniques. Understand and analyze the basic concepts of federated machine learning.
CO 2	Familiarize students with key FedML algorithms, including federated averaging, federated learning with deep neural networks, and federated transfer learning.
CO 3	Develop FedML algorithms using appropriate frameworks and tools, and evaluate their performance on distributed data.
CO 4	Apply FedML techniques to real-world problems, particularly in domains like healthcare or IoT.
CO 5	Identify research questions and challenges in Federated Machine Learning and contribute to the field through research projects or papers.

UNIT – I:

Introduction to Machine Learning and Federated Learning

Overview of machine learning concepts and techniques, Introduction to federated learning and its significance, Historical context and real-world applications.

Basics of Privacy and Security in Federated Learning: Privacy challenges in federated learning, Differential privacy and its role in federated learning, Security threats and safeguards.

UNIT-II

Federated Learning Algorithms

Federated averaging, Federated learning with deep neural networks, Federated transfer learning.

Communication and Optimization in Federated Learning: Communication-efficient federated learning, Optimization techniques for federated learning, Model aggregation methods.

UNIT-III

Federated Learning Frameworks and Tools

TensorFlow Federated (TFF), PySyft and PyTorch, Google's Federated Learning of Cohorts (FLoC)

UNIT-IV

Federated Learning in Specific Domains: Healthcare applications, Federated learning in finance, Federated learning for IoT and edge devices.

UNIT-V

Challenges and Future Directions

Open problems and research directions in federated learning, Ethical considerations and bias in federated learning, Scalability and deployment issues.

Text Books:

1. "Federated Learning: Strategies, Applications, and Challenges" by Qiang Yang, Wei Li, and Zhaoyang Lv.
2. "Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy.
3. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.

Reference Books:

1. "Distributed Machine Learning" by Qirong Ho and Alex Smola.
2. Machine Learning, Tom M.Mitchell, McGraw-Hill.
3. Dr. S. Lovelyn Rose, Dr. L. Ashok Kumar, Dr. D. Karthika Renuka, "Deep Learning Using Python", Wiley India Pvt Ltd, 2019

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Course Title	Intrusion Detection Systems (Program Elective Course - V)				M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298303	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- Understand when, where, how, and why to apply Intrusion Detection tools and techniques in order to improve the security posture of an enterprise.
- Apply knowledge of the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems
- Analyze intrusion detection alerts and logs to distinguish attack types from false alarms

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Explain the fundamental concepts of Network Protocol Analysis and demonstrate the skill to capture and analyze network packets.
CO 2	Use various protocol analyzers and Network Intrusion Detection Systems as security tools to detect network attacks and troubleshoot network problems.

UNIT-I

History of Intrusion detection, Audit, Concept and definition , Internal and external threats to data, attacks, Need and types of IDS, Information sources Host based information sources, Network based information sources.

UNIT-II

Intrusion Prevention Systems, Network IDs protocol based IDs ,Hybrid IDs, Analysis schemes, thinking about intrusion. A model for intrusion analysis , techniques Responses requirement of responses, types of responses mapping responses to policy Vulnerability analysis, credential analysis non credential analysis.

UNIT-III

Introduction to Snort, Snort Installation Scenarios, Installing Snort, Running Snort on Multiple Network Interfaces, Snort Command Line Options. Step-By-Step Procedure to Compile and Install Snort Location of Snort Files, Snort Modes Snort Alert Modes.

UNIT-IV

Working with Snort Rules, Rule Headers, Rule Options, The Snort Configuration File etc. Plugins, Preprocessors and Output Modules, Using Snort with MySQL.

UNIT-V

Using ACID and Snort Snarf with Snort, Agent development for intrusion detection, Architecture models of IDs and IPs.

Text Books:

1. Rafeeq Rehman : " Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1st Edition, Prentice Hall , 2003.

Reference Books:

1. Christopher Kruegel,Fredrik Valeur, Giovanni Vigna: "Intrusion Detection and Correlation Challenges and Solutions", 1st Edition, Springer, 2005.

2. Carl Endorf, Eugene Schultz and Jim Mellander " Intrusion Detection & Prevention", 1st Edition, Tata McGraw-Hill, 2004.

3. Stephen Northcutt, Judy Novak : "Network Intrusion Detection", 3rd Edition, New Riders Publishing, 2002.

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Course Title	Dissertation Phase - I				M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298307	PROJ	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	20	10	100	0	100
Exam Duration: 2 Hours								

Course Objectives:

-

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Students will learn to survey the relevant literature such as books, national/international refereed journals and contact resource persons for the selected topic of research.
CO 2	Students will be able to use different experimental techniques.
CO 3	Students will be able to use different software/ computational/analytical tools
CO 4	Students will be able to design and develop an experimental set up/ equipment/testing.
CO 5	Students will be able to conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them
CO 6	Students will be able to either work in a research environment or in an industrial environment.

Syllabus Contents:

The Project Work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M. Tech. The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report. The work has to be presented in front of the examiners panel set by Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student

Course Title	Co-curricular Activities				M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298308		L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	0	2	-	-	-

Course Objectives:

- To promote the development of non-academic skills among students.
- To provide exposure to a range of co-curricular activities.
- To encourage students to pursue their interests and passions outside of the classroom.
- To enhance teamwork, leadership, and communication skills.
- To develop a sense of community and camaraderie among students.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Demonstrate an understanding of the importance of the Co-curricular Activities in personal and professional development.
CO 2	Identify different types of Co-curricular Activities and how they complement academic pursuits.
CO 3	Develop effective communication, leadership, teamwork, problem solving and creative skills.
CO 4	Participate in a range of cultural, physical, professional development, entrepreneurial and community service activities.
CO 5	Apply the skills developed through co-curricular activities to personal and professional context.

Week 1: Introduction to Co-Curricular Activities

- Importance of co-curricular activities in personal and professional development
- Different types of co-curricular activities
- How co-curricular activities complement academic pursuits

Week 2: Communication Skills

- Importance of communication skills in personal and professional life
- Different forms of communication
- Techniques to improve communication skills

Week 3: Leadership Skills

- What is leadership?

- Different styles of leadership
- Techniques to develop leadership skills

Week 4: Teamwork Skills

- Importance of teamwork in personal and professional life
- Characteristics of effective teams
- Techniques to develop teamwork skills

Week 5: Problem-Solving Skills

- Importance of problem-solving skills in personal and professional life
- Different approaches to problem-solving
- Techniques to improve problem-solving skills

Week 6: Creative Skills

- Importance of creativity in personal and professional life
- Different forms of creativity
- Techniques to develop creativity skills

Week 7: Cultural Activities

- Importance of cultural activities in personal and professional development
- Different forms of cultural activities
- Techniques to develop cultural awareness and sensitivity

Week 8: Physical Activities

- Importance of physical activities in personal and professional development
- Different forms of physical activities
- Techniques to develop physical fitness and well-being

Week 9: Professional Development Activities

- Importance of professional development activities in personal and professional growth
- Different forms of professional development activities
- Techniques to develop skills for career growth

Week 10: Entrepreneurial Activities

- Importance of entrepreneurial activities in personal and professional development
- Different forms of entrepreneurial activities
- Techniques to develop entrepreneurial skills

Week 11: Community Service Activities

- Importance of community service activities in personal and professional development
- Different forms of community service activities
- Techniques to develop community involvement and engagement

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4th Semester

Course Title	Dissertation Phase - II				M.Tech AI&DS IV Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2298401	PROJ	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	32	16	50	50	100

Course Objectives:

-

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Students will develop attitude of lifelong learning and will develop interpersonal skills to deal with people working in diversified field will.
CO 2	Students will learn to write technical reports and research papers to publish at national and international level.
CO 3	Students will develop strong communication skills to defend their work in front of technically qualified audience

Syllabus Contents:

It is a continuation of Project work started in semester IV. He has to submit the report in prescribed format and also present a seminar. The dissertation should be presented in standard format as provided by the department. The candidate has to prepare a detailedproject report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion. The report must bring out the conclusions of the work and future scope for the study. . The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner and a guide, co-guide etc. as decided by the Head and PG coordinator. The candidate has to be in regular contact with his guide.

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Text Books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

Reference Books:

1. Adrian W lwork, English for Academic Research: Grammar Usage and Style, Springer.

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Course Title	DISASTER MANAGEMENT (Audit Course)				M.Tech AI&DS I/II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2270A02	Audit Course	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand foundations of hazard, disasters and natural/social phenomena.
CO 2	Analyze Repercussions of disasters and hazards.
CO 3	Understand key concepts in disaster risk reduction and humanitarian response.

UNIT I

Introduction to Disaster: Definition, Factors and Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT II

Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III

Disaster Prone Areas In India

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics.

UNIT IV

Disaster Preparedness and Management

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

UNIT V

Risk Assessment

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People'sParticipation In Risk Assessment. Strategies for Survival.

Disaster Mitigation

Meaning, Concept and Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

Text Books:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

Reference Books:

1. Fundamentals of Disaster Management, Shekhawat R.S, Bhatnagar Harshul.
2. Disaster management, Ruthra, Lakshmi Publications.
3. Disaster Management and Preparedness, Nidhi Gauba Dhawan, Ambrina Sardar Khan, CBS Publishers.

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Course Title	SANSKRIT FOR TECHNICAL KNOWLEDGE (Audit Course)				M.Tech AI&DS I/II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2270A03	Audit Course	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world.
- Learning Sanskrit to improve brain functioning.
- Learning Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand Sanskrit grammar and Composition.
CO 2	Understand the roots of technical information about Sanskrit literature.
CO 3	Understand Technical concepts of Engineering.

UNIT I

Alphabets in Sanskrit,

Past/Present/Future Tense,

Simple Sentences

UNIT III

Order

Introduction of roots

Technical information about Sanskrit Literature

UNIT III

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Text Books:

1.Dr.Vishwas, "Abhyaspustakam" – Samskrita-Bharti Publication, New Delhi.

2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication.

3. Suresh Soni , "India's Glorious Scientific Tradition", Ocean books (P) Ltd., New Delhi.

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Course Title	VALUES FOR PROFESSIONAL ETHICS (Audit Course-I)				M.Tech AI&DS		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2270A04	AC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Knowledge of self-development
CO 2	Learn the importance of Human values
CO 3	Developing the overall personality

UNIT I

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.

Moral and non- moral valuation. Standards and principles.

Value judgements

UNIT II

Importance of cultivation of values.

Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness.

Honesty, Humanity. Power of faith, National Unity.

Patriotism.Love for nature, Discipline

UNIT III

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline.

Punctuality, Love and Kindness.

Avoid fault Thinking.

Free from anger, Dignity of labour.

Universal brotherhood and religious tolerance.

True friendship.

Happiness Vs suffering, love for truth.

Aware of self-destructive habits.

Association and Cooperation.

Doing best for saving nature

UNIT IV

Character and Competence –Holy books vs Blind faith.

Self-management and Good health.

Science of reincarnation.

Equality, Nonviolence ,Humility, Role of Women.

All religions and same message.

Mind your Mind, Self-control.

Honesty, Studying effectively

Text Books:

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.
2. John Haffai, Lead on & How to win over worry, World Book Publisher.
3. Swami Vivekananda, Call to the Youth for Nation Building, Advaita Ashrama, Calcutta.
4. Swami Vivekananda, Youth and Modern India, Rama Krishna Mission, Chennai.

Reference Books:

1. M.G. Chitakra, Education and Human values, A.P.H. Publishing corporation, New Delhi.

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Course Title	CONSTITUTION OF INDIA (Audit Course-I)					M.Tech AI&DS		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2270A05	AC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik
- Revolution in 1917 and its impact on the initial drafting of the Indian Constitution

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Discuss the growth of the demand for civil right s in India for the bulk of Indians before the arrival of Gandhi in Indian politics
CO 2	Discuss the intellectual origins of the frame work of argument that informed the conceptualization of sociall reforms leading to revolution in India
CO 3	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
CO 4	Discuss the passage of the Hindu Code Bill of 1956

UNIT I

History of Making of the Indian Constitution:

History, Drafting Committee, (Composition & Working)

Philosophy of the Indian Constitution:

Preamble, Salient Features

UNIT II

Contours of Constitutional Rights & Duties:

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT III

Organs of Governance:

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions

Executive:

President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT IV

Local Administration:

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

Pachayati raj: Introduction, PRI: Zila Pachayat.

Elected officials and their roles, CEO Zila Pachayat: Position and role.

Block level: Organizational Hierarchy (Different departments),

Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT V

Election Commission:

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners.

State Election Commission: Role and Functioning.

Institute and Bodies for the welfare of SC/ST/OBC and women.

Text Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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Course Title	PEDAGOGY STUDIES (Audit Course-II)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2270A06	AC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
CO 2	What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
CO 3	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

UNIT I

Introduction and Methodology:

Aims and rationale, Policy background, Conceptual framework and terminology

Theories of learning, Curriculum, Teacher education.

Conceptual framework, Research questions.

Overview of methodology and Searching.

UNIT II

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.

Curriculum, Teacher education.

UNIT III

Evidence on the effectiveness of pedagogical practices

Methodology for the in depth stage: quality assessment of included studies.

How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Theory of change.

Strength and nature of the body of evidence for effective pedagogical practices.

Pedagogic theory and pedagogical approaches.

Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV

Professional development: alignment with classroom practices and follow- up support

Peer support

Support from the head teacher and the community.

Curriculum and assessment

Barriers to learning: limited resources and large class sizes

UNIT V

Research gaps and future directions

Research design, Contexts, Pedagogy

Teacher education

Curriculum and assessment

Dissemination and research impact.

Text Books:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.

2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.

3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.

Reference Books:

1. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

2. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

Web Links:

1. www.pratham.org/images/resource%20working%20paper%202.pdf.

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Course Title	STRESS MANAGEMENT BY YOGA (Audit Course-II)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2270A07	AC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- To achieve overall health of body and mind.
- To overcome stress

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Develop healthy mind in a healthy body thus improving social health also
CO 2	Improve efficiency.

UNIT I

Definitions of Eight parts of yog. (Ashtanga)

UNIT II

- Yam and Niyam. Do`s and Don't's in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT III

- Asan and Pranayam

i)Various yog poses and their benefits for mind & body
ii)Regularization of breathing techniques and its effects- Types of pranayam

Text Books:

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
2. Swami Vivekananda, "Rajayoga or conquering the Internal Nature".
3. Advaitashrama (Publication Department), Kolkata.
4. Acharya Yatendra, Yoga & Stress Management, Finger Print Publishing.

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Course Title	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS (Audit Course-II)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2270A08	AC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
CO 2	The person who has studied Geeta will lead the nation and mankind to peace and prosperity
CO 3	Study of Neetishatakam will help in developing versatile personality of students

UNIT I

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)
- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT II

- Approach to day to day work and duties.
- Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT III

- Statements of basic knowledge.
- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

Text Books:

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath,Rashtriya Sanskrit Sansthanam, New Delhi.
3. Enlightenment: Personality Development and management, Sagir Ahmed, Independently Published.

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Open Electives

Course Title	Knowledge Engineering and Data Science (Professional Elective-3)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
22OE981	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- To explore the practical application of intelligent technologies into the different domains
- To give students insight and experience in key issues of data and knowledge processing

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand and describe the concepts central to the creation of knowledge bases and ex systems.
CO 2	Conduct an in-depth examination of an existing expert system with an emphasis on basicmethods of creating a knowledge base.
CO 3	Demonstrate proficiency with statistical analysis of data.
CO 4	Build and assess data-based models.

UNIT-I

Formalisms - Logic as a programming language, Logic as a knowledge language, Logic as a database language, lambda calculus, Data, information and knowledge, Knowledge based systems.

