	SJPN Trust's Hirasugar Institute of Technology, Nidasoshi. <i>Inculcating Values, Promoting Prosperity</i>	Dept. of CSE Academic Course Plan
	Approved by AICTE, New Delhi, Permanently Affiliated to VTU, Belagavi Recognized under 2(f) & 12B of UGC Act, 1956	2023-24 (ODD)
	Accredited at 'A' Grade by NAAC & Programmes Accredited by NBA:CSE & ECE	

INSTITUTE VISION

“To be a preferred institution in Engineering Education by achieving excellence in teaching and research and to remain as a source of pride for its commitment to holistic development of individual and society”

INSTITUTE MISSION

“To continuously strive for the overall development of students by educating them in a state-of-the-art-infrastructure, by retaining the best practices, faculties and inspire them to imbibe real time problem solving skills, leadership qualities, human values and societal commitments, so that they emerge as competent professionals”.

DEPARTMENT VISION

“To be a center of excellence in providing education in the field of Computer Science and Engineering to produce technically competent and socially responsible IT professionals”

DEPARTMENT MISSION


“To provide a theoretical foundation in computing with the exposure of latest tools and technologies, IT infrastructure and encourage students for continuous learning to make them competent professionals”

PROGRAM EDUCATIONAL OBJECTIVES (PEO's) :

1. *Pursue a successful career in the field of Computer Science & Engineering utilizing his/her knowledge and contribute to the profession as an excellent employee, or as an entrepreneur.*
2. *Apply the knowledge of mathematics & computer science fundamentals to analyze & formulate the solution to solve real time problems.*
3. *Exhibit the professional and ethical values, communication & teamwork skills, lifelong learning, multidisciplinary approach to address computer engineering and societal issues.*

PROGRAM OUTCOMES (PO's) :

1. **Engineering knowledge:** *Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.*
2. **Problem analysis:** *Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.*
3. **Design/development of solutions:** *Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.*
4. **Conduct investigations of complex problems:** *Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.*
5. **Modern tool usage:** *Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.*
6. **The engineer and society:** *Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.*

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7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.


PROGRAM SPECIFIC OUTCOMES (PSO's) :

PSO1: Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Bigdata Analytics, Machine Learning and Networking.

PSO2: Make use of modern computer tools for creating innovative career paths to be an entrepreneur and desire for higher studies.

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1.0 Student Help Desk

Sl. No.	Purpose	Contact Person	
		Faculty	Instructor
1	Head of Department ,NBA Criterial Coordinator ,Module Coordinator, NAAC Criteria 2 Coordinator , Computer Center Lab Incharge, VTU/LIC Coordinator Students Mentor	Dr. K. B. Manwade	Mr. A. R. Bhiste
2	Website Coordinator .Feedback Coordinator , NBA Criteria 4 Coordinator, NAAC Criteria 2,3,5 Co-Coordinator, Module Coordinator, Students Mentor	Dr. Mahesh. G. Huddar	Mr. A. K. Badakar
3	Dept. ED Cell Coordinator , NBA Criteria 6 Coordinator, Module Coordinator,, Class Teacher for VII Sem, Microprocessor Lab Incharge, Students Mentor	Prof. N K Honnagoudar	Mr. A. K. Talawar
4	Innovation Club Coordinator, Dept. NBA Coordinator, AICTE/NIRF activity point Coordinator, NBA Criteria7 and 10 Coordinator, NAAC Criteria 4 Coordinator , Research Center Coordinator , Module Coordinator, Project Lab Incharge, Students Mentor	Prof. S. V. Manjaragi	Mr. Suyash Badi
5	EMS/IA Coordinator, Alumni Coordinator , NBA Criteria 3 Coordinator, NAAC Criterian-7 Co-Coordinator, Dept. Time table Coordinator / Meeting Coordinator, Module coordinator ,Students Mentor	Prof. A A Daptardar	Miss. S. B. Vairagi
6	Department Association Coordinator (STAC) ,Dept. T&P coordinator, Technical magazine / Newsletter Professional body Coordinator ,(IEEE/ISTE), NBA Criteria 5 Coordinator , NACC Criteria 1,5 Co-coordinator, Students Mentor	Prof. Prasanna. G. Patil	Miss. S. G. Gurav
7	Project/KSCST Coordinator, NBA Criteria 2 Coordinator, Class Teacher for III Sem A-DIV, Web Programming Lab Incharge, Students Mentor	Prof. S. I. Mane	Miss. S. B. Vairagi
8	NBA Criterion 9 Coordinator, Class Teacher for V Sem Conference / FDP / Workshop, IIIC/Internship Coordinator, Student Registration Coordinator Students Mentor	Prof. M. G. Ganachari	Mr. A. B. Bennoli
9	Final year seminar Coordinator, System Programming Lab Incharge, GATE/Pre-placement Coaching Coordinator, Class Teacher for III Sem B-DIV, Students Mentor	Prof. Sapna Patil	Miss. S. G. Gurav
10	Dept. Library	Mr. A. R. Bhiste	
Institute Level			
12.	Dean Student Welfare Convener	Dr. Mahesh G. Huddar (7411043272)	
13.	Dean Placements and III Cell	Prof. P. V. Patil (9731104059)	
14.	Anti Ragging Convener	Prof. Girish Zulapi (9480213587)	
15.	Anti Squad Convener	Prof. Girish Zulapi (9480213587)	
16.	Internal Complaint Committee Convener	Prof. S. S. Kamte (9008696825)	
17.	Grievance Redressal Convener	Prof. S. S. Tabhaj (9901398134)	
18.	Sports & Cultural/Extra-Curricular Activities Convener	Sri. S.B. Sarawadi (9739109383)	

2.0 Departmental Resources

Department of Computer Science and Engineering was established in the year 1996 and is housed in a total area of 1206 Sq. Mtrs.

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2.1 Faculty Position

Sl.No.	Category	No. in Position	Average experience (in years)
1.	Teaching Faculty	09	12.5
2.	Technical Supporting Staff	06	15
3.	Helper Staff	03	19

2.2 Major Laboratories

Sl.No.	Name of the laboratory	Area in Sq. Mtrs	Amount Invested (Rs. in Lakhs)
1.	System Programming Lab.	70	12.65
2.	C Programming Lab/ Algorithms/ Network Lab.	70	19.34
3.	Project Laboratory	70	20.06
4.	Microprocessors Lab.	70	22.14
5.	Web Programming/DBA Lab.	70	09.56
6.	Computer Center	220	234.79

Total Investment in the Department

Rs. 318.54 Lakhs

3.0 Teaching Faculty Details

Sl. No.	Name	Designation	Qualification	Specialization	Professional Membership	Teaching Exp (in yrs)	Phone No.
1	Dr. K. B. Manwade	Assoc. Prof	M. Tech, Ph.D	CSE	LMISTE,CSI	17.06	8412968254
2	Dr. Mahesh. G. Huddar	Assoc. Prof	M. Tech, Ph.D	CSE	LMISTE	13.00	7411043272
3	Prof. N K Honnagoudar	Asst. Prof.	M.E	ECE	LMISTE	19.06	9449495302
4	Prof. S. V. Manjaragi	Asst. Prof.	M.Tech.(Ph.D)	CSE	LMISTE	18.06	9986658309
5	Prof. A A Daptardar	Asst. Prof	M. Tech.	CSE	LMISTE	15.06	9620851002
6	Prof. Prasanna. G. Patil	Asst. Prof	M. Tech	CSE	LMISTE,CSI,IE	09.1	9743202717
7	Prof. S. I. Mane	Asst. Prof	M. Tech	CNE	--	8.00	9743202717
8	Prof. M. G. Ganachari	Asst. Prof	M. Tech	IE	-	12.00	8904879471
9	Prof. Sapna Patil	Asst. Prof	M. Tech	DE	--	1.00	9740875627



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Dept. of CSE

Academic

Course Plan

2023-24 (ODD)

4.0

Institute Academic Calendar

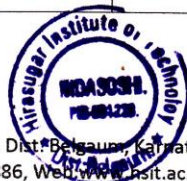
ACADEMIC CALENDAR OF EVENTS-01 (CoE-01) OF I & VII SEM FOR THE AY: 2023-24

Ref: 1. VTU CoE Notification No.: VTU/BGM/ACA/2023-24/2668, Dated 25th Aug. 2023
2. HSIT/NDS/HOD-Meeting-23/2022-23, Dated: 20th Sept. 2023