Items and Objects - unified representation, structure of data, information, and knowledge items, structure of object, data, information, and knowledge objects. Algebra of objects.

UNIT-II

Schema and normalization - r-schema and i-schema, o-schema, t- schema, Classical normal forms.

Analysis - conceptual view of objects, c-coupling map, constraints. Functional model - functional view, f-coupling map, constraints. Layout- internal view, i-coupling.

UNIT-III

Evidence and Knowledge, Abductive Reasoning, Probabilistic Reasoning, Belief functions, Baconian and Fuzzy probability, Evidence based reasoning. Ontology of problem solving tasks, Building knowledge based agents. Agent Design and Development using Learning Technology.

UNIT - IV

Problem solving through analysis and synthesis, Inquiry driven analysis and synthesis for Evidence-based reasoning, Believability assessment.

UNIT-V

Ontology Design and Development, Reasoning with ontologies and rules - Reduction and synthesis rules, Rule and ontology matching, Partially learned knowledge, Reasoning with partially learned knowledge. Generalization and specialization for knowledge based agents, Rule learning - Analogy-based generalization, Hypothesis learning.

Text Books:

1. John Debenham, "Knowledge Engineering - Unifying Knowledge Base and DatabaseDesign", Springer 2007.
2. Jude Hemnath, Madhulika Bhatia, Oana Geman, "Data Visualization and Knowledge Engineering", Springer 2020.
3. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, "Knowledge Engineering - Building Cognitive Assistants for Evidence Based Reasoning", Cambridge University Press,2016.

Reference Books:

1. Data Science and Knowledge Engineering for Sensing Decision support , Jun Liu, Jie Lu, Yong Xu, Luis Martinez, Etiennne E- Kerre, World Scientific Publications.
2. An Introduction to Knowledge Engineering, Simon Kendal, Malcolm Creen, Springer.
3. Knowledge Engineering and Management, Guus Schreiber, Hans Akkermans, Anjo Anjewierden, Robert De Hoog, Nigel Shadbolt, Walter Van de Velde and Bob Wielings, Universities Press.

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Course Title	Cloud Data Management (Professional Elective-2)				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
22OE982	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- Familiarise the different types of cloud infrastructures.
- Manage cloud infrastructure in terms of organisation, scale, and security.
- Appraise different cloud offerings based on replication and availability.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Demonstrate the concepts and technologies of Cloud Computing
CO 2	Understand the security aspects associated with Cloud Computing
CO 3	Demonstrate the virtual server component of Cloud Computing
CO 4	Understand Cloud storage and usage monitoring along with security mechanism

UNIT-I

Cloud infrastructures; public, private, hybrid. Service provider interfaces; Saas, Paas, Iaas. VDC environments; concept, planning and design, business continuity and disaster recovery principles. Managing VDC and cloud environments and infrastructures. Scalability and Cloud Services- Large Scale Data Processing- Databases and Data Stores- Data Archival.

UNIT-II

Data Security - Storage strategy and governance; security and regulations. Designing secure solutions; the considerations and implementations involved. Securing storage in virtualized and cloudenvironments. Monitoring and management; security auditing and SIEM.

UNIT-III

Data Location and Control - Architecture of storage, analysis and planning. Storage network design considerations; NAS and FC SANs, hybrid storage networking technologies (iSCSI, FCIP, FCoE), design forstorage virtualization in cloud computing, host system design considerations.

UNIT – IV

Global storage management locations, scalability, operational efficiency. Global storage distribution; terabytes to petabytes and greater. Policy based information management; metadata attitudes; file systems or object storage.

UNIT-V

Securing data for transport, Designing backup/recovery solutions to guarantee data availability in a virtualized environment. Design a replication solution, local remote and advanced. Investigate Replication in NAS and SAN environments. Data archiving solutions; analyzing compliance and archiving design considerations.

Text Books:

1. Cloud data management, Liang Zhao, Sherif Sakr Anna Liu, Athman Bouguettaya, Springer
2. Cloud data development and Management, Lee Chao, CRC Press.
3. Cloud Data Management interface, The ultimate Step by Step Guide, Geradus Blockdyk, Create Space Independent Publisher.

Reference Books:

1. Data management in the Cloud: Challenged and Opportunities, Divyakanth Agarwal, Sudipto Das, Amr El Abbadi, Morgan & Claypool Publishers.
2. Data Management in the Cloud, George Bowlin, Create Space Independent Publisher.
3. Data Management in Cloud, Grid and P2P Systems, Abdelkader Hameurlain, Farookh Khadeer Hussain, Franck Morvan, A Min Joa, Springer.

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Course Title	Soft Computing (Open Elective)				M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
22OE983	OE	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- To learn the key aspects of Soft computing and Neural networks.
- To study the fuzzy logic components.
- To gain insight onto neuro fuzzy modeling and control.
- To know about the components and building block hypothesis of genetic algorithm.
- To gain knowledge in machine learning through Support Vector Machines.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Discuss on machine learning through neural networks
CO 2	Apply knowledge in developing a Fuzzy expert system
CO 3	Model Neuro Fuzzy system for clustering and classification
CO4	Discover knowledge to develop Genetic Algorithm and Support vector machine based machine learning system

UNIT I

Introduction to Soft Computing: Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence - Machine Learning Basics.

UNIT II

Genetic Algorithms: Introduction to Genetic Algorithms (GA) – Applications of GA - Building block hypothesis- Representation – Fitness Measures – Genetic Operators-. GA based Machine Learning.

UNIT III

Neural Networks: Machine Learning using Neural Network, Adaptive Networks – Feed Forward Networks – Supervised Learning Neural Networks – Radial Basis Function Networks - Reinforcement Learning – Unsupervised Learning Neural Networks – Adaptive Resonance Architectures – Advances in Neural Networks.

UNIT IV

Fuzzy Logic: Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions- Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making.

UNIT V

Neuro-Fuzzy Modeling: Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification – Neuro-Fuzzy Control – Case Studies.

Text Books:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2002.

2. Kwang H.Lee, "First course on Fuzzy Theory and Applications", Springer, 2005.

3. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall,1996.

4. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.

Reference Books:

1. David E.Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 1989.
2. Mitchell Melanie, "An Introduction to Genetic Algorithm", MIT Press, 1996.
3. S.N.Sivanandam, S.N.Deepa, "Introduction to Genetic Algorithms", Springer, 2008 edition

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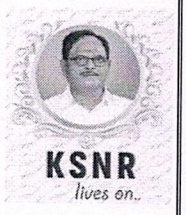

Artificial Intelligence & Machine Learning

Curriculum and Syllabus

B.Tech. III Sem (R20UG)									
S.No.	Course Code	Course Name	Category	Hours per Week			IM	EM	Credits
				L	T	P	40	60	
1	2021303	Probability and Optimization	BSC	3	0	0	40	60	3
2	2039302	Discrete Mathematics & Graph Theory	PCC	3	0	0	40	60	3
3	2039303	Digital Systems and Computer Organization	PCC	3	0	0	40	60	3
4	2039304	Introduction to Artificial Intelligence	PCC	3	0	0	40	60	3
5	2039305	RDBMS	PCC	3	0	0	40	60	3
6	2039306	**Skill Course – I** (MAT Lab Programming)	SC-I	1	0	2	40	60	2
7	2024310	Universal Human Values	HSMC	3	0	0	40	60	3
8	2039307	Digital Systems and Computer Organization Lab	PCC LAB	0	0	3	40	60	1.5
9	2039308	RDBMS Lab	PCC LAB	0	0	3	40	60	1.5
10	2039309	Exploratory Data Analysis with R	PCC LAB	0	0	3	40	60	1.5
		Total					**400**	**600**	**24.5**

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Course Title	PROBABILITY AND OPTIMIZATION				B.Tech. III Sem (R20UG) AI & ML		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2021303	BSC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 minutes					End Exam Duration: 3Hours		

Course Objectives:

- To help the students in getting a thorough understanding of the fundamentals of probability.
- The course is intended to identify and develop operations research models, understand the mathematical tools to solve optimization problems and develop a report that describes the model, the solving techniques and analyze the results.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the concepts of Probability.
CO 2	Apply the concepts of random variables.
CO 3	Understand various concepts of Operations research.
CO 4	Apply linear programming to optimization techniques.
CO 5	Analyze Transportation problem.

UNIT I: Probability

Probability, Sample space and events, Axioms of Probability, Conditional Probability, Baye's theorem.

UNIT II: Random variables

Discrete random variables, Continuous random variables, Probability distribution function, Discrete and continuous probability distribution, Mathematical Expectation, Variance and standard deviation of probability distribution.

UNIT III: Introduction to Operations research

Introduction, Models of Operations research, Advantages of Operations research, Limitations of Operations research.

UNIT IV: Linear Programming

Linear programming, Assumptions of linear programming, Properties of linear programming, Development of LP models, Graphical method, Simplex method.

UNIT V: Transportation Problem

Transportation problem, Mathematical model for transportation problem, Types of transportation problem, Starting solutions: North- West corner rule, least cost method, Vogel's approximation method.

Text Books:

1. Probability and Statistics for Engineers and Scientists, Walpole and Myers, Seventh edition, Pearson Education Asia, 2002
2. Probability and Statistics for Engineers, Johnson, Fifth edition, Prentice Hall of India.
3. Operations Research by R. Pannerselvam, PHI Publications, 2nd Edition, 2012
4. Operations Research by N.K.Tiwari, Shishir K. Shandilya Prentice-Hall of India.

Reference Books:

1. Probability and Statistics by E. Rukmangadachari & E. Keshava Reddy, Pearson Publishers.
2. Statistical Methods by S.P.Gupta, S Chand Publications, 44th revised edition 2014.
3. Engineering Optimization by Singiresu S.Rao New Age International Publishers.
4. Engineering Mathematics by Srimanta Pal, Subodh C. Bhunia, Oxford University Press.

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Course Title	DISCRETE MATHEMATICS & GRAPH THEORY				B.Tech. III Sem (R20UG) AI & ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
2039302	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
		Mid Exam Duration: 90 mins				End Exam Duration: 3Hrs		

Course Objectives:

- To introduce the concepts of mathematical logic.
- To introduce the concepts of sets, relations and functions.
- To perform the operations associated with sets, functions and relations.
- To introduce generating functions and recurrence relations.
- To use Graph Theory for solving problems

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Demonstrate knowledge on mathematical logic and Analyze truth tables, normal forms, implications, rules of inference
CO 2	Understand the basic principles of mathematical objects such as sets, relations
CO 3	Apply basic counting techniques to solve combinatorial problems
CO 4	Able to solve recurrence relations
CO 5	Demonstrate different traversal methods for trees and graphs

UNIT – I:

Mathematical Logic: Introduction, Statements and notations, Connectives, Well-formed formulas, Tautologies and contradictions, Equivalence of Formulas, duality law, Tautological Implications, Normal forms, The theory of inference for the statement calculus, rules of inference.

UNIT – II:

Relations and Ordering: Relations, Properties of Binary Relations in a Set, Equivalence Relations, operations on relations, representations of relations, Composition of Binary Relations, Compatibility Relations, Partial Ordering relations, Hasse diagram (or) Poset diagram.

UNIT – III:

Elementary Combinatorics: Basics of counting, Combinations and Permutations, Enumeration of Combinations and Permutations (without repetition), Enumerating Combinations and Permutations with repetitions.

UNIT – IV:

Recurrence Relations: Generating functions of sequences, calculating coefficients of generating functions, Recurrence relations, solving recurrence relations by substitution and characteristic roots, solutions of Inhomogeneous Linear recurrence relations.

UNIT – V:

Graphs: Basic Concepts, Isomorphism and Sub graphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multi graphs and Euler circuits, Hamiltonian graphs, Chromatic Numbers, The Four-Colour Problem.

Text Books:

1. Discrete Mathematics and its applications, 6th edition, K.H.Rosen, TMH. **(for UNITS-I, II & V)**
2. Discrete Mathematics for Computer Scientists & Mathematicians, 2/e, J.L.Mott, A.Kandel, T.P.Baker, PHI. **(for UNIT-III)**
3. Mathematical Foundations of Computer Science (Discrete Structures). Dr. D.S.C., Prism Publications **(for UNIT-IV)**
4. Elements of Discrete Mathematics- A Computer Oriented Approach,C.L.Liu,D.P. Mohapatra, 3/e, TMH.

References:

1. Discrete and Combinatorial Mathematics- An Applied Introduction, Ralph. P. Grimaldi, 5/e, Pearson Education.
2. Discrete Mathematical Structures, Mallik and Sen, Cengage Learning.
3. Discrete Mathematical Structures, BernandKolman, Robert C. Busby, SharonCutler Ross, PHI/Pearson Education.
4. Discrete Mathematics with Applications, ThomasKoshy, Elsevier.
5. Discrete Mathematics, Lovasz, Springer.

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Course Title	DIGITAL SYSTEMS AND COMPUTER ORGANIZATION					B.Tech. III Sem (R20UG) AI & ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2039303	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
		Mid Exam Duration: 90 minutes				End Exam Duration: 3Hrs		

Course Objectives:

- To understand the basic theoretical concepts of digital systems like the binary system and Boolean algebra.
- To express real life problem in logic design terminology.
- To design logic circuits using combinational/sequential logic.
- To understand the Instruction execution stages.
- To explain the functions of the memory and concepts of pipelining

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand significance of number systems, conversions, binary codes (L2)
CO 2	Apply different simplification methods for minimizing Boolean functions (L3)
CO 3	Illustrate knowledge on design of various combinational circuits, sequential logic circuits and analyze the operation of flipflops, registers, counters (L3)
CO 4	Discuss the basic structure and organization of computers (L2)
CO 5	Understand the concept of Pipelining and Memory

UNIT – I:

Binary Systems: Binary Numbers, Number base conversions, Octal and Hexadecimal Numbers, complements, Binary codes.

Boolean Algebra and Logic Gates: Basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms, Digital logic Gates.

Gate - Level Minimization: The map method, Four-variable map, Five-variable map, Product of sums (POS) simplification, Don't-Care conditions, NAND and NOR implementation.

UNIT – II:

Combinational Logic: Combinational Circuits, Analysis of Combinational circuits, Code - converters, Binary adder-subtractor, Decimal Adder, Decoders, Encoders, Multiplexers.

Sequential Logic: Sequential circuits, Latches, Flip-Flops, State Reduction and Assignment.

UNIT – III:

Registers, Counters & Programmable Logic Devices: Registers, Shift Registers, Ripple counters, synchronous counters.

Basic Structure of Computers: Computer types, Functional units, Basic operational concepts, Bus structures.

UNIT – IV:

Basic Computer Organization and Design: Computer instructions, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt, Addressing modes.

Micro Programmed Control: Control memory, Address sequencing, Design of control unit, Hard wired control.

UNIT – V:

Memory Organization: Memory hierarchy, main memory, associative memory, cache memory, virtual memory.

Input or Output Organization: Input or output Interface, asynchronous data transfer, priority interrupt, direct memory access.

Text Books:

1. Digital Design: With an introduction to the Verlog HDL, VHDL and System Verilog – 6thedition, M. Morris Mano and Michael D. Ciletti, Pearson Education/PHI.
2. Fundamentals of digital logic design with VHDL By Stephen Brown and I Zvonko Vranesic, second edition, The McGraw-Hill.
3. Fundamentals of logic design, Roth, 5th edition, Thomson publications.
4. Computer Organization – Carl Hamacher, Zvonks Vranesic, Safea Zaky, Vth Edition, McGraw Hil.
5. Computer Systems Architecture – M. Moris Mano, III rd Edition, Pearson/PHI.

References:

1. Switching and Finite Automata Theory by Zvi. Kohavi, Tata McGraw Hill.
2. Switching and Logic Design, C.V.S. Rao, Pearson Education
3. Digital Principles and Design –Donald D. Givone, Tata McGraw Hill, Edition. 6.
4. Fundamentals of Digital Logic & Micro Computer Design, 5TH Edition, M. Rafiquzzaman John Wiley.
5. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI.
6. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition, PHI/Pearson.
7. Fundamentals of Computer Organization and Design, - Sivaraama Dandamudi, Springer Int. Edition.

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Course Title	INTRODUCTION TO ARTIFICIAL INTELLIGENCE				B.Tech. III Sem (R20UG) AI & ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
2039304	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
		Mid Exam Duration: 90 mins				End Exam Duration: 3Hrs		

Course Objectives:

- To understand how a computer making intelligent decisions.
- To understand the notions of state space representation, heuristic search methods.
- To learn different knowledge representation techniques
- To understand the applications of AI.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Know the strength & Weakness of AI.
CO 2	Given a search problem, analyze and formalize the problem (as a state space, graph, etc.).
CO 3	Ability defines admissible and consistent heuristics and completeness and optimality.
CO 4	Ability to represent knowledge using Logic.
CO 5	Ability to understand the concept of Fuzzy logic system.

UNIT-I:

Introduction to AI: Definition, Approaches of AI, History, Application of an AI, What is an AI Technique?

UNIT- II:

Problem, Problem Definition, Problem Space and Search, Example Problems: Tic-Tac-Toe, Water Jug problem.

UNIT -III:

Uniformed search strategies – Breadth first search, depth first Search.

Heuristic Search Techniques- Hill climbing, A*, AO* Algorithms, Problem reduction.

UNIT- IV:

Approaches to Knowledge Representation, Using Predicate Logic, Declarative Vs Procedural Knowledge.

UNIT- V:

Fuzzy Logic System: What is Fuzzy Logic ?, Applications, Example Problem.

Text Books:

1. Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition 2009.
2. Russell, Norvig: Artificial intelligence, A Modern Approach, Pearson Education, Second Edition. 2004.
3. Philip C Jackson, Introduction to Artificial Intelligence: Second, Enlarged Edition.
4. Saroj Kaushik. Artificial Intelligence. Cengage Learning, 2011.

References:

1. Charu C. Aggarwal,Artificial Intelligence,Springer,2021.
2. Adelyn Zhou, Mariya Yao and Marlene Jia Applied Artificial Intelligence: A Handbook for Business Leaders, 2017.
3. Peter Norvig, Paradigms of Artificial Intelligence Programming: Case Studies in Common Lisp.
4. Dr. Dheeraj Mehrotra,Basics of Artificial Intelligence & Machine Learning
5. Chandra S.S.V,Artificial Intelligence and Machine Learning
6. Denis Rothman, Artificial Intelligence by Example

Web Links:

- https://onlinecourses.nptel.ac.in/noc22_cs56/preview
- https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_fuzzy_logic_systems.htm

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Course Title	RDBMS					B.Tech. III Sem (R20UG) AI & ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2039305	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
		Mid Exam Duration: 90 mins				End Exam Duration: 3Hrs		

Course Objectives:

- ❖ Understanding Database Concepts, Database Storage, Entities and Relationships, Relational Data Model, Normalization, Database Design and Performance Tuning.
- ❖ To be able to Database Design and Performance Tuning, Creating Database Objects, Manipulating Data, JDBC As the Fundamental Java API, JPA as the JAVA ORM API, Database Security, Understanding Database Backup and Restore, Introduction of MySQL.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Explain the database concepts like tables and different keys, Install SQLite, MySQL and DB2
CO 2	Explain database normalization, clustered as well as non-clustered indexes, Create Indexes in database
CO 3	Understand concepts like entities, attributes, data modelling and relationship in RDBMS
CO 4	Understand the Relational Data Model in RDBMS, Understand concepts like database views and data dictionary
CO 5	Understand the Database Normalization and all the database normal forms
CO 6	Understand the tuning of database
CO 7	Understand how DDLs used to create or modify the Schema, tables index etc.
CO 8	Understand how DMLs used to store, manipulate, retrieve data from tables
CO 9	Understand on how to create Database and to connect through Java API, and CRUD operations using Java API
CO 10	Understand on how to adopt JPA from JDBC and CRUD operation using JPA
CO 11	Understand on external security threats, internal threats and the social remedies
CO 12	Understand on different backups, how to take a Database backup, restore point
CO 13	Understand how to insert, delete, select, update, where, drop, create queries in MySQL Database

UNIT – I:

Understanding Database Concepts: This chapter provides an overview on database concepts, provides details on database tables, primary keys and foreign keys. Also, it gives detailed steps on installation of SQLite and Dockerized MySQL and DB2 databases.

UNIT – II:

Understanding Database Storage: In this chapter, you will get an overview on Database normalization, Indexes and how they are used along with configuring clustered as well as non-clustered indexes in databases.

UNIT – III:

Entities and Relationships: This chapter provides an overview on entities and relationships in RDBMS and explains concepts like Domains, Relationship and Business rules, Data Modelling and Schemas etc.

UNIT – IV:
The Relational Data Model: This chapter provides an overview on Database relations, primary keys and how to represent the data relationships in RDBMS. This chapter also explains about views and Data dictionary in RDBMS.

UNIT – V:
Normalization: This chapter provides an overview on the Database Normalization and all the database normal forms (from first till sixth) and Boyce-Codd Normal form.

UNIT – VI:
Database Design and Performance Tuning: This chapter provides an overview on the performance and tuning of a database.

UNIT – VII:
Creating Database Objects: This chapter provides an overview of Data definition language and its operation.

UNIT – VIII:
Manipulating Data: This chapter provides an overview of Data manipulation language and its operation.

UNIT – IX:
JDBC As the Fundamental Java API: This chapter provides an overview on JDBC Basics.

UNIT – X:
JPA as the JAVA ORM API: This chapter provides an overview of JPA

UNIT – XI:
Database Security: This chapter provides an overview of Database Security on External Security threats, Internal threats.

UNIT – XII:
Understanding Database Backup and Restore: This chapter provides an overview of Data Backup and Restore.

UNIT – XIII:
Introduction to MySQL: This chapter provides an overview of basics of MySQL, basic queries.

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Course Title	SKILL COURSE – I (MAT LAB PROGRAMMING)					B.Tech. III Sem (R20UG) AI & ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2039306	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		1	0	2	2	40	60	100
		Mid Exam Duration: 90 mins				End Exam Duration: 3Hrs		

Course Objectives:

- The main objective of the course is to make the students familiar with scripts, functions, control flow and plotting in MATLAB and use it to solve various engineering problems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Able to understand basic MATLAB features, arrays.
CO 2	Able to analyze various control flow structures.
CO 3	Able to solve linear equations
CO 4	Able to plot two-dimensional graphics

MODULE-I

Basics of MATLAB: Basic features, script M-files, code cells, arrays creation, addressing and array operations; multi-dimensional arrays, Arithmetic & Logical operators.

MODULE-II

Control Flow: control flow - if, if-else, for, while constructions
Mathematical Operations: Matrix algebra and solutions to systems of linear equations, polynomials.

MODULE-III

MATLAB Graphics & Numerical techniques: Two-dimensional graphics: plot function- line styles, Markers and colors – grids – axes box – labels - multiple plots – subplots – interactive plotting tools – specialized 2-D plots- interpolation, curve fitting.

Text books

1. Mastering MATLAB by Hanselman, Littlefield – Pearson Publications, 1st Edition, 2012.
2. MATLAB Programming by David C. Kuncicky -Prentice Hall, 2004

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Course Title	UNIVERSAL HUMAN VALUES				B.Tech. III Sem (R20UG) AI & ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
2024310	HSMC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
		Mid Exam Duration: 90 mins				End Exam Duration: 3Hrs		

Course Objectives:

- To understand the moral values that ought to guide the Management profession and resolve the moral issues in the profession.
- To justify the moral judgment concerning the profession.
- To develop a set of beliefs, attitudes, and habits that engineers should display concerning morality.
- To create an awareness on Management Ethics and Human Values.
- To inspire Moral and Social Values and Loyalty.
- To appreciate the rights of others.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Develop appropriate technologies and management patterns to create harmony in professional and personal life.
CO 2	Ensure students sustained happiness through identifying the essentials of human values and skills
CO 3	Get awareness of types of ethical challenges and dilemmas confronting members of a range of professions (business, media, police, law, medicine, research)
CO 4	Bring to bear ethical analysis and reasoning in the light of normative ethics frameworks on a selection of ethical challenges and dilemmas across the chosen range of professions
CO 5	Relate ethical concepts and materials to ethical problems in specific professions and professionalism

UNIT I: HUMAN VALUES

Morals, Values and Ethics - Integrity - Trustworthiness - Work Ethics - Service Learning - Civic Virtue - Respect for others - Living Peacefully - Caring - Sharing - Courage - Value Time - Co-operation - Commitment - Empathy - Self-confidence - Spirituality - Character.

UNIT - II: ENGINEERING ETHICS

Senses of Engineering Ethics – Variety of Moral issues – Types of inquiry – Moral Dilemmas – Moral Autonomy – Kohlberg's Theory – Consensus and Controversy – Professions and Professionalism – Professional ideals and virtues.

UNIT – III: ENGINEER'S RESPONSIBILITY FOR SAFETY

Safety and Risk – Assessment of Safety and Risk – Risk benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk – Chernobyl Case and Bhopal Case studies.

UNIT- IV: VALUE EDUCATION

Self- exploration- its content and process- natural acceptance- Happiness and Prosperity- Understanding Human relations.

UNIT - V: HOLISTIC PERCEPTION OF HARMONY

Understanding the Harmony in the society- -Universal order- critical appreciation of Human values- Justice, Trust.

Text Books:

1. Mike martin and Roland Scherzinger. "Ethics in Engineering'', McGrow Hill, New York 2005
2. Charles E Harris. Michael S Pritchard and Michael J Rabins. "Engineering Ethics – Concepts and Cases", Thompson Learning 2000.
3. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034-47-1

References:

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.
2. John R Baatright. "Ethics and the Conduct of Business", Pearson Education 2003.
3. Edmund G Seeabauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University press 2001.
4.JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amar kantak, 1999.
5. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.

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Course Title	DIGITAL SYSTEMS AND COMPUTER ORGANIZATION LAB				B.Tech. III Sem (R20UG) AI & ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2039307	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	3	1.5	40	60	100
		Mid Exam Duration: 90 mins				End Exam Duration: 3Hrs		

Course Objectives:

- To study the theory of Boolean algebra and acquire the skills to manipulate and examine Boolean algebraic expressions.
- To study the design principles of combinational and sequential circuits.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Apply knowledge of binary systems, logic gates and Boolean functions to minimize and implement digital logic circuit.
CO 2	Design digital logic circuit using combinational and sequential logic to solve engineering problems.

List of Experiments:

Digital Systems:

1. (a) Study of basic gates and verify through truth table
   (b) Implementation of basic gates with NAND and NOR gates
2. (a) Implementation of logic circuit for given Boolean Expression
   (b) Design 3-way lamp control using min-terms and maxterms
3. (a) Design logic circuit for adders and subtractors (half adder, full adder, parallel adder, half subtractor, full subtractor and parallel subtractor
   (b) 4-bit Binary adder cum subtractor
4. (a) Design combinational logic circuit for BCD to Excess-3 code conversion
   (b) Design combinational logic circuit for 4-bit Binary comparator
5. (a) Design 3x8 Decoder
   (b) Design Priority Encoder
6. (a) Design 4-bit shift register
   (b) Design asynchronous UP/DOWN counter
7. (a) Design Synchronous UP counter using D-flipflop
   (b) Design Modulo 6 counters

Computer Organization:

1. Write ALP to accept a character and display the same character.
2. Write ALP to display a string by reading character by characters.
3. Write ALP to accept a string and display the same string.
4. Write ALP to display a string for 5 times.
5. Write ALP to covert a given character from lower case to upper case
6. Write ALP to covert a given character from upper case to lower case
7. Write ALP to print alphabets both in upper case and lower case
8. Write ALP to determine whether the given character is alphabet or not

9. Write ALP to determine whether the given string is palindrome or not.
10. Write ALP to find the reverse of a given string
11. Write ALP to accept a digit and display the same digit
12. Write ALP to find the sum of two numbers.

Text Books:

1. Digital Design: With an introduction to the Verlog HDL, VHDL and System Verilog – 6thedition, M. Morris Mano and Michael D. Ciletti, Pearson Education/PHI.
2. Fundamentals of digital logic design with VHDL By Stephen Brown and I Zvonko Vranesic, second edition, The McGraw-Hill.
3. Fundamentals of logic design, Roth, 5th edition, Thomson publica.

Reference Books:

1. Switching and Finite Automata Theory by Zvi. Kohavi, Tata McGraw Hill.
2. Switching and Logic Design, C.V.S. Rao, Pearson Education.
3. Digital Principles and Design –Donald D.Givone, Tata McGraw Hill, Edition.
4. Fundamentals of Digital Logic & Micro Computer Design by M. Rafiquzzaman John Wiley, 5TH Edition.

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Course Title	EXPLORING DATA ANALYSIS WITH R				B.Tech. III Sem (R20UG) AI & ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2039309	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	3	1.5	40	60	100
		Mid Exam Duration: 90 mins				End Exam Duration: 3Hrs		

Course Objectives:

❖ The course enables the students to apply exploring data analysis with R on real time applications.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Understanding the basic concepts of R programming
CO 2	Apply critical R programming concepts to handle the data
CO 3	Apply statistical concepts on real data
CO 4	Use linear regression on given data set
CO 5	Apply data visualization using R packages

List of Experiments:

1. Download, install R and RStudio on windows.
2. Study of basic syntaxes in R
   (a) Write a R program to create a sequence of numbers from 20 to 50, find the mean of numbers from 20 to 60 and sum of numbers from 51 to 91.
   (b) Write a R program to get the first 10 Fibonacci numbers.
3. Implementation of different types of R operators.
4. Study and implementation of various control structures in R.
   (a) Write a R program to check weather given is even or odd.
   (b) Write a R program to find the sum of n natural numbers [1+2+3+.....+n].
   (c) Write a R program to get all prime numbers up to a given number.
5. Write a R program to find factorial of a given number using recursive function.
6. Programs using vectors, matrix, factor and list in R,
   (a) Write a R program to create a vector of a specified type and length. Create vector of numeric, complex, logical and character type of length 6.
   (b) Write a R program to create a matrix taking a given vector of numbers as input and define the column and row names. Display the matrix.
   (c) Write a R program to find the levels of factor of a given vector.
   (d) Write a R program to create a list containing strings, numbers, vectors and a logical value.
7. Programs using statics (apply all statistical concepts using R)
8. Programs using linear regression.
   Consider the "cars" dataset. Assume "cars$dist" as the response variable and "cars$speed" as the predictor variable. Create a model using the lm() function.
9. Write a R program to create data frame and extract specific rows and columns.
10. Study and implementation of data visualization using R packages.

Text Books:

1. Seema Acharya - "Data Analytics Using R", Jan 01, 2018, Seema Acharya-MC GRAW HILL INDIA (2018).
2. Aczel – Sounder Pandian: "Complete Business Statistics" 7th Edition Complete Business Statistics, Seventh Edition McGraw–Hill Primis.
3. Pierre Lafaye de Micheaux, Remy Drouilhet and Benoit Liquet – "The R Software Fundamentals of Programming and Statistical Analysis", Springer.

Reference Books:

1. **Robert I. Kabacoff** "R in Action Data analysis and graphics with R" Manning Publications Co 2011.