Calendar	Date	Events & Holidays																																																	
September -2023 <table border="1"> <tr><td>Sun</td><td>Mon</td><td>Tue</td><td>Wed</td><td>Thu</td><td>Fri</td><td>Sat</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td>1</td><td>2</td></tr> <tr><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr> <tr><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td></tr> <tr><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td></tr> <tr><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td></tr> </table>	Sun	Mon	Tue	Wed	Thu	Fri	Sat						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	14 th Aug.-9 th Sept. 2023	One Month Internship for VI Semester completed students							
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	4 th -14 th Sept. 2023	Commencement of I Semester & 11 days Students Induction Program (SIP)																																																	
	11 th Sept.2023	Commencement of VII Semester Classes																																																	
	15 th Sept.2023	Commencement of I Semester Classes																																																	
	19 th Sept.2023	GH: Varasiddhi Vinayaka Vrata																																																	
	21 st Sept. 2023	LH: Mahadasoha of Shri Math Nidasoshi																																																	
	28 th Sept.2023	GH: Eid-Milad																																																	
October -2023 <table border="1"> <tr><td>Sun</td><td>Mon</td><td>Tue</td><td>Wed</td><td>Thu</td><td>Fri</td><td>Sat</td></tr> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr> <tr><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td></tr> <tr><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td></tr> <tr><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td></tr> <tr><td>29</td><td>30</td><td>31</td><td></td><td></td><td></td><td></td></tr> </table>	Sun	Mon	Tue	Wed	Thu	Fri	Sat	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31					2 nd Oct. 2023	GH: Gandhi Jayanthi							
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	21 st Oct. 2023	1 st Feedback on Teaching-Learning (I & VII Sems.)																																																	
	23 rd -24 th Oct. 2023	GH: Mahanavami, Ayudhapooja, Vijayadasami																																																	
	26 th Oct. 2023	Display of 1 st IA Test Marks																																																	
November -2023 <table border="1"> <tr><td>Sun</td><td>Mon</td><td>Tue</td><td>Wed</td><td>Thu</td><td>Fri</td><td>Sat</td></tr> <tr><td></td><td></td><td></td><td>1</td><td>2</td><td>3</td><td>4</td></tr> <tr><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td></tr> <tr><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td></tr> <tr><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td></tr> <tr><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td></td><td></td></tr> </table>	Sun	Mon	Tue	Wed	Thu	Fri	Sat				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			1 st Nov. 2023	GH: Kannada Rajyothsava							
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	10 th -11 th Nov. 2023	Lab IA Test-I (2021 & 2022 Scheme)																																																	
	14 th Nov. 2023	GH: Balipadyami, Deepavali																																																	
	23 rd -25 th Nov. 2023	2 nd IA Test																																																	
December -2023 <table border="1"> <tr><td>Sun</td><td>Mon</td><td>Tue</td><td>Wed</td><td>Thu</td><td>Fri</td><td>Sat</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td>1</td><td>2</td></tr> <tr><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr> <tr><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td></tr> <tr><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td></tr> <tr><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td></tr> <tr><td>31</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>	Sun	Mon	Tue	Wed	Thu	Fri	Sat						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31							25 th Nov. 2023	2 nd Feedback on Teaching-Learning (I & VII Sems.)
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	29 th Nov. 2023	Display of 2 nd IA Test Marks																																																	
	30 th Nov. 2023	GH: Kanakadasa Jayanti																																																	
	8 th -9 th Dec. 2023	International Conference																																																	
	25 th Dec. 2023	GH: Christmas																																																	
January -2024 <table border="1"> <tr><td>Sun</td><td>Mon</td><td>Tue</td><td>Wed</td><td>Thu</td><td>Fri</td><td>Sat</td></tr> <tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr> <tr><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td></tr> <tr><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td></tr> <tr><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td></tr> <tr><td>28</td><td>29</td><td>30</td><td>31</td><td></td><td></td><td></td></tr> </table>	Sun	Mon	Tue	Wed	Thu	Fri	Sat		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31				1 st -3 rd Jan. 2024	3 rd IA Test							
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28	29	30	31																																																
	5 th Jan. 2024	Display of 3 rd IA Test Marks																																																	
	4 th -6 th Jan. 2024	Lab IA Test-II (2018, 2021 & 2022 Scheme)																																																	
	6 th Jan. 2024	Last Working Day of the I & VII Semesters																																																	
	8 th - 19 th Jan. 2024	VTU Practical Exams																																																	
	12 th Jan. 2024	National Youth Day																																																	
February -2024 <table border="1"> <tr><td>Sun</td><td>Mon</td><td>Tue</td><td>Wed</td><td>Thu</td><td>Fri</td><td>Sat</td></tr> <tr><td></td><td></td><td></td><td></td><td>1</td><td>2</td><td>3</td></tr> <tr><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr> <tr><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr> <tr><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td></tr> <tr><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td></td><td></td></tr> </table>	Sun	Mon	Tue	Wed	Thu	Fri	Sat					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29			26 th Jan. 2024	Republic Day							
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	22 nd Jan. 2024	Commencement of VTU SEE																																																	
	13 th Feb. 2024	Commencement of II Semester																																																	
	19 th Feb. 2024	Commencement of VIII Semester																																																	


GH: General Holiday, LH: Local Holiday

Dr.S.N.Topannavar
IQAC Coordinator & Dean (Academics)




Dr.S.C.Kamat
Principal

Nidasoshi, Taq: Hukkeri, Dist: Belgaum, Karnataka - 591 236
Phone:+91-8333-278887, Fax:278886, Web:www.hsit.ac.in, Mail:principal@hsit.ac.in

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5.0 Scheme of Teaching & Examination

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI												
Scheme of Teaching and Examination 2018 – 19												
Choice Based Credit System (CBCS) AND Outcome Based Education (OBE)												
(Effective from the academic year 2018 – 19)												
VII SEMESTER												
Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18CS71	Artificial Intelligence and Machine Learning	CS / IS	4	--	--	03	40	60	100	4
2	PCC	18CS72	Big Data Analytics	CS / IS	4	--	--	03	40	60	100	4
3	PEC	18CS733	Advanced Computer Architecture	CS / IS	3	--	--	03	40	60	100	3
4	PEC	18CS744	Cryptography	CS / IS	3	--	--	03	40	60	100	3
5	OEC	18ME751	Energy and Environment	CS / IS	3	--	--	03	40	60	100	3
6	PCC	18CSL76	Artificial Intelligence and Machine Learning Laboratory	CS / IS	--	--	2	03	40	60	100	2
7	Project	18CSP77	Project Work Phase – 1	CS / IS	--	--	2	--	100	--	100	1
8	INT	--	Internship	(If not completed during the vacation of VI and VII semesters, it has to be carried out during the intervening vacations of VII and VIII semesters)								
TOTAL					17	--	04	18	340	360	700	20
Note: PCC: Professional core, PEC: Professional Elective, OEC: Open Elective, INT: Internship.												
Professional Elective - 2												
Course code under 18CS73X		Course Title										
18CS731		Software Architecture and Design Patterns										
18CS732		High Performance Computing										
18CS733		Advanced Computer Architecture										
18CS734		User Interface Design										
Professional Electives – 3												
Course code under 18CS74X		Course Title										
18CS741		Digital Image Processing										
18CS742		Network management										
18CS743		Natural Language Processing										
18CS744		Cryptography										
18CS745		Robotic Process Automation Design & Development										
Open Elective –B (Not for CSE / ISE Programs)												
18CS751		Introduction to Big Data Analytics										
18CS752		Python Application Programming										
18CS753		Introduction to Artificial Intelligence										
18CS754		Introduction to Dot Net framework for Application Development										

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Students can select any one of the open electives offered by any Department (Please refer to the list of open electives under 18CS75X). Selection of an open elective is not allowed provided,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Adviser/Mentor.

Project work: Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

CIE procedure for Project Work Phase - 1:


(i) **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the Project report shall be the same for all the batch mates.

(ii) **Interdisciplinary:** Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(iii)

Internship: All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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Subject Title	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING		
Subject Code	18CS71	IA Marks	40
Number of Lecture Hrs / Week	4:0:0	Exam Marks	60
Total Number of Lecture Hrs	50	Exam Hours	03
CREDITS – 04			

FACULTY DETAILS:		
Name: Dr. Mahesh G. Huddar	Designation: Associate Professor	Experience: 14 Years
No. of times course taught: 06	Specialization: Computer Science and Engineering	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Computer Science and Engineering	I/II	Programming in C and Data Structures
02	Computer Science and Engineering	V	Application Development using Python

2.0 Course Objectives

Students should learn to:

1. Explain Artificial Intelligence and Machine Learning
2. Illustrate AI and ML algorithm and their use in appropriate applications

3.0 Course Outcomes

After studying this course, students will be able to

	Course Outcome	Cognitive Level	POs
C401.1	Appraise the theory of Artificial intelligence and Machine Learning	L2	1, 2, 3, 8, 10, 12
C401.2	Illustrate the working of AI and ML Algorithms.	L2	1, 2, 3, 8, 10, 12
C401.3	Demonstrate the applications of AI and ML.	L2	1, 2, 3, 8, 10, 12
Total Hours of Instruction			50

4.0 Course Content

Module – 1

10 Hours

What is artificial intelligence? Problems, problem spaces and search, Heuristic search techniques.