Journals/Magazines:

1. Journal of Information Organization (JIO)
2. Open Source for You
3. PC Quest.

SWAYAM/NPTEL/MOOCs:

1. https://onlinecourses.nptel.ac.in/noc21_ma35/preview
2. https://www.coursera.org/learn/data-analysis-r

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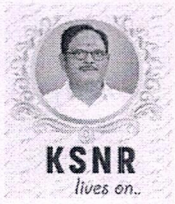

Artificial Intelligence & Machine Learning

Curriculum and Syllabus

B.Tech. IV Sem (R20UG)									
S.No.	Course Code	Course Name	Category	Hours per Week			IM	EM	Credits
				L	T	P	40	60	
1	2025401	Business Economics and Accounting for Engineers	HSMC	3	0	0	40	60	3
2	2039402	Design and Analysis of Algorithms	PCC	3	0	0	40	60	3
3	2039403	Operating Systems	PCC	3	0	0	40	60	3
4	2039404	Data Science	PCC	3	0	0	40	60	3
5	2039405	Business Intelligence Analyst	PCC	3	0	0	40	60	3
6	2039406	Operating Systems Lab	PCC LAB	0	0	3	40	60	1.5
7	2039407	Data Science Lab	PCC LAB	0	0	3	40	60	1.5
8	2039408	Business Intelligence Analyst Lab	PCC LAB	0	0	3	40	60	1.5
9	2039409	**Skill Course – II** (Advanced Python Programming)	SC	1	0	2	40	60	2
10	20MC409	**Mandatory Course** (Constitution of India)	MC	2	1	0	40	---	0
		Total					**400**	**540**	**21.5**

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Course Title	BUSINESS ECONOMICS AND ACCOUNTING FOR ENGINEERS				B.Tech. IV Sem (R20UG) AI & ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
2025401	HSMC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
		Mid Exam Duration: 90 mins				End Exam Duration: 3Hrs		

Course Objectives:

- To equip the budding engineering student with an understanding of concepts and tools of economic analysis.
- To provide knowledge of Business economics through differential economics concepts and theories.
- To make aware of accounting concepts to analyze and solve complex problems relating financial related matters in industries.
- To understand professional and ethical responsibility and ability to communicate effectively.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the concept of Business Economics and able to apply
CO 2	UnderstandtheProductionfunctionsandapplicationofBusinessEconomicsand Accounts form a king business decision.
CO 3	To Analyze the markets conditions and determine price-output relations.
CO 4	TounderstandtheconceptsofAccountingandabletoprepare thefinancialstatementof A business firms.
CO 5	To evaluate, analyze and interpret the financial performance of business.

UNIT–I: INTRODUCTION TO BUSINESSE CONOMICS

Meaning, Definition, Nature and scope of Business Economics, Demand Analysis: Concept of Demand, Determinants of demand, Law of Demand and its exceptions, Elasticity of Demand – Types, Measurement of Elasticity of Demand, Demand Forecasting – Techniques of Demand Forecasting.

UNIT–II: THEORY OF PRODUCTION AND COST ANALYSIS

Production Functions: Law of variable proportion, Isoquants and Iso cost, least cost combination of inputs, Returns to Scale and Cobb- Douglas production function. Internal and external economies of scale.

Cost Analysis: Cost concepts – Break-Even Analysis (BEA) – Break Even Point – significance and limitations of BEA.

UNIT–III: CLASSIFICATION OF MARKETS AND PRICING METHODS

Markets structures: Perfect and Imperfect competition–Features of Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly. Price- Output determination under perfect competition, monopoly and monopolistic competition– Price rigidity in Oligopoly.

Methods of Pricing – cost plus pricing, marginal cost pricing, skimming pricing, penetration pricing, differential pricing and administrative pricing.

UNIT–IV: INTRODUCTION TO FINANCIAL ACCOUNTING

Definition to Accounting, objective and need for Accounting, Double Entry Book keeping – Accounting process, Journal Ledger, Trial Balance, and Final Accounts– Trading Account, Profit and Loss Account and Balance sheet with problems.

UNIT–V: FINANCIAL ANALYSIS THROUGH RATIOS

Concept of Financial Ratios, Types of Ratios– Liquidity Ratios, Turnover Ratios, Capital Structure Ratios, Profitability Ratios with problems.

Textbooks:

1. Introductory Managerial economics for BMS; Mithani DM, PERASON
2. management science :Principles and world wide application, Salvatore Dominick. PEARSON
3. A.Ramachandra Aryasri: Managerial Economics and Financial Analysis, PEARSON
4. Varshney & Maheswari: Managerial Economics, Sultan Chand Publishers, 2009.
5. Prasad and K.V.Rao: Financial Accounting, Jai Bharath Publishers, Vijayawada.
6. A.R.Aryasri: Managerial Economics and Financial Analysis, TATA McGraw-Hill Publishing Co. Ltd.

Reference Books:

1. Managerial economics (Economics tools for todays Decision Makers),Pal G.Keat, Philip K.Y. Young, Stephen E.Erfle, Sreejata Banerjee, PEARSON
2. P.L Mehtha: Managerial Economics, Sulthan Chand Publishers
3. K K Dewett -Managerial Economics, S. Chand Publishers
4. S.P Jain & K.L Narang: Financial Accounting, Kalyani publishers.
5. M. Sugunatha Reddy: Managerial Economics and Financial Analysis, Research India Publication, NewDelhi,2013.
6. Paul A Samuleson and Williamnordhaus: Economics, Oxford University Publications.
7. M L Jhingan: Micro Economics & Macro Economics, Vrinda Publacations (P)Ltd.

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Course Title	DESIGN AND ANALYSIS OF ALGORITHMS				B.Tech. IV Sem (R20UG) AI & ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2039402	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
		Mid Exam Duration: 90 mins				End Exam Duration: 3Hrs		

Course Objectives:

- To understand and apply the algorithm analysis techniques.
- To critically analyze the efficiency of alternative algorithmic solutions for the same problem
- To understand different algorithm design techniques.
- To understand the limitations of Algorithmic power

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Prove the correctness and analyze space and time complexity of an algorithm
CO 2	Understand different algorithm design strategies
CO 3	Analyze & Apply standard algorithms
CO 4	Understand Graph/Tree bases applications and appropriate techniques
CO 5	Current trends in non-Deterministic concepts

UNIT – I:

Introduction: What is an algorithm? Algorithm Specification, **Performance Analysis**: Space complexity, Time Complexity. **Asymptotic Notations**: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), **Elementary Data Structures**: Set and Disjoint Set (Union and Find).

UNIT- II:

Divide and Conquer: General method, Binary search, Finding the maximum and minimum, Merge sort, Quick sort, Strassen's Matrix multiplication.

Greedy Method: General method, Knapsack Problem, Job sequencing with deadlines. Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm.

UNIT- III:

Dynamic Programming: General method with Examples, Multistage Graphs, All Pairs Shortest Paths, Single Source Shortest Path, Optimal Binary Search Trees,0/1Knapsack problem), Travelling Sales Person problem .

UNIT- IV:

Search and Traversal techniques: Techniques for Binary tree, Technique for Graphs, connected components and spanning tree, Bi connected components and DFS.

Backtracking: General method, N-Queens problem, Sum of sub sets problem, Graph coloring, Hamiltonian cycles.

UNIT- V:

Branch and Bound: Travelling Sales Person problem, 0/1Knapsack problem: LC Branch and Bound solution, FIFO Branch and Bound solution.

NP-Complete and NP-Hard problems: Basic concepts on-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes, cook's theorem.

Text Books:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran," Fundamentals of Computer Algorithms", Galgotia Publications.
2. Levitin, Anany." Introduction to the design & analysis of algorithms" Pearson Education, 2008
3. Parag H.Dave Himanshu B.Dave "Design and Analysis of Algorithms" Pearson Education 2008.
4. Aho, Hopcroft, Ulman,"the Design and Analysis of Computer Algorithms" Pearson Education, 2000.

Reference Books:

1. Introduction to Algorithms, 2/e, T.H. Cormen, C.E. Leiserson, R.L.Rivest and C.Stein, PHI Pvt. Ltd. / Pearson Education.
2. Algorithm Design: Foundations, Analysis and Internet examples, M.T.Goodrich and R.Tomassia, John Wiley and sons.
3. Design and Analysis of Algorithms, S. Sridhar, Oxford Higher Education.

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Course Title	OPERATING SYSTEMS				B.Tech. IV Sem (R20UG) AI & ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
2039403	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
		Mid Exam Duration: 90 mins				End Exam Duration: 3Hrs		

Course Objectives:

- Have an overview of functions of operating systems.
- Have a thorough knowledge of process management and memory management.
- To have a thorough knowledge of how handle to deadlocks.
- Learn the concepts of files, protection and security

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Understand the basic concepts related to the operating systems
CO 2	Analyze the various process scheduling algorithms and process synchronization mechanisms.
CO 3	Analyze the various memory management schemes.
CO 4	Understand the ways to deal the deadlocks and the basic concepts related to files in the system.
CO 5	Analyze the protection and security mechanism.

UNIT – I:

Operating Systems Basics: Operating systems functions, Overview of computer operating systems, distributed systems, operating system services and systems calls, system programs, operating system structure.

UNIT – II:

Process Management: Process concepts, scheduling-criteria, CPU scheduling algorithms, Evaluation of Scheduling Algorithms.

Concurrency: Process synchronization, the critical-section problem, Peterson's Solution, semaphores, Classic problems of Synchronization, monitors.

UNIT – III:

Memory Management: Introduction, Swapping, contiguous memory allocation, paging,structure of the page table, segmentation, virtual memory, demand paging, page-replacement algorithms, Allocation of frames.

UNIT – IV:

Deadlocks: System model, deadlock characterization, deadlock prevention,detection and avoidance, recovery form deadlock.

Files: The concept of a file, Access Methods, File Allocation Methods, Directory structure, File system mounting, File sharing and Protection.

UNIT – V:

Protection: Protection, Goals of Protection, Principles of Protection, Domain of protection, Access Matrix, Implementation of Access Matrix.

Security: The security problem, Program threats, User authentication.

Text Books:

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Operating System Concepts", Eighth edition, John Wiley.
2. Andrew S Tanenbaum, "Modern Operating Systems", Fourth Edition, Pearson Education.
3. William Stallings, "Operating Systems: Internals and Design Principles", Sixth Edition 2009, Pearson Education.
4. D.M. Dhamdhere, "Operating Systems, A Concept based Approach", Third Edition, TMH.

Reference Books:

1. A.S. Godbole, "Operating Systems", Second Edition, TMH.
2. Operating Systems: A Spiral Approach – Elmasri, Carrick, Levine, TMH Edition.
3. Operating Systems – H.M. Deitel, P. J. Deitel, D. R. Choffnes, 3rd Edition, Pearson.
4. Operating Systems: A Practical Approach, Rajiv Chopra, 4th Edition, S Chand Publishers.

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Course Title	DATA SCIENCE					B.Tech. IV Sem (R20UG) AI & ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2039404	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
		Mid Exam Duration: 90 mins				End Exam Duration: 3Hrs		

Course Objectives:

- Provide you with the knowledge and expertise to become an efficient data scientist.
- R-Programming code to statistically analyze a dataset.
- Evaluating Data visualizations.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Understanding how data is collected, managed and stored for data science
CO 2	Understanding the key concepts in data science
CO 3	Learning R-Programming
CO 4	Understanding social networks

UNIT- I

Introduction: What Is Data Science? Big Data and Data Science Hype, Getting Past the Hype, Why Now? The Current Landscape (with a Little History), A Data Science Profile, Thought Experiment: Meta-Definition, What Is a Data Scientist, Really?

Statistical Inference, Exploratory Data Analysis, and the Data Science Process: Statistical Thinking in the Age of Big Data, Exploratory Data Analysis, The Data Science Process, Thought Experiment: How Would You Simulate Chaos? Case Study: RealDirect

UNIT - II

Algorithms: Machine Learning Algorithms, Three Basic Algorithms : Linear Regression, k-Nearest Neighbors (k-NN), k-means.

Spam Filters, Naive Bayes, and Wrangling: Learning by Example: Why Won't Linear Regression Work for Filtering Spam? How About k-nearest Neighbors? Naive Bayes: Bayes Law, A Spam Filter for Individual Words, A Spam Filter That Combines Words: Naive Bayes, Comparing Naive Bayes to k-NN, Web APIs and Other Tools.

UNIT -III

Data Visualization and Fraud Detection: Data Visualization History, What Is Data Science, Redux? A Sample of Data Visualization Projects, Mark's Data Visualization Projects, Data Science and Risk, Data Visualization at Square, Ian's Thought Experiment Data Visualization for the Rest of Us.

UNIT - IV

R-Programming: What is R? Why use R for analytics? How to run R? First R example, functions a short Programming example, some important R data structures, vectors, matrices, lists, R programming structures.

UNIT- V

Social Networks and Data Journalism: Social Network Analysis at Morning Analytics, Social Network Analysis, Terminology from Social Networks, Thought Experiment Morningside Analytics, More Background on Social Network Analysis from a Statistical Point of View, Data Journalism.

Text Books:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.
2. Norman matloff ,"The art of R programming". No Starch Press, 2009.
3. Thomas A. Runkler, "Data Analytics: Models and Algorithms for Intelligent Data Analysis", Springer Science & Business Media, 2012.
4. Mark Gardener, "Beginning R- The Statistical Programming Language", John Wiley & Sons, Inc.,

Reference Books:

1. Data Science, John D. Kelleher, Brendan Tierney, MIT Press.
2. R in Action Data Analysis and Graphics with R, Robert I. Kabacoff, Manning Publications, 2011.
3. Practical Statistics for Data Scientists, Peter Bruce, Andrew Bruce, O'Reilly Meida.

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Course Title	BUSINESS INTELLIGENT ANALYST				B.Tech. IV Sem (R20UG) AI & ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2039405	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
		Mid Exam Duration: 90 mins				End Exam Duration: 3Hrs		

Course Objectives:

- Basic principles of IOT.
- Various IOT platforms and application development.
- To know about Arduino board.
- To know about Raspberry pi.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	The importance of analytics and how its transforming the world today
CO 2	Understand how analytics provided a solution to industries using real case studies
CO 3	Explain what is analytics, the various types of analytics, and how to apply it
CO 4	Understand how a business analysis software works, and its architecture
CO 5	Describe a reporting application, its interface, and the different report types
CO 6	Create different types of advanced reports
CO 7	Understand Active Reports and how to create them

MODULE I: ANALYTICS OVERVIEW

Course I – Business Analytics Overview

Unit 1: Analytics Overview - This unit provides an understanding of the importance of business analytics in our world, society, and life.

Unit 2: Analytics trends: Past, present & future - This unit explains how analytics has evolved over time

Unit 3: Towards a predictive enterprise - This unit explains the effects of business analytics in the corporate world that has led to its global adoption across geographies and industries.

Unit 4: Analytics: Industry domains - This unit highlights the application of analytics across major industries.

Unit 5: Case studies and solutions - This unit covers real case studies and solutions of the adoption of business analytics across the world.

Course II – Business Intelligence and Analytics

Business Intelligence and Analytics: This course provides a collection of resources designed for participants to become familiar with business intelligence (BI) and analytics concepts. Participants will review materials to introduce themselves to terminology and practical business use cases for a high level understanding of BI and analytics. The course includes a pre-assessment for participants to measure their understanding of the content before taking the course, and a post-assessment for participants to gauge their learning after reviewing the materials

MODULE II – BUSINESS ANALYTICS FOUNDATIONS

Course I – IBM Cognos Analytics for Consumers

Business analysis solution for consumers: IBM Cognos Analytics for Consumers (v11.0) will teach IBM Cognos Analytics consumers how to access content, use reports, create dashboards, and personalize the appearance of IBM Cognos Analytics portal

MODULE III – BUSINESS INTELLIGENCE ANALYST

Course I – IBM Cognos Analytics: Author Reports Fundamentals

Unit 1: Introduction to IBM Cognos Analytics - In this unit, you will learn about IBM Cognos Analytics, different report types, how to create reports and examine personal data sources and modules.

Unit 2: Create list reports - In this unit you will learn about how to create list reports.

Unit 3: Focus reports using filters - In this unit you will learn about how to focus reports using filters.

Unit 4: Create crosstab reports - In this unit you will learn about how to create crosstab reports

Unit 5: Present data graphically - In this unit you will learn about how present data graphically.

Unit 6: Focus reports using prompts - In this unit you will learn how to focus reports using prompts.

Unit 7: Extend reports using calculations - In this unit you will learn how to extend reports using calculations.

Unit 8: Use additional report building techniques - In this unit, you will learn how to use additional report building techniques.

Unit 9: Customize reports with conditional formatting - In this unit you will learn how to customize reports using conditional formatting.

Unit 10: Drill-through definitions - In this unit you will learn how to drill-through from one report to another.

Unit 11: Enhance report layout - In this unit you will learn how to force page breaks in report, modify existing reports, apply formatting and format data and report objects.

Appendix A. Overview of IBM Cognos Analytics - In this appendix you will be introduced to IBM Cognos Analytics

Course II – IBM Cognos Analytics: Author Reports Advanced

Unit 1: Create query models - In this unit you will learn about creating query models and how to filter query data.

Unit 2: Create reports based on query relationships - In this unit, you will learn about query relationships and how to combine different queries to generate reports.

Unit 3: Create advanced dynamic reports - In this unit, you will learn how to create advanced dynamic reports.

Unit 4: Design effective prompts - In this unit, you will learn how to design effective prompts to create more efficient reports.

Unit 5: Create additional advanced reports - In this unit, you will learn how to create additional advanced reports.

Unit 6: Examine the report specification - In this unit, you will learn how to examine and modify report specification.

Unit 7: Distribute reports through bursting - In this unit, you will learn how to distribute reports through bursting and how to use burst tables

Unit 8: Enhance user interaction with HTML - In this unit, you will learn how to create interacting reports using HTML.

Course III – IBM Cognos Analytics: Author Active Reports

Unit 1: Introduction to IBM Cognos Active Reports - In this unit, you will learn about creating query models and how to filter query data.

Unit 2: Use Active Report connections - In this unit, you will use active report connections

Unit 3: Active Report charts, visualizations, and decks - In this unit, you will learn about active report charts, visualizations, and decks.

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Course Title	OPERATINGSYSTEMS LAB				B.Tech. IV Sem (R20UG) AI & ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
2039406	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	3	1.5	40	60	100
		Mid Exam Duration: 90 mins				End Exam Duration: 3Hrs		

Course Objectives:

- Have a thorough knowledge of process management and memory management.
- To have a thorough knowledge of how handle to deadlocks
- Have a thorough knowledge on paging and segmentation concepts

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Design, implement and analyze the various process scheduling algorithms and process synchronization mechanisms
CO 2	Understand, implement and analyze the various memory management schemes.
CO 3	Design, implement and analyze the ways to deal the deadlocks in the system.
CO 4	Understand and analyze the paging and segmentation schemes.
CO 5	Understand and analyze the File Allocation Techniques.

List of Experiments:

1. Write a C/C++ program to simulate the following CPU scheduling algorithms to find the average turnaround time and average waiting time of process.
   i. First Come First Serve
   ii. Shortest Job First
   iii. Priority
   iv. Round Robin Scheduling
2. Write a C/C++ Program to simulate Producer Consumer Problem.
3. Write a C program to simulate the concept of Dining-Philosophers problem.
4. Write a C/C++ program to simulate the following contiguous memoryallocation techniques
   i. First Fit ii. Best Fit iii. Worst Fit
5. Write a C/C++ program to simulate the following page replacement algorithms tofind the total number of page faults for given page reference string.
   i. First In First Out ii. Least Recently Used iii. Optimal
6. Write a C/C++ program to simulate the paging and segmentation concepts.
7. Write a C program to simulate the following:
   i. Deadlock avoidance ii. Deadlock detection
8. Write a C/C++program to simulate the following file allocation
   i. Sequential ii. Indexed iii. Linked

Text Books:

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, "Operating SystemConcepts", Eighth edition, John Wiley.
2. Andrew S Tanenbaum, "Modern Operating Systems", Fourth Edition, PearsonEducation
3. William Stallings, "Operating Systems: Internals and Design Principles", SixthEdition2009, Pearson Education.
4. D.M.Dhamdhere, "Operating Systems, A Concept based Approach", Third Edition,TMH

Reference Books:

1. A.S.Godbole, "Operating Systems", Second Edition, TMH.\
2. Operating Systems: A Spiral Approach – Elmasri, Carrick, Levine, TMH Edition
3. Operating Systems – H.M. Deitel, P. J. Deitel, D. R. Choffnes, 3rd Edition, Pearson
4. Operating Systems: A Practical Approach, Rajiv Chopra, 4th Edition, S Chand Publishers

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Course Title	DATA SCIENCE LAB				B.Tech. IV Sem (R20UG) AI & ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
2039407	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	3	1.5	40	60	100
		Mid Exam Duration: 90 mins				End Exam Duration: 3Hrs		

Course Objectives:

- Provide you with the knowledge and expertise to become an efficient data scientist.
- Python Programming code to statistically analyze a dataset.
- Evaluating Data visualizations.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Understanding how data is collected, managed and stored for data science
CO 2	Understanding the key concepts in data science
CO 3	Learning Python Programming
CO 4	Understanding social networks
CO 5	Understanding how data is collected, managed and stored for data science

List of Experiments:

1. Implement on Python Environment setup to work with Data science
2. Write a program an NumPy: Arithmetic Operations on Arrays
3. Generate Pseudo Random numbers using various methods in NumPy
4. Write a program on Pandas: Program to deal with missing data by reading data from a file.
5. Implement on data wrangling functions on raw data
6. Write a program an Matplotlib: Visualize data by plotting a scatter plot.
7. Write a Program to visualize data using pie and bar graphs.
8. Implement programs on Date and Time Data Types
9. Implement Binomial distribution of variable.
10. Implement ANNOVA Tests.
11. Implement Chi-Square Tests
12. Write a program to Find the Normal distribution of a variable.

Text Books:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.
2. Norman matloff ,"The art of R programming". No Starch Press, 2009.
3. Thomas A. Runkler, "Data Analytics: Models and Algorithms for Intelligent Data Analysis", Springer Science & Business Media, 2012.
4. Mark Gardener, "Beginning R- The Statistical Programming Language", John Wiley & Sons, Inc.,

Reference Books:

1. Data Science, John D. Kelleher, Brendan Tierney, MIT Press.
2. R in Action Data Analysis and Graphics with R, Robert I. Kabacoff, Manning Publications, 2011.
3. Practical Statistics for Data Scientists, Peter Bruce, Andrew Bruce, O'Reilly Meida.

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Course Title	SKILL COURSE – II (ADVANCED PYTHON PROGRAMMING)				B.Tech. IV Sem (R20UG) AI & ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2039409	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		1	0	2	2	40	60	100
		Mid Exam Duration: 90 mins				End Exam Duration: 3Hrs		

Course Objectives:

- Python is a very powerful programming language used for many different applications. Over time, the huge community around this open-source language has created quite a few tools to efficiently work with Python.
- The course enables the students to learn various python libraries starting from Numpy arrays, Pandas Data Frames, Matplotlib.
- Along the way, they'll learn about data cleaning, feature extraction and object oriented concepts using python.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understanding the basic concepts on Numpy arrays and performs calculations on givendata.
CO 2	Apply critical pandas concepts to handle the data frames.
CO 3	Apply data visualization using matplotlib packages.
CO 4	Analyze object oriented concepts for data reusability.
CO 5	Use data cleaning methods and feature extraction for data science applications.

List of Experiments:

Week-1: Study and implementation of various Basic Slicing and Advanced Indexing operations of NumPy arrays using Python over example data series?

Week-2: Implement the program using python Aggregations like Min, Max, and etc.?
Example: Consider the heights of all US presidents and find the Average Height of prime ministers of America? This data is available in the file "*president_heights.csv*".

Week-3: Write a python Program using Numpy Comparisons, Masks, and Boolean Logic?
Example: Consider the series of data that represents the amount of precipitation each day for a year in a given cityand count the Rainy Days.

Week-4: Write a python Program using Numpy Fancy Indexing in single and multiple dimensions by selecting Random Points?

Week-5: Study and implementation of various Pandas operations on

i. Data sets ii. Data Frames iii. Crosstab
iv. Group by v. Filter vi. Missing values

Week-6: Implement the python program using pandas

a) Program to Combining Datasets using Merge.
b) Program to Combining Datasets using joins.

Week-7: Implement the python program using pandas

a) Program using Pandas on Pivot Tables.
b) Program using Pandas to Vectorized String Operations.

Week-8: Program using Pandas to Working with Time Series.
Example: Visualizing Seattle Bicycle Counts data set.

Week-9: Implement the python program for the following matplotlib features

i. Color bars ii. Annotation iii. Matplotlib to Text.

iv. Histograms v. Scatter Plots vi. Box plot

Week 10: Write the python program to implement various sub packages of Scipy.

Week 11: Write a Python program to create a parent class and child class along with their own methods.Access parent class members in child class to implement the following sceneries.

a) Constructors & destructors
b) Polymorphism

Example: Create a class ATM and define ATM operations to create account, deposit, check_balance, withdrawand delete account. Use constructor to initialize members.

Week-12: Implement the various data cleaning steps of example data sets using python nympy andpandas

Week 13: Implement the feature selection of data set using appropriate sklearn libraries.

Text Books:

1. Robert Johansson, "Numerical Python: A Practical Techniques Approach for Industry" published byApress.
2. Daniel Y. Chen, "Pandas for Everyone: Python Data Analysis", First Edition by Addison-Wesley Professional
3. Alvaro Fuentes, "Become a Python Data Analyst" by Packt publishing
4. Paul Barry, "Head First Python a Brain Friendly Guide", O'Reilly, 2nd Edition, 2016.

Reference Books:

1. Advanced Python Programming By Dr. Gabriele Lanaro, Quan Nguyen, SakisKasampalis by Packt publishing
2. Advanced Python Development: Using Powerful Language Features in Real World Applications ByMatthew Wilkes Apress July 2020
3. Expert Python Programming - Fourth Edition By Michal Jaworski and Tarek ZiadePackt Publishing May 2021
4. Modern Python Cookbook - Second Edition By Steven F. Lott Packt Publishing July 2020.

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Course Title	MANDATORY COURSE (CONSTITUTION OF INDIA)					B.Tech. IV Sem (R20UG) AI & ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
20MC409	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	1	0	0	40	--	40
		Mid Exam Duration: 90 mins				End Exam Duration: 3Hrs		

Course Objectives:

- To realize the significance of the constitution of India to students from all walks of life and help them to understand the basic concepts of Indian constitution.
- To identify the importance of fundamental rights as well as fundamental duties.
- To understand the functioning of Union, State and Local Governments in the Indian federal system.
- To learn procedure and effects of emergency, composition and activities of election commission and amendment procedure.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Describe the historical background of the constitution making and its importance for building a democratic India
CO 2	Explain the functioning of three wings of the government i.e., executive, legislative and judiciary.
CO 3	Explain the value of the fundamental rights and duties for becoming good citizen of India
CO 4	Analyze the decentralization of power between central, state and local self government.
CO 5	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy

UNIT-I

Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution – Sources and constitutional history, Features – Citizenship, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT – II

Union Government and its Administration Structure of the Indian Union: Center- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions.

UNIT – III

State Government and its Administration Governor – Role and Position – CM and Council of ministers, State Secretariat: Organization, Structure and Functions.

UNIT – IV

Local Administration: District's Administration Head – Role and Importance, Municipalities – Mayor and role of Elected Representative – Zilla Panchayat, Elected officials and their roles, CEO

Zilla Panchayat: Block level Organizational Hierarchy – (Different departments), Village level – Role of Elected and Appointed officials.

UNIT – V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissioner State Election Commission, Functions of Commissions for the welfare of SC/ST/OBC and women.

Text Books:

1. M.V.Pylee, "Introduction to the Constitution of India",4th Edition, Vikas publication,2005.
2. Durga Das Basu (DD Basu), "Introduction to the constitution of India", (Student Edition),19th edition, Prentice-Hall EEE, 2008.

Reference Books:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. Subhash Kashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Seervai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government andPolitics Hans
7. J. Raj IndianGovernment and Politics
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012.

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Regulations and Curriculum for Minor Degree and Honours Degree in Computer Science and Engineering (R20 UG-Regulations)

Department of Computer Science and Engineering

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Kadapa- 516005
Andhra Pradesh

(Approved by AICTE, Affiliated to JNTUA, Ananthapuramu, Accredited by NAAC)
(An ISO 9001-2008 Certified Institution)

Minor degree in Computer Science and Engineering

Students with higher learning capabilities are encouraged to opt for Minor degree designation. Minor degree imply a higher level of academic achievement and improves employability. A student can earn minor degree designation by meeting the following requirements.

1. Minor degree is optional. A student can opt for either Minor degree or Honours designation but not both.
2. Entry eligibility: Students shall apply for minor degree at the beginning of fifth semester. Eligibility criteria are (i) minimum CGPA of 8.0 for Open Category and 7.5 for SC/ST (ii) No backlogs, reckoned up to third semester.
3. Additional coursework: Students shall complete an additional 20 credits coursework, in addition to 160 regular credits, in selected minor program during fifth to eighth semesters. The Board of Studies (BoS) of the department of Computer Science and Engineering shall specify the list of core/elective subjects for the purpose of minor degree. The core/elective subjects can be studied either by conventional classroom teaching or as online MOOCs on the recommendation of the chairperson of BoS of Computer Science and Engineering department.
4. Continuous performance: Student shall earn a minimum SGPA of 8.0 for Open Category and 7.5 for SC/ST in all semesters, from fifth to eighth, and without backlogs to be eligible for award of minor degree. Regular and additional subjects shall be considered for SGPA calculation. If a student does not get a minimum SGPA of 8.0 for Open Category and 7.5 for SC/ST or fails in any subject during fifth to eighth semesters, he/she will lose candidature for minor degree.

CURRICULUM FOR MINOR DEGREE IN COMPUTER SCIENCE AND ENGINEERING

S.No	Subject Code	Subject Name	Semester	L-T-P	Credits
1	2091501	Computer Networks	V Sem	4-0-0	4
2	2091502	Computer Organization	V Sem	4-0-0	4
3	2091503	Mobile Application Development	VI Sem	4-0-0	4
4	2091504	Artificial Intelligence	VI Sem	4-0-0	4
5	2091505	Cryptography & Network Security	VII Sem	MOOC	2
6	2091506	Big Data Technologies	VII Sem	MOOC	2
7	2091507	Internet of Things	VII Sem	MOOC	2
8	2091508	Software Engineering	VII Sem	MOOC	2
9	2091509	Design and Analysis of Algorithms	VII Sem	MOOC	2
10	2091510	Natural Language Processing	VII Sem	MOOC	2

Important Instructions:

1. A total of 6 Subjects must be taken.
2. In the above 6 MOOC subjects, the student can select any two subjects under MOOC/NPTEL, the credits for the MOOC/NPTEL subject is two only.
3. Total Credits required to award Minor degree are 20. The four theory subjects must be completed, each subject carries 4 credits (total 16 credits) and two MOOC/NPTEL carries 4 credits.