Textbook 1: Chapter 1, 2 and 3 RBT: L1, L2

Module – 2

10 Hours


Knowledge representation issues, Predicate logic, Representation knowledge using rules. Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Candidate Elimination Algorithm, Inductive bias of Candidate Elimination Algorithm. **Textbook 1:** Chapter 4, 5 and 6, **Textbook2:** Chapter 2 (2.1-2.5, 2.7) RBT: L1, L2, L3

Module – 3

08 Hours

Decision Tree Learning: Introduction, Decision tree representation, appropriate problems, ID3 algorithm. Artificial Neural Network: Introduction, NN representation, appropriate problems, Perceptions, Back propagation algorithm.

Textbook2: Chapter 3 (3.1-3.4), Chapter 4 (4.1-4.5) RBT: L1, L2, L3

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Module – 4

10 Hours

Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting, MDL principle, Bates optimal classifier, Gibbs algorithm, Naive Bayes classifier, BBN, EM Algorithm
 Textbook2: Chapter 6 RBT: L1, L2, L3

Module – 5

12 Hours

Instance-Base Learning: Introduction, k-Nearest Neighbor Learning, Locally weighted regression, Radial basis function, Case-Based reasoning. Reinforcement Learning: Introduction, The learning task, Q-Learning.
 Textbook 1: Chapter 8 (8.1-8.5), Chapter 13 (13.1 – 13.3) RBT: L1, L2, L3

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	VIII	Project Work	Classification and Prediction Problems

6.0 Relevance to Real World

Sl. No	Real World Mapping
01	Classification and Prediction Problems


7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	YouTube Videos	Machine Learning and Artificial Intelligence
02	NPTEL	Machine Learning and Artificial Intelligence

8.0 Books Used and Recommended to Students

Text Books
1. Tom M Mitchell, “Machine Learning”, 1st Edition, McGraw Hill Education, 2017. 2. Elaine Rich, Kevin K and S B Nair, “Artificial Intelligence”, 3 rd Edition, McGraw Hill Education, 2017.
Reference Books
1. Saroj Kaushik, Artificial Intelligence, Cengage learning 2. Stuart Russell, Peter Norving , Artificial Intelligence: A Modern Approach, Pearson Education 2nd Edition 3. AurÈlienGÈron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, Shroff/O'Reilly Media, 2017. 4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics. 5. Ethem Alpaydm, Introduction to machine learning, second edition, MIT press 6. Srinivasa K G and Shreedhar, “Artificial Intelligence and Machine Learning”, Cengage
Additional Study material & e-Books
1. Pattern Recognition and Machine Learning, Bishop, Christopher, Springer nature publications 2. Hands-On Machine Learning with Scikit-Learn and TensorFlow, Concepts, Tools, and Techniques to Build Intelligent Systems, Aurélien Géron, O'Reilly Media, March 2017.

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

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Website and Internet Contents References

- <https://www.kaggle.com/kanncaa1/machine-learning-tutorial-for-beginners>
- <https://www.toptal.com/machine-learning/machine-learning-theory-an-introductory-primer>
- <https://pythonprogramming.net/machine-learning-tutorial-python-introduction/>
- <https://machinelearningmastery.com/start-here/>
- https://www.tutorialspoint.com/mahout/mahout_machine_learning.htm

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	Machine Learning	https://www.springer.com/computer/ai/journal/10994
2	Artificial Intelligence an International Journal	https://www.journals.elsevier.com/artificial-intelligence

11.0 Examination Note

Internal Assessment: 30+10=40 Marks

30 marks –from internal assessment test

10 marks- from the assignments

Scheme of Evaluation for Internal Assessment (30 Marks)

- Internal Assessment test is conducted for 50 marks in the same pattern as that of the main examination. Average of all three Test marks will be taken and finally scale down to 30 marks.
- Assignment marks for each module is 25. Average of all 5 assignment marks will be taken and finally scale down to 10 marks.

Question Paper Pattern (IA):

- Two main questions to be set from syllabus covered up to IA tests.
- Student has to answer two full main questions and each question carries 25.
 - Q.No I or Q.No II =25 Marks
 - Q.No III or Q.No IV =25 Marks
 - Total =50 Marks**

Question Paper Pattern and instructions (Main Exam):

- The question paper will have TEN questions.
- There will be TWO questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Max. Marks: 100 and each question carries 20 marks. Exam Duration: 3 Hrs.

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
1	1	What is artificial intelligence?	20
	2	Continued...	
	3	Problems	
	4	Continued...	
	5	problem spaces and search	
	6	Continued...	
	7	Heuristic search techniques	
	8	Continued...	
	9	Continued...	
2	10	Continued...	20
	11	Knowledge representation issues,	
	12	Predicate logic	
	13	Continued...	



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	14	Representation knowledge using rules.	
	15	Concept Learning: Concept learning task	
	16	Concept learning as search	
	17	Find-S algorithm	
	18	Candidate Elimination Algorithm,	
	19	Continued...	
	20	Inductive bias of Candidate Elimination Algorithm.	
3	21	Decision Tree Learning	16
	22	Decision tree representation	
	23	Appropriate problems for decision tree learning	
	24	ID3 algorithm	
	25	Continued...	
	26	Artificial Neural Networks: Introduction	
	27	Neural Network representation	
	28	Appropriate problems	
	29	Perceptron	
	30	Back propagation algorithm	
4	31	Bayesian Learning: Introduction	20
	32	Bayes theorem	
	33	Bayes theorem and concept learning	
	34	ML and LS error hypothesis	
	35	ML for predicting probabilities	
	36	MDL principle	
	37	Bates optimal classifier, Gibbs algorithm	
	38	Naive Bayes classifier	
	39	Bayesian belief networks	
	40	BBN, EM algorithm	
5	41	Instance Based Learning: Introduction	24
	42	K-nearest neighbor learning,	
	43	Locally weighted regression	
	44	Radial basis function,	
	45	Cased-based reasoning	
	46	Continued...	
	47	Reinforcement Learning	
	48	Introduction, Learning Task	
	49	Q Learning	
	50	Continued...	

13.0

Assignments, Quiz, Mini Project, Seminars

Sl. No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book / website / Paper
1	Assignment 1: University Questions on Module 1	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 1 of the syllabus	2	Individual Activity. Printed solution expected.	Book 1
2	Assignment 2: University Questions on Module 2	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 2 of the syllabus	4	Individual Activity. Printed solution expected.	Book 1 and 2
3	Assignment 3: University Questions on Module 3	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 3 of the syllabus	6	Individual Activity. Printed solution expected.	Book 2
4	Assignment 4: University Questions on Module 4	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 4 of the syllabus	8	Individual Activity. Printed solution expected.	Book 2
5	Assignment 5: University Questions on Module 5	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 5 of the syllabus	10	Individual Activity. Printed solution expected.	Book 1

14.0 QUESTION BANK

MODULE – 1

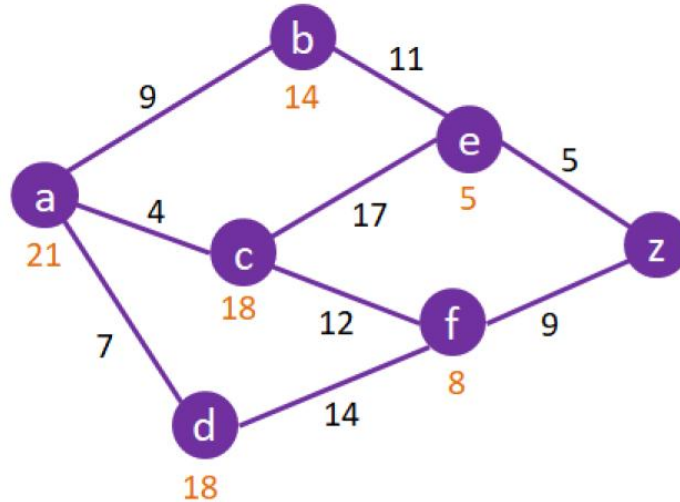
1. What is Artificial Intelligence? List the fields that form the basis for AI.
2. List the task domains of AI.
3. List four things (steps) to build a system to solve a problem.
4. What are the 3 different ways of solving Tic-Tac-Toe Problem applying AI. Show the improvements obtained from one over the other using better knowledge representation.
5. What is Production System? Explain production system characteristics.
6. Explain water Jug problem as a state space search.
7. Explain problem characteristics.
8. Define Control Strategy and requirements for good search strategy.
9. Define State Space Search. Explain.
10. How do you define a problem as a state-space search
11. Explain Breadth-first search and depth-first search. List down the advantages and disadvantages of both?
12. What do you mean by heuristic and heuristic search? What are the advantages of Heuristic Search?
13. What is constraint satisfaction problem? Explain it.
14. Write and explain Generate and Test algorithm.
15. Write and explain algorithms of hill climbing.
16. Consider trying to solve the 8-puzzle instance is given below using Hill Climbing. Apply any heuristic function appropriate to the problem.