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Honours degree in Computer Science and Engineering

Students with higher learning capabilities are encouraged to register for Honours degree. Degree with Honours imply a higher level of academic achievement. A student can earn B.Tech degree with honours designation by meeting the following requirements

1. Honours designation is optional one. A student can opt for either Honours designation or Minor degree but not both.
2. Entry eligibility: Students shall apply for Honours designation at the beginning of the fifth semester. Eligibility criteria are (i) minimum CGPA of 8.0 for Open Category and 7.5 for SC/ST (ii) No backlogs, reckoned up to third semester.
3. Additional coursework: Students shall complete an additional 20 credits coursework, in additional to 160 regular credits, in her/his own major during fifth to eighth semesters. The Board of Studies (BoS) of Computer Science and Engineering department shall specify the list of advanced subjects for the purpose of honours designation. The subjects can be studied either by conventional classroom teaching or as online MOOCs on the recommendation of the chairperson of the BoS of Computer Science and Engineering department.
4. Continuous performance: Students shall earn a minimum SGPA of 8.0 for Open Category and 7.5 for SC/ST in all semesters, from fifth to eighth, and without backlogs to be eligible for award of Honours degree. Regular and additional subjects shall be considered for SGPA calculation. If a student does not get a minimum SGPA of 8.0 for Open Category and 7.5 for SC/ST or fails in any subject during fifth to eighth semester, he/She will lose candidature for honours designation.

CURRICULUM FOR HONOURS DEGREE IN COMPUTER SCIENCE AND ENGINEERING

S.No	Subject Code	Subject Name	Semester	L-T-P	Credits
1	2092501	Data Science	V Sem	4-0-0	4
2	2092502	Computer Architecture and organization	V Sem	4-0-0	4
3	2092503	Applied Machine learning in Python	VI Sem	4-0-0	4
4	2092504	Deep Learning	VI Sem	4-0-0	4
5	2092505	Introduction to Block chain Technologies and Applications	VII Sem	MOOC	2
6	2092506	Big Data and Hadoop	VII Sem	MOOC	2
7	2092507	Introduction to Industry 4.0 and Industrial IOT	VII Sem	MOOC	2

Important Instructions:

1. A total of 6 Subjects must be taken.
2. In the above 3 MOOC subjects, the student can select any two subjects under MOOC/NPTEL, the credits for the MOOC/NPTEL subject is two only.
3. Total Credits required to award Honours degree are 20. The four theory subjects must be completed, each subject carries 4 credits (total 16 credits) and two MOOC/NPTEL carries 4 credits.

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MINOR DEGREE SYLLABUS

Course Title	COMPUTER NETWORKS				B.Tech CSE- V Sem (Minor Degree)		
Course Code	Hours/Week			Credits	Maximum Marks		
2091501	L	T	P	C	Continuous Internal Assessment	End Exams	Total
	4	0	0	4	40	60	100
Mid Exam Duration: 90 Minutes				End Exam Duration: 3Hrs			

Course Objectives:

- Study the evolution of computer networks and future direction.
- Study the concepts of computer networks from layered.
- Perspective study the issues open for research in computer networks.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the terminology and concepts of the OSI reference model and TCP-IP.
CO 2	Describe the functions of Data link layer and its protocols.
CO 3	Classifying the different routing algorithms and IP addressing with network layer
CO 4	Understand connection establishment and services provides by TCP and UDP.
CO 5	Explain the working of DNS and World Wide Web.

UNIT - I

Introduction: Uses of Computer Networks, Network Hardware, Reference Models: OSI, TCP/IP,Comparison of OSI & TCP/IP reference models.

Introduction to physical layer: Data and Signals, Transmission impairment, Datarate limits, Performance.

Transmission media: Introduction, Guided Media, Unguided Media.

Switching: Introduction, Circuit Switched Networks, Packet Switching.

UNIT - II

The Data Link Layer: Data Link Layer design issues, Error Detection and Correction, ElementaryData Link Protocols, Sliding Window Protocols.

The Medium Access Control sublayer : Multiple Access protocols, Ethernet, Data Link LayerSwitching.

UNIT - III

The Network Layer: Network layer design issues, Routing algorithms : The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Anycast Routing,

Congestion control algorithms, Quality of service, IP Addresses, IPv4,IPv6,Tunneling, Fragmentation.

UNIT - IV

The Transport Layer: The Transport Service, Elements of Transport Protocols, Congestion Control,The internet transport protocols: UDP, TCP: Introduction to TCP, Service Model, Protocol, Segment Header, Connection Establishment, Connection Release.

UNIT - V

The Application layer: Domain Name System (DNS), World Wide Web (WWW), E-mail.

Text Books:

1. "Computer Networks", Andrew S. Tanenbaum, David J.Wetherall, Pearson, 5th edition, 2010.

2. "Data communications and networking", Behrouz A. Forouzan, TMH, 5th edition, 2012.

3. "Internetworking with TCP/IP – Principles, protocols, and architecture- Volume 1, Douglas E. Comer, 5th edition, PHI

4. "Computer Networks", 5E, Peterson, Davie, Elsevier.

Reference Books:

1. "Introduction to Computer Networks and Cyber Security", Chawan- Hwa Wu, Irwin, CRC Publications.

2. "Computer Networks and Internets with Internet Applications", Comer.

3. Computer Networks, A Top-Down Approach, James F. Kurose, Keith W. Ross, 3rd Edition, Pearson.

4. Computer Networks, A Top-Down Approach, Behrouz A. Forouzan, Firoz Mosharraf, Special Indian Edition, McGraw Hill.

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Course Title	COMPUTER ORGANIZATION				B.Tech CSE- V Sem (Minor Degree)		
Course Code	Hours/Week			Credits	Maximum Marks		
2091502	L	T	P	C	Continuous Internal Assessment	End Exams	Total
	4	0	0	4	40	60	100
Mid Exam Duration: 90 Minutes				End Exam Duration: 3Hrs			

Course Objectives:

- To make the students understand the structure of computers and internal organization of different units like memory, I/O devices, registers.
- To study in detail about the microoperationsand implementation of fixed and floating point addition, subtraction, multiplication and division operations.
- To study in detail about pipelining, Memory, I/O organization and multiprocessors.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the Basic concepts of computers and Data representation.
CO 2	Understand the concept of Register Transfer and various Micro operations.
CO 3	Understand the concept of basic computer organization and design, Micro programmed control and Computer Arithmetic.
CO 4	Understand the concept of Pipelining and Memory.
CO 5	Understand concept of I/O organization and Multiprocessors.

UNIT-I

Basic Concepts of Computers: Computer Types, Functional units, Basic operational concepts, Bus Structures, Performance. **Data Representation-** Fixed Point Representation, Floating Point Representation.

UNIT-II

Register Transfer and Microoperations: Register Transfer, Bus and memory transfers. Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit.

UNIT-III

Basic Computer Organization and Design: Instruction codes, Computer instructions, Memory Reference Instructions, Input – Output and Interrupt, Addressing modes. **Micro Programmed Control:** Control memory, Address sequencing, Micro program example, Design of control unit, Hard wired control, Micro programmed control. **Computer Arithmetic:** Addition and subtraction, multiplication Algorithms, Division Algorithms.

UNIT-IV

Pipeline: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline.

Memory: Basic concepts, Memory Hierarchy, Cache memory, Performance considerations, Virtual memory.

UNIT-V

Input-Output Organization: Peripheral Devices, Input- Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct memory Access (DMA).

Multiprocessors: Characteristics of Multiprocessors, Interconnection Structures.

Text Books:

1. Computer Organization – Carl Hamacher, ZvonksVranesic, SafeaZaky, Vth Edition, McGraw Hill.
2. Computer Systems Architecture – M.Moris Mano, IIIrd Edition, Pearson/PHI.
3. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI.
4. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition, PHI/Pearson.

Reference Books:

1. Fundamentals of Computer Organization and Design, - SivaraamaDandamudi, Springer Int. Edition.
2. Computer Architecture a quantitative approach, John L. Hennessy and David A. Patterson, Fourth Edition, Elsevier.
3. Computer Architecture: Fundamentals and principles of Computer Design, Joseph D. Dumas II, BS Publication.

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Course Title	MOBILE APPLICATION DEVELOPMENT				B.Tech CSE-VI Sem (Minor Degree)		
Course Code	Hours/Week			Credits	Maximum Marks		
2091503	L	T	P	C	Continuous Internal Assessment	End Exams	Total
	4	0	0	4	40	60	100
Mid Exam Duration: 90 Min				End Exam Duration: 3Hrs			

Course Objectives:

- To Understand fundamentals of android operating systems.
- To learn the internals of the Android OS
- To learn the Mobile application development using the Android SDK.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the key features of various Mobile Operating Systems.
CO 2	Know essential Android programming concepts
CO 3	Develop Android Applications using GUI components
CO 4	Demonstrate and implement Database connectivity Applications

UNIT I

Android Introduction and Basics: The Android 4.1 jelly Bean SDK, Understanding the Android Software Stack, installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text view Control, Using the Android Emulator, The Android Debug Bridge (ADB), Launching Android Applications on a Handset.

UNIT II

Basic Widgets: Understanding the Role of Android Application Components, Understanding the Utility of Android API, Overview of the Android Project Files, Understanding Activities, Role of the Android Manifest File, Creating the User Interface, Commonly Used Layouts and Controls, Event Handling, Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit Text Control, Choosing Options with Checkbox, Choosing Mutually Exclusive Items Using Radio Buttons.

UNIT III

Building Blocks for Android Application Design: Introduction to Layouts, Linear Layout, Relative Layout, Absolute Layout, Using Image View, Frame Layout, Table Layout, Grid Layout, Adapting to Screen orientation.

Utilizing Resources and Media: Resources, Creating Values Resources, Using Drawable Resources, Switching States with Toggle Buttons, Creating an Images Switcher Application, Scrolling Through Scroll View, playing Audio, Playing Video, Displaying Progress with Progress Bar, Using Assets.

UNIT IV

Using Selection widgets and Debugging: Using List View, Using the Spinner control, Using the GridView Control, Creating an Image Gallery Using the ViewPager Control, Using the Debugging Tool: Dalvik Debug Monitor Service(DDMS), Debugging Application, Using the Debug Perspective.

Displaying And Fetching Information Using Dialogs and Fragments: What Are Dialogs?, Selecting the Date and Time in One Application, Fragments, Creating Fragments with java Code, Creating Special Fragments.

UNIT V

Building Menus and Storing Data: Creating Interface Menus and Action Bars, Menus and Their Types, Creating Menus Through XML, Creating Menus Through Coding, Applying a Context Menu to a List View, Using the Action Bar, Replacing a Menu with the Action Bar, Creating a Tabbed Action Bar, Creating a Drop-Down List Action Bar.

Using Databases: Using the SQLiteOpenHelperclasss, Accessing Databases with the ADB, Creating a Data Entry Form.

Text Books:

1. Android Programming by B.M Harwani, Pearson Education, 2013.
2. Android application Development for Java Programmers, James C Sheusi, Cengage Learning
3. Android In Action by w.Frank Ableson, Robi Sen, Chris King, C. Enrique Ortiz., Dreamtech.
4. Beginning Android 4 Application Development, by Wei-Meng Lee , Wiley India.

Reference Text Books:

1. Android Programming for Begineers, John Horton, Packt> Publications.
2. Professional Android 4 Application Development, Reto Meier, Wiley.
3. Android Programming: Big Nerd Ranch Guide, Bill Phillips, Chris Stewart, Pearson

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Course Title	ARTIFICIAL INTELLIGENCE				B.Tech CSE-VI Sem (Minor Degree)		
Course Code	Hours/Week			Credits	Maximum Marks		
2091504	L	T	P	C	Continuous Internal Assessment	End Exams	Total
	4	0	0	4	40	60	100
Mid Exam Duration: 90 Minutes				End Exam Duration: 3Hrs			

Course Objectives:

- To understand how a computer making intelligent decisions.
- To understand the notions of state space representation, heuristic search methods.
- To learn different knowledge representation techniques
- To understand the applications of AI.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Given a search problem, analyze and formalize the problem (as a state space, graph, etc.).
CO 2	The ability defines admissible and consistent heuristics and completeness and optimality.
CO 3	Analyze and Apply knowledge representation technique.
CO4	Ability to understand uncertainty and Design appropriate Bayes Nets corresponding to the causal relationships and conditional independence of a real world situation
CO5	Design good evaluation functions and strategies for game playing and Understand concept of natural language processing.

UNIT-I:

Introduction to AI: AI Problems History what is an AI Technique. Problem, Problem Space and Search, Heuristic Search Techniques.

UNIT-II:

Knowledge Representation Issues, Predicate Logic, Knowledge Representation using rules.

UNIT –III:

Symbolic reasoning under Uncertainty, Bayesian Networks.

UNIT-IV:

Weak Slot Filler Structures, Strong Slot and Filler Structures, Knowledge Representation summary.

UNIT –V:

Game Playing, Planning, Natural Language processing.

Text Books:

1. Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition 2009.
2. Russell, Norvig: Artificial intelligence, A Modern Approach, Pearson Education, Second Edition. 2004.
3. Philip C Jackson, Introduction to Artificial Intelligence: Second, Enlarged Edition.
4. Saroj Kaushik. Artificial Intelligence. Cengage Learning, 2011.

Reference Books:

1. Charu C. Aggarwal,Artificial Intelligence,Springer,2021.
2. Adelyn Zhou, Mariya Yao and Marlene Jia Applied Artificial Intelligence: A Handbook for Business Leaders, 2017
3. Peter Norvig, **Paradigms of Artificial Intelligence Programming: Case Studies in Common Lisp.**
4. Dr. Dheeraj Mehrotra,**Basics of Artificial Intelligence & Machine Learning**
5. Chandra S.S.V,**Artificial Intelligence and Machine Learning**
6. Denis Rothman, **Artificial Intelligence by Example**

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Course Title	CRYPTOGRAPHY & NETWORK SECURITY		B.Tech CSE-VII Sem (Minor Degree)		
Course Code	Hours/Week	Credits	Maximum Marks		
2091505	MOOC	C	Continuous Internal Assessment	End Exams	Total
		2	40	60	100
Mid Exam Duration: 90 Min		End Exam Duration: 3Hrs			

Course Objectives:

- Extensive, thorough and significant understanding of the concepts, issues, principles and theories of computer network security
- Identifying the suitable points for applying security features for network traffic
- Understanding the various cryptographic algorithms and implementation of the same.
- Understanding the various attacks, security mechanisms and services.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Identify information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory.
CO 2	Understand, compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication.
CO 3	Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
CO 4	Apply different digital signature algorithms to achieve authentication and create secure applications.
CO 5	Apply network security basics, analyze different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP.
CO 6	Apply the knowledge of cryptographic utilities and authentication mechanisms to design secure applications

UNIT I

Computer Security concepts, The OSI Security Architecture, Security attacks, Security services and Security mechanisms, A model for Network Security, Classical encryption techniques- symmetric cipher model, substitution ciphers, transposition ciphers, Steganography, Modern Stream ciphers.

UNIT II

Modern Block Ciphers: Block ciphers principles, Data encryption standard (DES), Strength of DES, Block cipher modes of operations, AES, RC4.

Introduction to Number theory : Integer Arithmetic, Modular Arithmetic,Linear Congruence, Algebraic Structures, GF(2n) Fields, Primes, Factorization, Chinese remainder Theorem, Quadratic Congruence.

UNIT III

Public-key cryptography : Principles of public-key cryptography, RSA Algorithm, Diffie-Hellman Key Exchange, ELGamal cryptographic system.

Cryptographic Hash functions: Applications of Cryptographic Hash functions, Requirements and security, Hash functions based on Cipher Block Chaining, Secure Hash Algorithm (SHA).

UNIT IV

Message Authentication Codes: Message authentication Requirements, Message authentication functions, Message authentication codes, security of MACs, HMAC.

Digital Signatures: Digital Signatures, Schnorr Digital Signature Scheme, Digital Signature Standard.

UNIT V

User Authentication: Remote user Authentication Principles, Kerberos

Electronic mail security: Pretty Good Privacy (PGP), S/MIME

Worms, Viruses, Firewalls.

Text Books:

1. Cryptography and network Security by Fourth edition, Stallings, PHI/Pearson
2. Cryptography & Network Security by Behrouz A. Forouzan, TMH.
3. Network Security: The complete reference by Robert Bragg, Mark Rhodes, TMH
4. Computer Security Basics by Rick Lehtinen, Deborah Russell & G.T.Gangemi Sr., SPD O'REILLY.

Reference Books:

1. Cryptography and network Security by Atul Kahate, 4th Edition, Tata McGraw Hill.
2. Understanding Cryptography, Christof Paar. Jan Pelzl, Springer.
3. Introduction to Modern Cryptography, Jonathan Katz, Yehuda Lindell, 2nd Edition, CRC Press.

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Course Title	BIG DATA TECHNOLOGIES		B.Tech CSE-VII Sem (Minor Degree)		
Course Code	Hours/Week	Credits	Maximum Marks		
2091506	MOOC	C	Continuous Internal Assessment	End Exams	Total
		2	40	60	100
Mid Exam Duration: 90 Min		End Exam Duration: 3Hrs			

Course Objectives:

- To introduce big data concepts.
- Understanding Hadoob.
- Understanding Big data Applications (HBASE, HIVE).

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Demonstrate knowledge in Big Data Characteristics & Hadoop Distributed File System.
CO 2	Analyze large data sets by using Hadoop, Map Reduce, Hive.
CO 3	Design and develop Map Reduce models for data sets.
CO 4	Select Hive and Hive services techniques for effective database models.
CO 5	Contribute towards societal issues and responsibilities in designing, modeling and developing Big Data systems

UNIT - I

Introduction to Big Data, Why is Big Data, Why Big Data is important, Meet Hadoop, Data, Data Storage and Analysis, Comparison with other systems, Grid Computing, A brief history of Hadoop, Apache Hadoop and the Hadoop EchoSystem, Linux refresher; VMWare Installation of Hadoop.

UNIT - II

The Design of HDFS, HDFS Concepts, Command Line interface to HDFS Hadoop File Systems, Interfaces, Java Interface to Hadoop, Anatomy of a file read, Anatomy of a file write, Replica placement and Coherency Model, Parallel copying with distcp, Keeping an HDFS cluster balanced.

UNIT - III

Introduction, Analyzing data with unix tools, Analyzing data with Hadoop, Java MapReduce classes(new API), Data flow, combiner functions, Running a distributed MapReduce job, Configuration API, Setting up the developing environment, Managing configuration, Writing a unit test with MRUnit, Running a job in local job runner, Running on a cluster, Launching a job, The MapReduce WebUI.

UNIT - IV

Class MapReduce, Job submission, Job initialization, Task Assignment, Task execution, Progress and status updates, Job Completion, Shuffle and sort on Map and Reducer side, Configuration tuning, Map Reduce types, Input formats, Sorting, Map side and Reduce side joins.

UNIT - V

The Hive Shell, Hive services, Hive clients, The meta store, comparison with traditional databases, Hive QI, Hbasics, Concepts, implementation, Java and Map reduce clients, Loading Data, Web queries.

Text Books:

1. Tom White, Hadoop, "The Definitive Guide" , 3rd Edition, O'Reilly Publications,2012.
2. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, "Undetstanding Big Data Analytics for Enterprise class Hadoop and Streaming Data", 1st Edition, TMH, 2012.
3. Bart Baesens, Analytics in a Big Data World: The Essential Guide to DataScience and its Applications, Wiley Publications, 2014.
4. Big Data Technologies and Applications, Borko Furht, Flavio Villanustre, Springer.

Reference Books:

1. Hand Book of Big Data Technologies, Albert Y. Zomaya, Sherif Sakr, Springer.
2. Big Data Analytics: Tools and Technology for Effective Planning, Arun K. Somani, Ganesh Chandra Deka, CRC Press.
3. Big Data, Big Analytics, Michael Minelli, Michele Chambers, Ambiga Dhiraj, John Wiley and Sons.

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Course Title	INTERNET OF THINGS		B.Tech CSE-VII Sem (Minor Degree)		
Course Code	Hours/Week	Credits	Maximum Marks		
2091507	MOOC	C	Continuous Internal Assessment	End Exams	Total
		2	40	60	100
Mid Exam Duration: 90 Minutes		End Exam Duration: 3Hrs			

Course Objectives:

- Basic principles of IOT.
- Various IOT platforms and application development.
- To know about Arduino board.
- To know about Raspberry pi.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Demonstrate knowledge on Protocols, functional blocks and communicationmodels of Internet of Things.
CO 2	Identify domain specific IoT's.
CO 3	Design appropriate solutions for IoT applications.
CO4	Working with Arduino board.
CO5	Design and develop applications using Raspberry pi device.

UNIT I

INTRODUCTION TO IoT:

Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels and Development Templates.

UNIT II

DOMAIN SPECIFIC IoTs

Introduction, Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle.

UNIT III

IOT and M2M:

Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT

IoT Platform Design Methodology:

Introduction, IoT Design Methodology, Case Study on IoT System for Weather Monitoring.

UNIT IV

Introduction to Arduino:

Introduction, The Arduino Way, The Arduino Platform, Getting started with Arudino, Advanced Input and Output, Sample Programs.

Sensors:

Introduction to sensors, Transducer, Sensors characteristics.

UNIT V

IOT Physical Devices:

What is an IOT device, basic building blocks of an IOT device, Exemplary device: Raspberry Pi, about the board, linux on raspberry Pi, raspberry Pi interfaces, Programming Raspberry Pi with Python, Other IoT Devices.

Text Books:

1. Adrian McEwen,Hakin Cassimally "Designing the Internet of Things" Wiley India.
2. Getting Started with Arduino, 3rd Edition, Massimo Banzi and Michael Shiloh
3. Getting Started with Raspberry Pie, Matt Richardson & Shawn Wallace, O'Reilly-2014.
4. ArshdeepBahga, Vijay Madisetti " Internet of Things(A hands on approach)"1STedition, VPI publications,2014.

Reference Books:

1. Raj Kamal, "Internet of Things", McGraw Hill, 1st Edition, 2016.
2. Internet of Things, Surya Durbha, Jyothi Joglekar, Oxford Higher Education.
3. The Internet of Things, Michael Miller, Pearson.
4. The Internet of Things, Samuel Greengard, The MIT Press Ltd

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Course Title	SOFTWARE ENGINEERING		B.Tech CSE-VII Sem (Minor Degree)		
Course Code	Hours/Week	Credits	Maximum Marks		
2091508	MOOC	C	Continuous Internal Assessment	End Exams	Total
		2	40	60	100
Mid Exam Duration: 90 Minutes		End Exam Duration: 3Hrs			

Course Objectives:

- Knowledge of basic Software engineering methods and practices, and their appropriate application also the software engineering layered technology and Process frame work.
- A general understanding of software process models such as the waterfall and evolutionarymodels.
- Understanding of the role of project management including planning, scheduling, risk management, etc.
- Understanding of data models, object models, context models and behavioural models alsodifferent software architectural styles.
- Understanding of software testing approaches such as unit testing and integration testingother testing strategies and Risk management.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Ability to apply software engineering principles and techniques.
CO 2	Ability to develop, maintain and evaluate large-scale software systems.
CO 3	To produce efficient, reliable, robust and cost-effective software solutions.
CO 4	To manage time, processes and resources effectively by prioritising competing demands to achieve personal and team goals Identify and analyzes the common threats in each domain.

UNIT - I

Software and Software Engineering: The Nature of Software, Software Engineering, Software Process Software Myths. Process Models: A Generic Process Model, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models.

UNIT - II

Understanding Requirements: Requirements Engineering, Establishing the Groundwork, ElicitingRequirements, Building the Requirements Model, Negotiating Requirements, Validating Requirements.

Requirements Modeling: Requirements Analysis, Scenario-Based Modeling, Data Modeling Concepts, Class-Based Modeling.

UNIT - III

Design Concepts: Design within the Context of Software Engineering, Design Process, Design Concepts, The Design Model.

Architectural Design: Software Architecture, Architectural Genres, Architectural Styles, ArchitecturalDesign.

UNIT - IV

User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

Coding and Testing: Testing, Testing in the Large versus Testing in the Small, Unit Testing, Integration Testing, Black-Box Testing, White-Box Testing, Debugging, System Testing.

UNIT - V

Software Project Management: Project Planning, Metrics for Project Size Estimation, Project Estimation Techniques, Empirical Estimation Techniques, COCOMO-A Heuristic Estimation Technique, Halstead's Software Science-An Analytical Technique, Risk Management.

Text Books:

1. Software Engineering: A practitioner's Approach, Roger S. Pressman, Seventh Edition, 2010,McGrawHill International Edition.
2. Fundamentals of Software Engineering, Rajib Mall, 4th Edition, 2014, PHI.
3. Software Engineering, Ian Sommerville, Ninth edition, Pearson education.
4. Software Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008.

Reference Books:

1. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
3. Software Engineering1: Abstraction and modeling, Diner Bjorner, Springer Internationaledition, 2006.
4. Software Engineering2: Specification of systems and languages, Diner Bjorner, SpringerInternational edition , 2006.
5. Software Engineering Foundations, Yingxu Wang, Auerbach Publications,2008.

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Course Title	DESIGN AND ANALYSIS OF ALGORITHMS		B.Tech CSE-VII Sem (Minor Degree)		
Course Code	Hours/Week	Credits	Maximum Marks		
2091509	MOOC	C	Continuous Internal Assessment	End Exams	Total
		2	40	60	100
Mid Exam Duration: 90 Minutes		End Exam Duration: 3Hrs			

Course Objectives:

- To understand and apply the algorithm analysis techniques.
- To critically analyze the efficiency of alternative algorithmic solutions for the same problem.
- To understand different algorithm design techniques.
- To understand the limitations of Algorithmic power.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Prove the correctness and analyze space and time complexity of an algorithm.
CO 2	Understand different algorithm design strategies.
CO 3	Analyze & Apply standard algorithms.
CO 4	Understand Graph/Tree bases applications and appropriate techniques.
CO 5	Current trends in Non Deterministic concepts.

UNIT-I

Introduction: What is an algorithm? Algorithm Specification, **Performance Analysis**: Space complexity, Time Complexity**. Asymptotic Notations**: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), **Brute Force Method:** Sequential Search, Selection Sort, Bubble Sort.

UNIT-II

Divide and Conquer: General method, Binary search, Merge sort, Quick sort, Strassen's Matrix multiplication.

Greedy Method: General method, Knapsack Problem, Job sequencing with deadlines. **Minimum cost spanning trees:** Prim's Algorithm, Kruskal's Algorithm.

UNIT-III

Dynamic Programming: General method, Multistage Graphs, All Pairs Shortest Paths, Single Source Shortest Path, Optimal Binary Search Trees,0/1Knapsack problem, Travelling Sales Person problem .

UNIT-IV

Search and Traversal techniques: Techniques for Binary tree, Technique for Graphs, connected components and spanning tree, Bi connected components.

Backtracking: General method, N-Queens problem, Sum of sub sets problem, Graph coloring, Hamiltonian cycles.

UNIT-V

Branch and Bound: Travelling Sales Person problem, 0/1Knapsack problem: LC Branch and Bound solution, FIFO Branch and Bound solution.

NP-Complete and NP-Hard problems: Basic concepts on-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes.

Text Books:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran,"Fundamentals of Computer Algorithms", Galgotia Publications.
2. Levitin, Anany." Introduction to the design & analysis of algorithms" Pearson Education, 2008.
3. Udit Agarwal," Algorithms Design and Analysis",Dhanpath Rai & Co,2017.
4. Sedgewick Robert and Kevin Wayne, "Algorithms" , Pearson Education, Fourth Edition.
5. Parag H.Dave Himanshu B.Dave "Design and Analysis of Algorithms" Pearson Education 2008.

Reference Books:

1. Aho, Hopcroft, Ulman,"the Design and Analysis of Computer Algorithms" Pearson Education, 2000.
2. Steven S.Skiena," The Algorithm Design Mannual", Spingers, Third Edition.
3. R.L.Rivest and C.Stein" Introduction to Algorithms",Second Edition, Pearson Education
4. M.T.Goodrich and R.Tomassia, John Wiley and sons," Algorithm Design: Foundations, Analysis and Internet examples".
5. Sanjoy Dasgupta, Christos H Papadimitriou, Umesh Virkumar Vazirani, "Algorithms" , McGraw-Hill Higher Education,2008

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Course Title	NATURAL LANGUAGE PROCESSING		B.Tech CSE-VII Sem (Minor Degree)		
Course Code	Hours/Week	Credits	Maximum Marks		
2091510	MOOC	C	Continuous Internal Assessment	End Exams	Total
		2	40	60	100
Mid Exam Duration: 90 Min		End Exam Duration: 3Hrs			

Course Objectives:

- Understand approaches to syntax and semantics in NLP.
- Understand current methods for statistical approaches to machine translation.
- Understand language modeling.
- Understand machine learning techniques used in NLP.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the fundamentals required for Computational Linguistics
CO 2	Understand the concepts of Language design, Text Transformer and their Products
CO 3	Have the clear idea of language specifications using context and free grammars
CO 4	Understand machine learning techniques used in NLP

UNIT I

Introduction to Natural Language Understanding, Syntactic Processing: Grammars and Parsing.

UNIT II

Features and Augmented Grammars, Toward Efficient Parsing, Ambiguity Resolution.

UNIT III

Statistical Methods: Probabilistic Context-Free Grammars, Best-First Parsing.

UNIT IV

Semantic Interpretation: Linking Syntax and Semantics, Ambiguity Resolution, other Strategies for Semantic Interpretation.

UNIT V

Context and World Knowledge: Using World Knowledge, Discourse Structure, Defining a Conversational Agent.

Text Book:

1. Natural Language Understanding – James Allen, Second Edition, Pearson Education.

2. Speech and Language Processing – Daniel Jurafsky, James H.Martin.

3. Foundations of Statistical Natural Language Processing – Christopher Manning, Hinrich Schutze, MIT Press.

4. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.

Reference Books:

1. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2013-2014

2. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

3. Introduction to Natural Language Processing,Jacob Eisenstein, MIT Press.

4. Natural Language Processing In Action, Hobson Lane, Cole Howard & Hannes Max Hapke, Manning Publications.

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HONOURS DEGREE SYLLABUS

Course Title	DATA SCIENCE				B.Tech CSE - V Sem (Honours Degree)		
Course Code	Hours/Week			Credits	Maximum Marks		
2092501	L	T	P	C	Continuous Internal Assessment	End Exams	Total
	4	0	0	4	40	60	100
Mid Exam Duration: 90 Minutes				End Exam Duration: 3Hrs			

Course Objectives:

- Introduce R as a programming language
- Introduce the mathematical foundations required for data science
- Introduce the first level data science algorithms
- Introduce a data analytics problem solving framework

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Describe a flow process for data science problems (Remembering)
CO 2	Classify data science problems into standard typology (Comprehension)
CO 3	Develop R codes for data science solutions (Application)
CO 4	Correlate results to the solution approach followed (Analysis)
CO 5	Assess the solution approach (Evaluation)
CO 6	Construct use cases to validate approach and identify modifications required (Creating)

UNIT-I

R – Programming:

Introduction to R, variables and datatypes In R, data frames, recasting and joining of dataframes, arithmetic, logical and matrix operations in R, functions, control structures, data visualization in R basic graphics.