Start State	Goal State																		
<table border="1" style="border-collapse: collapse; text-align: center;"> <tr><td>2</td><td>8</td><td>3</td></tr> <tr><td>1</td><td></td><td>4</td></tr> <tr><td>7</td><td>6</td><td>5</td></tr> </table>	2	8	3	1		4	7	6	5	<table border="1" style="border-collapse: collapse; text-align: center;"> <tr><td>1</td><td>2</td><td>3</td></tr> <tr><td>8</td><td></td><td>4</td></tr> <tr><td>7</td><td>6</td><td>5</td></tr> </table>	1	2	3	8		4	7	6	5
2	8	3																	
1		4																	
7	6	5																	
1	2	3																	
8		4																	
7	6	5																	

17. List the disadvantages of hill climbing and explain suitable technique to overcome.
18. Write and explain Best first search algorithm with example.

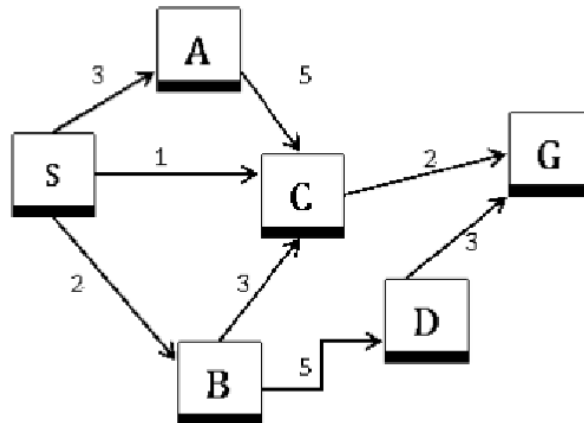


19. Write and explain A* algorithm with example.
20. Explain Problem reduction techniques with a suitable example.
21. Write AO* algorithm and explain the steps in it.
22. What is Means-Ends Analysis? Explain with an example.
23. Explain A* algorithm and find the shortest path from 'a' to 'z' using the following graph using A*



24. Apply A* Algorithm to the following graph, where S is the Initial State and G is the Goal state. The table below indicates h' values.

State	h(n)
S	6
A	2
B	4
C	1
D	2
G	0



25. Puzzle problem, Crypt arithmetic problem.
 - a. SEND + MORE = MONEY
 - b. DONALD + GERALD = ROBERT
 - c. CROSS + ROADS = DANGER

MODULE – 2

1. Define Machine Learning. Explain with examples why machine learning is important.
2. Discuss some applications of machine learning with examples.
3. Explain different perspective and issues in machine learning.
4. Define concept learning and discuss with example.
5. Explain the General-to-Specific Ordering of Hypotheses
6. Write FIND-S algorithm and explain with example given below



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Example	Sky	AirTemp	Humidity	Wind	Water	Forecast	EnjoySport
1	Sunny	Warm	Normal	Strong	Warm	Same	Yes
2	Sunny	Warm	High	Strong	Warm	Same	Yes
3	Rainy	Cold	High	Strong	Warm	Change	No
4	Sunny	Warm	High	Strong	Cool	Change	Yes

7. What are the key properties and complaints of FIND-S algorithm?
8. Define Consistent Hypothesis and Version Space.
9. Write LIST-THEN-ELIMINATE algorithm.
10. Write the candidate elimination algorithm and illustrate with example
11. Write the final version space for the below mentioned training examples using candidate elimination algorithm.

Example – 1:

Origin	Manufacturer	Color	Decade	Type	Example Type
Japan	Honda	Blue	1980	Economy	Positive
Japan	Toyota	Green	1970	Sports	Negative
Japan	Toyota	Blue	1990	Economy	Positive
USA	Chrysler	Red	1980	Economy	Negative
Japan	Honda	White	1980	Economy	Positive
Japan	Toyota	Green	1980	Economy	Positive
Japan	Honda	Red	1990	Economy	Negative

Example – 2:

Size	Color	Shape	Class
Big	Red	Circle	No
Small	Red	Triangle	No
Small	Red	Circle	Yes
Big	Blue	Circle	No
Small	Blue	Circle	Yes

Example – 3:

Example	Citations	Size	InLibrary	Price	Editions	Buy
1	Some	Small	No	Affordable	One	No
2	Many	Big	No	Expensive	Many	Yes
3	Many	Medium	No	Expensive	Few	Yes
4	Many	Small	No	Affordable	Many	Yes

12. Explain in detail the Inductive Bias of Candidate Elimination algorithm.

MODULE – 3

1. What is decision tree and decision tree learning? Explain representation of decision tree with example.
2. What are appropriate problems for Decision tree learning? Explain the concepts of Entropy and Information gain.
3. Describe the ID3 algorithm for decision tree learning with example.
4. Give Decision trees to represent the Boolean Functions:
 - a. $A \ \&\& \ \sim B$
 - b. $A \vee [B \ \&\& \ C]$
 - c. $A \ \text{XOR} \ B$
 - d. $[A \ \&\& \ B] \vee [C \ \&\& \ D]$
5. Give Decision trees for the following set of training examples



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Day	Outlook	Temperature	Humidity	Wind	PlayTennis
D1	Sunny	Hot	High	Weak	No
D2	Sunny	Hot	High	Strong	No
D3	Overcast	Hot	High	Weak	Yes
D4	Rain	Mild	High	Weak	Yes
D5	Rain	Cool	Normal	Weak	Yes
D6	Rain	Cool	Normal	Strong	No
D7	Overcast	Cool	Normal	Strong	Yes
D8	Sunny	Mild	High	Weak	No
D9	Sunny	Cool	Normal	Weak	Yes
D10	Rain	Mild	Normal	Weak	Yes
D11	Sunny	Mild	Normal	Strong	Yes
D12	Overcast	Mild	High	Strong	Yes
D13	Overcast	Hot	Normal	Weak	Yes
D14	Rain	Mild	High	Strong	No

6. Consider the following set of training examples.
- What is the entropy of this collection of training example with respect to the target function classification?
 - What is the information gain of a_2 relative to these training examples?

Instance	Classification	a_1	a_2
1	+	T	T
2	+	T	T
3	-	T	F
4	+	F	F
5	-	F	T
6	-	F	T

7. Identify the entropy, information gain and draw the decision trees for the following set of training examples

Gender	Car ownership	Travel cost	Income Level	Transportation (Class)
Male	0	Cheap	Low	Bus
Male	1	Cheap	Medium	Bus
Female	1	Cheap	Medium	Train
Female	0	Cheap	Low	Bus
Male	1	Cheap	Medium	Bus
Male	0	Standard	Medium	Train
Female	1	Standard	Medium	Train
Female	1	Expensive	High	Car
Male	2	Expensive	Medium	Car
Female	2	Expensive	High	Car



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Instance	a1	a2	a3	Classification
1	True	Hot	High	No
2	True	Hot	High	No
3	False	Hot	High	Yes
4	False	Cool	Normal	Yes
5	False	Cool	Normal	Yes
6	True	Cool	High	No
7	True	Hot	High	No
8	True	Hot	Normal	Yes
9	False	Cool	Normal	Yes
10	False	Cool	High	Yes

8. Discuss Hypothesis Space Search in Decision tree Learning.
9. List and explain issues in learning decision trees.
10. What is Artificial Neural Network?
11. Explain appropriate problem for Neural Network Learning with its characteristics.
12. Explain the single perceptron with its learning algorithm.
13. How a single perceptron can be used to represent the Boolean functions such as AND, OR gate.
14. Write Gradient Descent algorithm for training a linear unit. Derive the Gradient Descent Rule
15. Write Stochastic Gradient Descent algorithm for training a linear unit. Differentiate between Gradient Descent and Stochastic Gradient Descent
16. Write Stochastic Gradient Descent version of the Back Propagation algorithm for feed forward networks containing two layers of sigmoid units.
17. Derive the Back Propagation Rule.

MODULE - 4

1. Define Bayesian theorem? What is the relevance and features of Bayesian theorem? Explain the practical difficulties of Bayesian theorem.
2. Define is Maximum a Posteriori (MAP), Maximum Likelihood (ML) Hypothesis. Derive the relation for h_{MAP} and h_{ML} using Bayesian theorem.
3. Consider a medical diagnosis problem in which there are two alternative hypotheses: 1. that the patient has a particular form of cancer (+) and 2. That the patient does not (-). A patient takes a lab test and the result comes back positive. The test returns a correct positive result in only 98% of the cases in which the disease is actually present, and a correct negative result in only 97% of the cases in which the disease is not present. Furthermore, .008 of the entire population have this cancer. Determine whether the patient has Cancer or not using MAP hypothesis.
4. Explain Brute force Bayes Concept Learning.
5. What are Consistent Learners?
6. Discuss Maximum Likelihood and Least Square Error Hypothesis
7. Describe Maximum Likelihood Hypothesis for predicting probabilities.
8. Describe the concept of MDL. Obtain the equation for h_{MDL} .
9. Explain Naïve Bayes Classifier with an Example
10. What are Bayesian Belief nets? Where are they used?
11. Explain Bayesian belief network and conditional independence with example





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MODULE - 5

1. What are instance based learning? Explain key features and disadvantages of these methods.
2. Explain the K – nearest Neighbour algorithm for approximating a discrete – valued target function with pseudo code. Also explain the distance weighted KNN algorithm for discrete – valued target function.
3. Describe K-nearest Neighbour learning Algorithm for continues (real) valued target function. Also explain the distance weighted KNN algorithm for real – valued target function.
4. Discuss the major drawbacks of K-nearest Neighbour learning Algorithm and how it can be corrected.
5. Explain Locally Weighted Linear Regression.
6. Explain radial basis function
7. Explain CADET System using Case based reasoning.
8. What is Reinforcement Learning and explain Reinforcement learning problem with neat diagram.
9. Write Reinforcement learning problem characteristics.
10. Explain the Q function and Q Learning Algorithm assuming deterministic rewards and actions with example.

15.0 University Result

Examination	FCD	FC	SC	Fail	% Passing
Jan/Feb 2023	4	19	24	4	92
Jan/Feb 2022	15	14	14	00	100

Prepared by	Checked by		
 Dr. Mahesh Huddar	 Dr. Mahesh Huddar	 HOD	 Principal

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Subject Title	BIG DATA ANALYTICS	
Subject Code	18CS72	IA Marks
Number of Lecture Hrs / Week	04 L	Exam Marks
Total Number of Lecture Hrs	50	Exam Hours
CREDITS – 04		

FACULTY DETAILS:	
Name: Dr. K B Manwade	Designation: Professor
No. of times course taught: 03	Specialization: Computer Science and Engineering

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Computer Science and Engineering	VII	Machine Learning
02	Computer Science and Engineering	VII	Machine Learning Laboratory

2.0 Course Objectives

Students should learn to:

1. Understand fundamentals of Big Data analytics
2. Explore the Hadoop framework and Hadoop Distributed File system
3. Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data
4. Employ MapReduce programming model to process the big data
5. Understand various machine learning algorithms for Big Data Analytics, Web Mining and Social Network Analysis.

3.0 Course Outcomes


After studying this course, students will be able to

	Course Outcome	Cognitive Level	POs
C416.1	Understand fundamentals of Big Data analytics.	L2	1, 2, 3, 8, 10, 12
C416.2	Investigate Hadoop framework and Hadoop Distributed File system.	L2	1, 2, 3, 8, 10, 12
C416.3	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.	L2	1, 2, 3, 8, 10, 12
C416.4	Demonstrate the MapReduce programming model to process the big data along with Hadoop tools.	L2	1, 2, 3, 8, 10, 12
C416.5	Use Machine Learning algorithms for real world big data and analyze web contents and Social Networks to provide analytics with relevant visualization tools.	L2	1, 2, 3, 8, 10, 12
Total Hours of instruction			50

4.0 Course Content

Module – 1 **10 Hours**
 Introduction to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies.

Module – 2 **10 Hours**
 Introduction to Hadoop (T1): Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, Map Reduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools. Hadoop Distributed File System Basics (T2): HDFS Design Features, Components, HDFS User Commands. Essential Hadoop Tools (T2): Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase.

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Module – 3

10 Hours

NoSQL Big Data Management, MongoDB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases.

Module – 4

10 Hours

MapReduce, Hive and Pig: Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig.

Module – 5

10 Hours

Machine Learning Algorithms for Big Data Analytics: Introduction, Estimating the relationships, Outliers, Variances, Probability Distributions, and Correlations, Regression analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Itemsets and Association Rule Mining.
 Text, Web Content, Link, and Social Network Analytics: Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics:

5.0 Relevance to future subjects

Sl. No.	Semester	Subject	Topics
01	VIII	Academic Project	Hadoop installation and Data Analytics Concepts

6.0 Relevance to Real World

Sl. No.	Real World Mapping
01	Final year projects on analytics


7.0 Gap Analysis and Mitigation

Sl. No.	Delivery Type	Details
01	YouTube / NPTEL Videos	Hadoop Tutorials
02	YouTube / NPTEL Videos	Data Analytics Tutorials

8.0 Books Used and Recommended to Students

Text Books
1. Raj Kamal and Preeti Saxena, "Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning", McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966
2. Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop2 Ecosystem", 1 st Edition, Pearson Education, 2016. ISBN- 13: 978-9332570351
Reference Books
1. Tom White, "Hadoop: The Definitive Guide", 4 th Edition, O'Reilly Media, 2015.ISBN-13: 978- 9352130672
2. Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, "Professional Hadoop Solutions", 1 st Edition, Wrox Press, 2014ISBN-13: 978-8126551071
3. Eric Sammer, "Hadoop Operations: A Guide for Developers and Administrators", 1 st Edition, O'Reilly Media, 2012.ISBN-13: 978-9350239261
4. Arshdeep Bahga, Vijay Madiseti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577
Additional Study material & e-Books
1. Big Data Analytics by Parag Kulkarni, Sarang Joshi, Meta S. Brown

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

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Website and Internet Contents References

- https://www.tutorialspoint.com/big_data_analytics/
- <https://www.tutorialride.com/big-data-analytics/big-data-analytics-tutorial.htm>

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	Big Data Analytics, ISSN: 2058-6345	https://link.springer.com/journal/41044
2	Big Data Research, ISSN: 2214-5796	https://www.journals.elsevier.com/big-data-research

11.0 Examination Note

Internal Assessment: 30+10=40 Marks

30 marks –from internal assessment test

10 marks- from the assignments

Scheme of Evaluation for Internal Assessment (30 Marks)

- Internal Assessment test is conducted for 50 marks in the same pattern as that of the main examination. Average of all three Test marks will be taken and finally scale down to 30 marks.
- Assignment marks for each module is 25. Average of all 5 assignment marks will be taken and finally scale down to 10 marks.

Question Paper Pattern (IA):


- Two main questions to be set from syllabus covered up to IA tests.
- Student has to answer two full main questions and each question carries 25.
 - Q.No I or Q.No II =25 Marks
 - Q.No III or Q.No IV =25 Marks
 - Total =50 Marks**

Question Paper Pattern and instructions (Main Exam):

- The question paper will have TEN questions.
 - There will be TWO questions from each module.
 - Each question will have questions covering all the topics under a module.
 - The students will have to answer FIVE full questions, selecting ONE full question from each module.
- Max. Marks: 100 and each question carries 20 marks. Exam Duration: 3 Hrs.

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
1	1	Introduction to Big Data	20
	2	Scalability	
	3	Parallel Processing	
	4	Designing Data Architecture	
	5	Data Sources	
	6	Quality	
	7	Pre-Processing and Storing	
	8	Data Storage and Analysis	
	9	Big Data Analytics Applications	
	10	Case Studies	
2	11	Introduction to Hadoop	20
	12	Hadoop and its Ecosystem	
	13	Hadoop Distributed File System	
	14	MapReduce Framework and Programming Model	
	15	Hadoop Yarn, Hadoop Ecosystem Tools	
	16	HDFS Design Features, Components	
	17	HDFS User Commands	
	18	Using Apache Pig	
	19	Hive, Sqoop	

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3	20	Flume, Oozie, HBase	20
	21	NoSQL Big Data Management	
	22	Introduction MongoDB	
	23	Cassandra	
	24	NoSQL Data Store	
	25	NoSQL Data Architecture Patterns	
	26	NoSQL to Manage Big Data	
	27	Shared-Nothing Architecture for Big Data Tasks	
	28	MongoDB	
	29	Databases	
4	30	Cassandra Databases	20
	31	Introduction MapReduce operation	
	32	MapReduce Map Tasks	
	33	Reduce Tasks	
	34	MapReduce Execution	
	35	Composing MapReduce for Calculations	
	36	Composing MapReduce for Calculations	
	37	Algorithms	
	38	Hive	
	39	HiveQL	
5	40	Pig	20
	41	Introduction, Estimating the relationships	
	42	Outliers, Variances	
	43	Probability Distributions, and Correlations	
	44	Regression analysis, Finding Similar Items	
	45	Similarity of Sets and Collaborative Filtering	
	46	Frequent Itemsets and Association Rule Mining	
	47	Text mining, Web Mining	
	48	Web Content and Web Usage Analytics	
	49	Page Rank, Structure of Web and analyzing a Web Graph	
50	Social Network as Graphs and Social Network Analytics		

13.0 Assignments, Pop Quiz, Mini Project, Seminars

Sl. No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book / website / Paper
1	Assignment 1: University Questions on Module 1	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 1 of the syllabus	2	Individual Activity. Printed solution expected.	Book 1
2	Assignment 2: University Questions on Module 2	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 2 of the syllabus	4	Individual Activity. Printed solution expected.	Book 1
3	Assignment 3: University Questions on Module 3	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 3 of the syllabus	6	Individual Activity. Printed solution expected.	Book 2
4	Assignment 4: University Questions on Module 4	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 4 of the syllabus	8	Individual Activity. Printed solution expected.	Book 2
5	Assignment 5: University Questions on Module 5	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 5 of the syllabus	10	Individual Activity. Printed solution expected.	Book 2