UNIT-II

Linear Algebra:

Linear algebra for data science, solving linear equations, Linear algebra – distance, hyperplanes and half-spaces, Eigenvalues, Eigenvectors, statistical modeling, random variables and probability mass/density functions, sample statistics, hypotheses testing.

UNIT-III

Optimization:

Optimization for data science, unconstrained multivariate optimization, Gradient Descent learning rule, multivariate optimization with equality constraints, multivariate optimization with inequality constraints. Introduction to data science, solving data analysis problems – a guided thought process.

UNIT-IV

First level data science algorithms:

Predictive modeling, linear regression, model assessment, diagnostics to improve linear model fit, simple linear regression model building, simple linear regression model assessment, multiple linear regression.

UNIT-V

Regression Analysis:

Cross validation, multiple linear regression modeling building and selection, classification, logisitic regression, performance measures, logistic regression implementation in R, K-nearest neighbors, K-nearest neighbors implementation in R, K-means clustering, K-means implementation in R.

Text Books:

1. Introduction to Linear Algebra – by Gilbert Strang
2. Applied Statistics and Probability for Engineers – by Douglas Montgomery
3. R Programming for Data Science – by Roger D. Peng

Web Links:

1. **https://nptel.ac.in/courses/106/106/106106179/**

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Course Title	Computer Architecture and Organization				B.Tech CSE - V Sem (Honours Degree)		
Course Code	Hours/Week			Credits	Maximum Marks		
2092502	L	T	P	C	Continuous Internal Assessment	End Exams	Total
	4	0	0	4	40	60	100
Mid Exam Duration: 90 Minutes				End Exam Duration: 3Hrs			

Course Objectives:

- To make the students to understand the structure of computers and internal organization of different units like memory, I/O devices and registers.
- To Study the basic concepts of computer architecture and organization.
- To study in detail about the operation of control unit and Arithmetic unit

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the basic concepts of computer architecture and organization
CO 2	Understand the design of the control unit and memory organization
CO 3	Understand the design of Adders, Multipliers and Dividers
CO 4	Understand the basic concepts of pipelining and Vector processor
CO 5	Use of memory and I/O devices effectively and to explore requirements of cache Memory and Multiprocessors

UNIT-I

Basic Computer Organization and Design:

Evolution of Computer Systems, Basic Operation of a Computer, Memory Addressing and Languages, Software and Architecture Types, Instruction Set Architecture, Number Representation, Instruction format and Addressing Modes, CISC and RISC Architecture.

UNIT-II

Control Unit:

Measuring CPU Performance, Design of control unit.

Memory Organization:

Processor memory interaction, Static and Dynamic RAM, Asynchronous DRAM, Synchronous DRAM, Memory interfacing and addressing, Memory hierarchy design, Cache Memory, Improving cache performance.

UNIT-III

Computer Arithmetic:

Design of Adders, Design of Multipliers, Design of Dividers, Floating point numbers, Floating point arithmetic.

Pipelining and Vector Processing:

Parallel processing, Pipelining, Arithmetic pipeline, Instruction Pipeline, Vector Processing.

UNIT-IV

Input – Output Organization:

Secondary storage devices, Input Output Organization, Data transfer techniques, Interrupt handling, Dynamic Memory Access.

UNIT-V

Multiprocessors:

Characteristics of Multiprocessors, Interconnection Structures,Interprocessor Arbitration Inter Processor Communication and synchronization.

TEXT BOOKS:

1. D.A.Patterson and J.L.Hennessy," ComputerArchitecture:AQuantitative approach, 5/E", Morgan KoFFman, 2011

2.Computer Systems Architecture – M.Moris Mano, IIIrd Edition, Pearson/PHI.

3.William Stallings,"Computer Organization and Architecture: Designing for Performance",- Tenth Edition, Pearson/PHI, 2015.

4. Carl Hamacher, ZvonksVranesic, SafeaZaky,,"Computer Organization,5/E",Vth Edition, McGraw Hill,2011.

REFERENCE BOOKS:

1. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition, PHI/Pearson.

2. Fundamentals of Computer Organization and Design, - SivaraamaDandamudi, Springer Int. Edition.

3. Computer Architecture a quantitative approach, John L. Hennessy and David A. Patterson, Fourth Edition, Elsevier.

4. Computer Architecture: Fundamentals and principles of Computer Design, Joseph D. Dumas II, BS Publication.

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Course Title	APPLIED MACHINE LEARNING IN PYTHON				B.Tech CSE - VI Sem (Honours Degree)		
Course Code	Hours/Week			Credits	Maximum Marks		
2092503	L	T	P	C	Continuous Internal Assessment	End Exams	Total
	4	0	0	4	40	60	100
Mid Exam Duration: 90 Minutes				End Exam Duration: 3Hrs			

Course Objectives:

- Understand the Machine Learning Basic concepts.
- Understand the need of python in machine learning.
- To Analyse Supervised Learning Algorithms.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	students will be able to identify the difference between a supervised (classification) and unsupervised (clustering) technique
CO 2	Understand Supervised Learning Algorithms.
CO 3	Identify which technique they need to apply for a particular dataset and need, engineer features to meet that need, and write python code to carry out an analysis.

UNIT-I

Machine learning basics: The need for Machine learning, understanding machine learning, machine learning methods, Supervised learning, Un supervised learning, semi supervised learning, reinforcement learning.

UNIT-II

The Python Machine Learning Ecosystem: Python Introduction, strengths, pitfalls, setting up a python Environment, Why Python for Data science.
Introducing thePython Machine Learning Ecosystem: Jupiter notebooks,Numpy, Pandas.

UNIT-III

Processing, Wrangling and Visualizing data: Data collection, Data description, Data Wrangling, data Summarization, Data Visualization.

UNIT-IV

Machine Learning Algorithms: Introduction to Classification, **Logistic Regression**: Introduction, Types of Logistic Regression,Binary Logistic regression Model, Multinomial Logistic regression Model,**Support vector machine:** Introduction to SVM, Pros and Cons of SVM classifier.

UNIT-V

Classification Algorithms: Decision Tree, Naïve-Bayes, Random Forest.
Case studies: Analyzing Bike sharing Trends.

TEXT BOOKS:

1.Practical Machine Learning with Python- A problem solver's Guide to Building Real world intelligent Systems, Dipanjan Sarkar, Raghav Bali, Tushar Sharma.Apress publications.

2.Introduction to Machine Learning with Python- A Guide for Data Scientists, Andreas C.Miiller and sarah Guido, O'REILLY publications.

REFERENCES:

Machine Learning with Python tutorials point.www.tutorialspoint.com

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Course Title	DEEP LEARNING				B.Tech CSE - VI Sem (Honours Degree)		
Course Code	Hours/Week			Credits	Maximum Marks		
2092504	L	T	P	C	Continuous Internal Assessment	End Exams	Total
	4	0	0	4	40	60	100
Mid Exam Duration: 90 Minutes				End Exam Duration: 3Hrs			

Course Objectives:

- Study about basic concepts of deep learning
- Introduce deep learning algorithms, te problem settings and their applications to solve real world problems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the historical trends in deep learning and use Tensor flow for performing Linear Regression, Gradient Descent, optimizers, graph visualization and training curves.
CO 2	Summarize the fundamentals of Artificial Neural Networks.
CO 3	Understand the training of Deep Neural Nets
CO 4	Understand the Convolutional Neural Networks Architecture.
CO 5	Understand the Recurrent Neural Networks and deep RNN training.

UNIT-I

Introduction to Deep Learning: Introduction, Historical trends in Deep Learning

Up and Running with TensorFlow

Installation, Creating Your First Graph and Running It in a Session, Managing Graphs, Lifecycle of a Node Value, Linear Regression with TensorFlow. Implementing Gradient Descent, Feeding Data to the Training Algorithm, Saving and Restoring Models, Visualizing the Graph and Training Curves Using TensorBoard, Name Scopes, Modularity, Sharing Variables.

UNIT-II

Introduction to Artificial Neural Networks From Biological to Artificial Neurons, Training an MLP with TensorFlow's High-Level API, Training a DNN Using Plain TensorFlow, Fine-Tuning Neural Network Hyperparameters.

UNIT-III

Training Deep Neural Nets

Vanishing/Exploding Gradients Problems, Reusing Pretrained Layers, Faster Optimizers, Avoiding Over fitting Through Regularization.

UNIT-IV

Convolutional Neural Networks

The Architecture of the Visual Cortex, Convolutional Layer, Pooling Layer., CNN Architectures : LeNet5, AlexNet, GoogLeNet, ResNet.

UNIT-V

Recurrent Neural Networks Recurrent Neurons, Basic RNNs in TensorFlow, Training RNNs, Deep RNNs.

Text Books:

1. "Deep Learning" Ian Goodfellow Yoshua Bengio Aaron Courville, MIT Press book.
2. "Hands-On Machine Learning with Scikit-Learn and TensorFlow" March 2017: First Edition

Reference Books:

1. "Neural Networks and Deep Learning", Michael Nielsen.
2. 2. "Neural Networks and Deep Learning " Aggarwal, Charu C.Springer International Publishing.

Web References:

1. https://www.coursera.org/specializations/deep-learning?
2. https://www.coursera.org/learn/introduction-tensorflow?

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Course Title	INTRODUCTION TO BLOCKCHAIN TECHNOLOGIES AND APPLICATIONS		B.Tech CSE - VII Sem (Honours Degree)		
Course Code	Hours/Week	Credits	Maximum Marks		
2092505	MOOC	2	Continuous Internal Assessment	End Exams	Total
			40	60	100
Mid Exam Duration: 90 Minutes		End Exam Duration: 3Hrs			

Course Objectives:

- Understand how block chain systems work
- To securely interact with them
- Integrate ideas from block chain technology into their own projects

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Recall cryptographic concepts, hashing, public key cryptosystems.
CO 2	Understand basic concept of Block chain technology
CO 3	Understand design principles of Bitcoin and Alternative coins
CO 4	Study on the usecases of Block chain technology.

UNIT-I

Introduction – basic ideas behind blockchain, how it is changing the landscape of digitalization, introduction to cryptographic concepts required, Hashing, public key cryptosystems, private vs public blockchain and use cases, Hash Puzzles, Introduction to BitcoinBlockchain.

UNIT-II

BitcoinBlockchain and scripts, Use cases of BitcoinBlockchain scripting language in micropayment, escrow etc Downside of Bitcoin – mining.

UNIT-III

Alternative coins – Ethereum and Smart contracts , IOTA, The real need for mining – consensus– Byzantine Generals Problem, and Consensus as a distributed coordination problem – Coming to private or permissioned blockchains.

UNIT-IV

Permissioned Blockchain and use cases – Hyperledger, Corda.

UNIT-V

Uses of Blockchain in E-Governance, Land Registration, Medical Information Systems.

Text Book:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

Reference Books:

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
4. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts

https://www.gitam.edu/departments_cms/assets/uploads/syllabus/1566624781_Certification_course_on_Blockchain_Technology_w__e__f__2019-20_admitted_batch.pdf

SWAYAM NPTEL Link: https://onlinecourses.nptel.ac.in/noc20_cs01/preview

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Course Title	BIG DATA & HADOOP		B.Tech CSE - VII Sem (Honours Degree)		
Course Code	Hours/Week	Credits	Maximum Marks		
2092506	MOOC	2	Continuous Internal Assessment	End Exams	Total
			40	60	100
Mid Exam Duration: 90 Minutes		End Exam Duration: 3Hrs			

Course Objectives:

- To introduce big data concepts.
- To introduce the tools required to manage and analyze big data like Hadoop, NoSql MapReduce.
- Understanding Hadoob.
- Understanding Big data Applications (HBASE, HIVE)
- To enable students to have skills that will help them to solve complex real-world problems in for decision support.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Installation of Hadoop Tools.
CO 2	Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.
CO 3	Working with HBASE and HIVE.
CO 4	Achieve adequate perspectives of big data in various applications like recommender systems, social media applications etc

UNIT-I

Introduction to Big Data, What is Big Data Why Big Data is Important, Meet Hadoop, Big Data Storage and Analysis, Comparison with other systems, Grid Computing, A brief history of Hadoop, Apache Hadoop and the Hadoop Eco system, Linux refresher VM Ware Installation of Hadoop.

UNIT-II

The design of HDFS, HDFS concepts, Command line interface to HDFS Hadoop File Systems, Interfaces Java Interface to Hadoop, Anatomy of a file read, Anatomy of a File Write, Replica placement and Coherency Model, Parallel copying with distep, Keeping an HDFS cluster balanced.

UNIT-III

Introduction. Analyzing data with unix tools, Analyzing data with Hadoop, Java Map Reduce classes (New API). Data flow, combiner functions, Running a distributed MapReduce Job. Configuration API, Setting up the development environment. Managing configuration, Writing a unit test with MRunit, Running a Job in local job runner. Running on a cluste. Launching a job. The MapReduce WebUI.

UNIT-IV

Classic Mapreduce. Job submission, Job Initialization, Task Assignment, Task execution, Progress and status updates, Job Completion, Shuffle and sort on Map and reducer side, Configuration tuning. Map Reduce. Types, Input formats, Output formats, Sorting Map side and Reduce Side joins.

UNIT-V

The Hive Shall, Hive services, Hive clients, The meta store. Comparison with traditional databases, Hive QI,

Hbase: Concepts, Implementation, Java and Map reduce clients. Loading data, Web queries.

Text Books:

1. Tom White, Hadoop, "The Definitive Guide" , 3rd Edition, O'Reilly Publications, 2012
2. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, "Undetstanding Big Data Analytics for Enterprise class Hadoop and Streaming Data", 1st Edition, TMH, 2012.

Reference links:

https://www.coursera.org/learn/hadoop#syllabus
https://www.coursera.org/lecture/hadoop/introduction-to-apache-hive-0AToF

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Course Title	Introduction to Industry 4.0 and Industrial IOT		B.Tech CSE - VII Sem (Honours Degree)		
Course Code	Hours/Week	Credits	Maximum Marks		
2092507	MOOC	C	Continuous Internal Assessment	End Exams	Total
		2	40	60	100
Mid Exam Duration: 90 Minutes		End Exam Duration: 3Hrs			

Course Objectives:

- Introduction to Sensors, Communication and Networking
- Introducing Cyber Security in Industry 4.0
- To learn Big Data Analytics and SDN
- To know about various application domains

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understanding various sensors in IoT
CO 2	Understanding Cyber Security with IIoT
CO 3	Understanding various application domains
CO 4	Build skills in Hardware, Software, Application Systems, and Data management

UNIT-I

Introduction: Sensing & actuation, Communication, Networking.
Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories
Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis.

UNIT-II

Cyber security in Industry 4.0, Basics of Industrial IoT: Industrial Processes, Industrial Sensing & Actuation, Industrial Internet Systems.
IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models, IIoT Reference Architecture.

UNIT-III

Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing, IIoT Communication. Industrial IoT- Layers: IIoT Communication, IIoT Networking. Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science, R and Julia Programming, Data Management with Hadoop.

UNIT-IV

Big Data Analytics and Software Defined Networks: SDN in IIoT, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT.

Security and Fog Computing - Fog Computing in IIoT, Security in IIoT, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.

UNIT-V

Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Case studies. Self-Referential Structures and Introduction to Lists.

https://nptel.ac.in/courses/106/105/106105195/

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