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14.0

QUESTION BANK

MODULE – 1

- 1) Briefly explain HDFS components.
- 2) List and explain HDFS user commands.
- 3) Explain steps in running MapReduce programs.
- 4) What is Mapreduce Parallel dat a flow, explain.
- 5) Write WordCount program, compile and run in Haddop.
- 6) Define Big Data. Explain the Evolution of Big Data and their characteristics (Jan 2021)
- 7) What is grid computing? List and explain the features, drawbacks of grid computing(Jan 2021)
- 8) Discuss the functions of each of the five layers in Big Data architecture design(Jan 2021)
- 9) Illustrate the various phases involved in Big Data Analytics with neat diagram. (Jan 2021)
- 10) Discuss the evolution of big data. (March 2022)
- 11) Explain characteristics of big data. (March 2022)
- 12) With neat block diagram explain data architecture design. (March 2022)
- 13) Write notes on analytics scalability to big data and massively parallel platform. (March 2022)
- 14) Highlights big data analytics applications with one case study. (March 2022)

MODULE – 2

1. Explain the usage of Apache Pig and Apache Hive.
2. Explain how Apache Flume is used to acquire Data Streams.
3. Explain the usage of YARN distributed shell.
4. Explain how Hadoop services are managed by Apache Ambari.
5. Explain basic HDFS and YARN administration.
6. Illustrate the Hadoop core components with neat diagram(Jan 2021)
7. Discuss the Hadoop system and ecosystem components in four layers(Jan 2021)
8. Illustrate YARN based execution model and its functions With a neat diagram(Jan 2021)
9. Discuss the Apache sqoop import and export methods with neat diagram(Jan 2021)
10. What are the core components of hadoop? Explain in brief its each components. (March 2022)
11. Explain Hadoop distributed file system. (March 2022)
12. Define MapReduce framework and its function. (March 2022)
13. Write down the steps on the request to map reduce and the type of processes in map reduce. (March 2022)
14. Write short note on flume Hadoop tool. (March 2022)

MODULE – 3

1. Why organizations invest in business intelligence solutions? Are BI tools are more important than IT security solutions.
2. List three business intelligence applications in the hospitality industry.
3. What is the purpose of data warehousing.
4. What are the key elements of data warehousing. Describe each one of them.
5. How will the data warehouse evolve n the age of social media?
6. What is data mining? What are supervised and unsupervised learning techniques?
7. What is confusion matrix?
8. What are some of the most common data mining techniques?
9. What are the key requirements for a skilled data analyst?
10. Describe some key steps in data visualization.
11. What are the data visualization techniques? When would you use tables or graphs?
12. What are the key requirements for good visualization?
15. Discuss the NoSQL data stores and their characteristic features(Jan 2021)
16. Illustrate the key value pairs in data architectural patterns with an example(Jan 2021)
17. Discuss the functions of MangoDB query language and database commands(Jan 2021)
18. Illustrate the CQL commands and their functionality(Jan 2021)
19. Discuss characteristics of NOSQL data store along with the features of NOSQL transaction. (March 2022)
20. With neat diagram explain components of shared nothing architecture. (March 2022)
21. Define key-value pair with example. What are the advantages of key value pair store. (March 2022)
22. Write down the steps to provide client to read and write values using key value pairs. What are the typical use of key value pair. (March 2022)

MODULE – 4

1. What are decision trees? Why are the decision trees the most popular classification techniques?

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2. What are Gini's coefficient and information gain?
3. What is a regression model?
4. What is a scatter plot? How does it help?
5. What is a neural network? How does it work?
6. What makes a neural network versatile enough for supervised as well as non-supervised learning tasks?
7. What is unsupervised learning? When it is used?
8. What are association rules? How do they help?
23. Describe the MapReduce execution steps with neat diagram **(Jan 2021)**
24. Discuss the functions of Group By, partitioning and combining using one example for each **(Jan 2021)**
25. Illustrate main features and Architecture of Hive with neat diagram. **(Jan 2021)**
26. Discuss the pig Latin data types and examples **(Jan 2021)**
27. With neat diagram explain the process of map reduce when client submit a job. **(March 2022)**
28. Explain hive integration and work flow steps involved with the diagram. **(March 2022)**
29. Using HiveQL for create table for partition and add, rename, remove partition. **(March 2022)**
30. What is pig in big data? Explain the features of big data. **(March 2022)**


MODULE – 5

- i) Why is the text mining useful in the age of social media?
- ii) What is a Naïve-Bayes technique? What do Naïve and Bayes stand for?
- iii) What is a Support Vector Machine?
- iv) Explain the kernel method.
- v) What are the three types of web mining? Explain each of them.
- vi) What is clickstream analysis?
- vii) What are the primary issues in web mining?
- viii) What is a social network analysis? How is it different from other data mining techniques such as clustering or decision trees?
31. Discuss Analysis of Variances(ANOVA) and correlation indicators of linear relationship **(Jan 2021)**
32. Describe the regression analysis predict the value of the dependent variable in case of linear regression **(Jan 2021)**
33. Illustrate the various phases in text mining process pipeline **(Jan 2021)**
34. Describe the web content mining and three phases for web usage mining **(June 2021)**
35. In machine learning explain linear and nonlinear relationship with essential graphs. **(March 2022)**
36. Write the block diagram of text mining process and explain its phases. **(March 2022)**
37. Define multiple regression. Write down the examples involved in the forecasting and optimization in regression. **(March 2022)**
- 38) Explain the parameters in social graph network topology analysis using centralities and page ranks. **(March 2022)**

15.0 University Result

Examination	No. of Students	No. of Students passed	FCD	FC	SC	Fail	% Passing
March 2023							

Prepared by	Checked by		
			
Dr. K. B. Manwade	Dr. K. B. Manwade	HOD	Principal

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Subject Title	ADVANCED COMPUTER ARCHITECTURE		
Subject Code	18CS733	IA Marks	40
Number of Lecture Hrs / Week	3:0:0	Exam Marks	60
Total Number of Lecture Hrs	40	Exam Hours	03
CREDITS – 04			

FACULTY DETAILS:		
Name: Prof. N. K. Honnagoudar	Designation: Assistant Professor	Experience: 21
No. of times course taught: 05	Specialization: Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Computer Science and Engineering	IV	Computer Organization
02	Computer Science and Engineering	V	Operating system

2.0 Course Objectives


This course will enable students to

1. Describe computer architecture.
2. Measure the performance of architectures in terms of right parameters.
3. Summarize parallel architecture and the software used for them.

3.0 Course Outcomes

The student will be able to:

CO'S	Course Outcome	RBT Level	POs
C405.1	Explain the fundamentals of computer architecture.	L2	1,2,3,4,6,8,12
C405.2	Explain the basic concepts of Pipelining.	L2	1,2,3,4,6,8,12
C405.3	Explain Internal Data Forwarding, Software Interlocking, Hardware Score boarding, Hazard avoidance, Branch handling and Instruction issuing techniques.	L2	1,2,3,4,6,8,12
C405.4	Explain multi-processor and thread level parallelism.	L2	1,2,3,4,6,8,12
C405.5	Explain parallel programming model.	L2	1,2,3,4,6,8,12
Total Hours of instruction			40

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4.0 Course Content

Module – 1 Theory of Parallelism: Parallel Computer Models, The State of Computing, Multiprocessors and Multicomputer, Multi vector and SIMD Computers, PRAM and VLSI Models, Program and Network Properties, Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures, Principles of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws. for all algorithm or mechanism any one example is sufficient.	08Hours
Module – 2 Hardware Technologies1: Processors and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology for all algorithm or mechanism any one example is sufficient.	08Hours
Module – 3 Hardware Technologies2: Bus, Cache, and Shared Memory, Bus Systems, Cache Memory Organizations, Shared Memory Organizations, Sequential and Weak Consistency Models, Pipelining and Superscalar Techniques, Linear Pipeline Processors, Nonlinear Pipeline Processors. For all algorithm or mechanism any one example is sufficient.	08Hours
Module – 4 Parallel and Scalable Architectures: Multiprocessors and Multicomputer, Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Three Generations of Multicomputer, Message-Passing Mechanisms, Multi vector and SIMD Computers, Vector Processing Principles, Multi vector Multiprocessors, Compound Vector Processing, SIMD Computer Organizations (Upto 8.4), Scalable, Multithreaded, and Dataflow Architectures, Latency-Hiding Techniques, Principles of Multithreading, Fine-Grain Multicomputer, for all algorithm or mechanism any one example is sufficient.	08Hours
Module – 5 Software for parallel programming: Parallel Models, Languages, and Compilers, Parallel Programming Models, Parallel Languages and Compilers, Dependence Analysis of Data Arrays, Parallel Program Development and Environments, Synchronization and Multiprocessing Modes. Instruction and System Level Parallelism, Instruction Level Parallelism, Computer Architecture, Contents, Basic Design Issues, Problem Definition, Model of a Typical Processor, Compiler-detected Instruction Level Parallelism, Operand Forwarding, Reorder Buffer, Register Renaming, Tomasulo's Algorithm. for all algorithm or mechanism any one example is sufficient.	08Hours

5.0 Relevance to future subjects


Sl. No	Semester	Subject	Topics
01	VIII	Project work	Design and implementation of computer architectural models

6.0 Relevance to Real World

Sl. No	Real World Mapping
01	Advance computer architecture in Education: Slide Rocket, Data type, Amazon Web Services
02	Advance computer architecture: IBM

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Module I-Module V
02	NPTEL	NPTEL online course on Advanced computer Architecture

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8.0 Books Used and Recommended to Students

Text Books
1. Kai Hwang and Naresh Jotwani, Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability, McGraw Hill Education 3/e. 2015.
Reference Books
1. John L. Hennessy and David A. Patterson, Computer Architecture: A quantitative approach, 5th edition, Morgan Kaufmann Elsevier, 2013
Additional Study material & e-Books
1. Getting Started with computer architecture : https://studytm.files.wordpress.com/2014/03/hand-book-of-computer-architecture.pdf
2. Advance computer architecture , Moving IT Out of the Office: http://www.bcs.org/upload/pdf/advance-computer-architecture.pdf

9.0 Relevant Websites (Reputed Universities and Others) for Notes /Animation / Videos Recommended

Website and Internet Contents References
1. https://nptel.ac.in/courses
2. https://www.iitk.ac.in
3. https://www.coursera.org/lecture/advance-computer/introduction-to-advance-computer-concepts-par

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	Website
1	Journal of computer architecture - Springer	https://link.springer.com/journal
2.	IEEE Transaction on computer architecture	https://ieeexplore.ieee.org/xpl/aboutJournal.jsp?punumber=6245519#AimsScope

11.0 Examination Note

Internal Assessment: 30+10=40 Marks

30 marks –from internal assessment test

10 marks- from the assignments

Scheme of Evaluation for Internal Assessment (30 Marks)

a) Internal Assessment test is conducted for 50 marks in the same pattern as that of the main examination. Average of all three Test marks will be taken and finally scale down to 30 marks.

b) Assignment marks for each module is 25. Average of all 5 assignment marks will be taken and finally scale down to 10 marks.

Question Paper Pattern (IA):

5. Two main questions to be set from syllabus covered up to IA tests.

6. Student has to answer two full main questions and each question carries 25.

a. Q.No I or Q.No II =25 Marks

b. Q.No III or Q.No IV =25 Marks

c. **Total =50 Marks**

Question Paper Pattern and instructions (Main Exam):


9. The question paper will have TEN questions.

10. There will be TWO questions from each module.

11. Each question will have questions covering all the topics under a module.


12. The students will have to answer FIVE full questions, selecting ONE full question from each module.

Max. Marks: 100 and each question carries 20 marks. Exam Duration: 3 Hrs.

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12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
		PART - A	
MODULE 1	1	Theory of Parallelism: Parallel Computer Models,	20
	2	The State of Computing, Multiprocessors and Multicomputer	
	3	Multi vector and SIMD Computers, PRAM	
	4	VLSI Models, Program and Network Properties, Conditions of Parallelism,	
	5	Program Partitioning and Scheduling, Program Flow Mechanisms	
	6	System Interconnect Architectures, Principles of Scalable Performance	
	7	Performance Metrics and Measures, Parallel Processing Applications,	
	8	Speedup Performance Laws. for all algorithm or mechanism any one example is sufficient.	
MODULE 2	9	Hardware Technologies 1: Processors and Memory Hierarchy,	20
	10	Advanced Processor Technology	
	11	Superscalar	
	12	Vector Processors,	
	13	Memory Hierarchy Technology	
	14	Virtual Memory Technology	
	15	for all algorithm or mechanism any one example is sufficient.	
	16	for all algorithm or mechanism any one example is sufficient.	
MODULE 3	17	Hardware Technologies 2: Bus,	20
	18	Cache, and Shared Memory, Bus Systems	
	19	Cache Memory Organizations, Shared Memory Organizations	
	20	Sequential and Weak Consistency Models	
	21	Pipelining and Superscalar Techniques	
	22	Linear Pipeline Processors	
	23	Nonlinear Pipeline Processors	
	24	for all algorithm or mechanism any one example is sufficient.	
MODULE 4	25	Parallel and Scalable Architectures	20
	26	Multiprocessors and Multicomputer, Multiprocessor System	
	27	Interconnects, Cache Coherence and Synchronization Mechanisms	
	28	Three Generations of Multicomputer	
	29	Message-Passing Mechanisms, Multi vector and SIMD Computers, Vector Processing Principles	
	30	Multi vector Multiprocessors, Compound Vector Processing, SIMD Computer Organizations	
	31	Scalable, Multithreaded, and Dataflow Architectures, Latency-Hiding Techniques, Principles of Multithreading,	
	32	Fine-Grain Multicomputer, for all algorithm or mechanism any one example is sufficient.	
MODULE 5	33	Software for parallel programming: Parallel Models,	20
	34	Languages, and Compilers, Parallel Programming models	
	35	Parallel Languages and Compilers, Dependence Analysis of Data Arrays	
	36	Parallel Program Development and Environments, Synchronization and Multiprocessing Modes.	
	37	Instruction and System Level Parallelism, Instruction Level Parallelism, Computer Architecture, Contents,	
	38	Basic Design Issues, Problem Definition, Model of a Typical Processor, Compiler-detected Instruction Level Parallelism	
	39	Operand Forwarding, Reorder Buffer, Register Renaming, Tomasula's Algorithm	
	40	for all algorithm or mechanism any one example is sufficient.	

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13.0 Assignments, Pop Quiz, Mini Project, Seminars

Sl. No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: University Questions on basics of Theory of Parallelism	Students study the Topics and write the Answers. Get practice to solve university questions.	Module I of the syllabus	2	Individual Printed expected. Activity. solution	Text Book 1 & Website of the Reference list
2	Assignment 2: University Questions on Hardware Technologies.	Students study the Topics and write the Answers. Get practice to solve university questions.	Module II of the syllabus	4	Individual Printed expected. Activity. solution	Text Book 1 & Website of the Reference list
3	Assignment 3: University Questions on Bus, Cache, and Shared Memory	Students study the Topics and write the Answers. Get practice to solve university questions.	Module III of the syllabus	6	Individual Printed expected. Activity. solution	Text Book 1 & Website of the Reference list
4	Assignment 4: University Questions on Parallel and Scalable Architectures	Students study the Topics and write the Answers. Get practice to solve university questions.	Module IV of the syllabus	8	Individual Printed expected. Activity. solution	Text Book 1 & Website of the Reference list
5	Assignment 5: University Questions on Software for parallel programming	Students study the Topics and write the Answers. Get practice to solve university questions.	Module V of the syllabus	10	Individual Printed expected. Activity. solution	Text Book 1 & Website of the Reference list

14.0 QUESTION BANK

Module: 1

1. What is computer architecture explain briefly.
2. What is SIMD? briefly explain. (JAN19/SEPT21)
3. Compare programming partitioning and program flow mechanisms? (JAN 2018/AUG2020)
4. What is speed up explain Amdahl's law. (JAN 2017/SEPT2019/JAN2020)
5. Explain Scalability Analysis and Approaches. (JAN 2017/AUG2019)
6. Explain about evolution of computer architecture. (JAN 2016/AUG2018)
7. Explain about Two NUMA models for multiprocessor systems. (JAN 2018/AUG2020)
8. Explain about detection of parallelism in a program using Bernstein, conditions. (JAN 2018/SEPT2020)
9. Explain about mismatch between software parallelism and Hardware parallelism. (JAN 2016/AUG2017)
10. Describe static multiprocessor scheduling. (JAN 2018/AUG2020)
11. Comparison of dataflow and control flow computers.
12. Explain about scalability of matrix multiplication algorithms (JAN 2015/AUG2019)
13. Explain about Amdahl's law for affixed workload.



Module: 2

1. What are the different hardware technologies? Explain briefly. (JAN 2016/AUG2018)
2. Explain Memory Hierarchy with neat diagram?
3. Explain different advanced technologies and Superscalar operation? (JAN 2017/AUG2018)
4. Explain Vector Processors & Virtual Memory Technology? (JAN 2016/AUG2021)
5. Design a space of processor.
6. Explain characteristic of a typical CISC and RISC architectures. (JAN 2019/AUG2020)
7. Explain about digital equipment VAX8600 processor. (JAN 2017/AUG2018)
8. Explain about i860 processor architecture. (JAN 2016/AUG2018)
9. Explain about superscalar and vector processors. (JAN 2017/AUG2020)
10. Explain VLIW architecture. (JAN 2017/AUG2019)
11. Explain about hierarchical memory technology.
12. Explain about virtual memory technology. (JAN 2016/AUG2019)
13. Explain page replacement policies. (JAN 2017/AUG2019)

Module: 3

1. What is Shared Memory organization explain briefly. (JAN 2016/AUG2018)
2. Explain Cache Memory Organizations. (JAN 2017/AUG2021)
3. Compare Sequential and Weak Consistency Models? (JAN 2017/AUG2019)
4. Write a short note on Pipelining and Superscalar Techniques. (JAN 2017/AUG2019)
5. Explain Arithmetic Pipeline Design with diagram. (JAN 2016/AUG2018)
6. Explain about Backplane bus architecture.
7. Explain about cache addressing models. (JAN 2017/AUG2021)
8. Explain about pipelined memory access.
9. Describe event ordering in three processing system. (JAN 2017/AUG2019)
10. Explain about sequential consistency model. (JAN 2019/AUG2020)
11. Explain about Weak consistency model.
12. Comparison of memory models. (JAN 2017/AUG2019)
13. Brief notes on TSO weak consistency.

Module: 4

1. Difference between Multiprocessors and Multi computers. (JAN 2016/AUG2018)
2. What is Cache Coherence explain briefly. (JAN 2017/AUG2020)
3. What is Compound Vector Processing explain.
4. Explain Multithreaded, and Dataflow Architectures. (JAN 2016/AUG2019)
5. Explain different Multithreading techniques. (JAN 2017/AUG2019)
6. Explain about multistage and combining networks. (JAN 2016/AUG2020)
7. Describe processor migration and I/O.
8. Explain the generations of multicomputer. (JAN 2017/AUG2019)
9. Explain vector processing principles.
10. Describe vector access memory schemes. (JAN 2019/AUG2021)
11. Describe S-access memory organization.
12. Explain architecture design goals of multi vector multiprocessors. (JAN 2017/AUG2019)
13. Explain stardent 3000 system architecture.

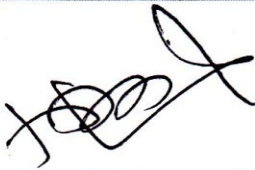



Module: 5


1. Explain different Languages, and Compilers for parallel programming. (JAN 2017/AUG2021)
2. Explain Parallel Program Development and Environments. (JAN 2017/AUG2019)
3. Explain Instruction and System Level Parallelism. (JAN 2017/AUG2019)
4. Write a short note on Register Renaming and Tomasulo's Algorithm? (JAN 2016/AUG2021)
5. How to Exploit Instruction Level Parallelism and Thread Level Parallelism? (JAN 2017/AUG2020)
6. Explain about parallel programming models. (JAN 2017/AUG2019)
7. Explain shared variable communication model. (JAN 2016/AUG2018)
8. Explain message passing model.
9. Explain data parallel model. (JAN 2017/AUG2019)
10. Explain parallel languages and compilers.
11. Explain subscript types in a loop computation. (JAN 2016/AUG2018)
12. Describe categorized dependence tests. (JAN 2017/AUG2019)
13. Explain code optimization and scheduling.
14. Explain about instruction and system level parallelism.



15.0 University Result

Examination	S+	S	A	B	C	D	E	Fail	% Passing
	FCD			FC	SC			Fail	
JAN-2022		11		18		14		00	100
JAN-2023		24		14		13		00	100

Prepared by	Checked by		
			
Prof N. K. Honnagoudar	Prof N. K. Honnagoudar	HOD	Principal

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			Academic
			Course Plan
			2023-24 ODD

Subject Title	CRYPTOGRAPHY		
Subject Code	18CS744	IA Marks	40
Number of Lecture Hrs / Week	3:0:0	Exam Marks	60
Total Number of Lecture Hrs	40	Exam Hours	03
CREDITS – 03			

FACULTY DETAILS:

Name: Prof. Aruna A. Daptardar	Designation: Assistant Professor	Experience: 16.5 Years
No. of times course taught: 03		Specialization: Computer Science and Engineering

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Computer Science and Engineering	V	Computer Networks

2.0 Course Objectives

This course will enable students to

1. Define cryptography and its principles
2. Explain Cryptography algorithms
3. Illustrate Public and Private key cryptography
4. Explain Key management, distribution and certification
5. Explain authentication protocols
6. Tell about IPsec

3.0 Course Outcomes

After studying this course, students will be able to

CO	Course Outcome	Cognitive Level	POs
C411.1	Define and Explain cryptography, its principles and algorithms.	L2	PO1-PO3, PO8, PO10
C411.2	Illustrate Public and Private key cryptography	L2	PO1-PO3, PO8, PO10
C411.3	Explain Key management, distribution and certification	L2	PO1-PO3, PO8, PO10
C411.4	Explain authentication protocols	L2	PO1-PO3, PO8, PO10
C411.5	Explain IP Security.	L2	PO1-PO3, PO8, PO10
Total Hours of instruction		40	

4.0 Course Content

Module 1

8 Hours

Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad. **Block Ciphers and the data encryption standard:** Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm **Textbook 1: Ch. 2.1,2.2, Ch. 3**



Module 2

8 Hours

Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA.

Other Public-Key Cryptosystems: Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems **Textbook 1: Ch. 9, Ch. 10.1, 10.2**

Module 3

8 Hours

Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Z_p , elliptic curves over $GF(2^m)$, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates. **Textbook 1: Ch. 10.3-10.5, Ch.14.1 to 14.3**

Module 4

8 Hours

X-509 certificates. Certificates, X-509 version 3, public key infrastructure. **User Authentication:** Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation, Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication. **Electronic Mail Security:** Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. **Textbook 1: Ch. 14.4, Ch. 15.1 to 15.4, Ch.19**

Module 5

8 Hours

IP Security: IP Security overview, applications of IPsec, benefits of IPsec, Routing 08 applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service

Transport and tunnel modes, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits.

Textbook 1: Ch. 20.1 to 20.3

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VII	Project work	Academics Project
01	VIII	Seminar	Academic Seminars

6.0 Relevance to Real World

SL.No.	Real World Mapping
01	Development of final year project

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	https://www.tutorialspoint.com/cryptography/index.htm
02	NPTEL	Cryptography



8.0 Books Used and Recommended to Students

Text Books
1. William Stallings: Cryptography and Network Security, Pearson 6 th Edition.
Reference Books
1. V K Pachghare: Cryptography and Information Security, PHI 2 nd Edition.

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References
1. http://uru.ac.in/uruonlinelibrary/Cyber_Security

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	Website
1	CSI communications	www.csi-india.org

11.0 Examination Note

Internal Assessment: 30+10=40 Marks

- 30 marks –from internal assessment test
- 10 marks- from the assignments

Scheme of Evaluation for Internal Assessment (30 Marks)

- a) Internal Assessment test is conducted for 50 marks in the same pattern as that of the main examination. Average of all three Test marks will be taken and finally scale down to 30 marks.
- b) Assignment marks for each module is 25. Average of all 5 assignment marks will be taken and finally scale down to 10 marks.

Question Paper Pattern (IA):

- 7. Two main questions to be set from syllabus covered up to IA tests.
- 8. Student has to answer two full main questions and each question carries 25.
 - a. Q.No I or Q.No II =25 Marks
 - b. Q.No III or Q.No IV =25 Marks
 - c. **Total =50 Marks**


Question Paper Pattern and instructions (Main Exam):

- 13. The question paper will have TEN questions.
 - 14. There will be TWO questions from each module.
 - 15. Each question will have questions covering all the topics under a module.
 - 16. The students will have to answer FIVE full questions, selecting ONE full question from each module.
- Max. Marks: 100 and each question carries 20 marks. Exam Duration: 3 Hrs.

12.0 Course Delivery Plan



Module	Lecture No.	Content of Lecturer	% of Portion
1	1	Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack	20
	2	Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher	
	3	Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad.	
	4	Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure	
	5	the feistel Cipher, The data encryption standard, DES encryption, DES decryption	
	6	A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys,	
	7	the nature of the DES algorithm, timing attacks, Block cipher design principles,	
	8	number of rounds, design of function F, key schedule algorithm	
2	9	Public-Key Cryptography and RSA: Principles of public-key cryptosystems.	20
	10	Public-key cryptosystems, Applications for public-key cryptosystems	
	11	Requirements for public-key cryptosystems. public-key cryptanalysis.	
	12	The RSA algorithm, description of the algorithm	
	13	computational aspects, the security of RSA.	
	14	Other Public-Key Cryptosystems: Diffie-hellman key exchange, The algorithm,	
	15	key exchange protocols, man in the middle attack	
	16	Elgamal Cryptographic systems	
3	17	Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Z_p	20
	18	Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.	
	19	Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario	
	20	Hierarchical key control, session key lifetime, a transparent key control scheme	
	21	Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption	
	22	simple secret key distribution, secret key distribution with confidentiality and authentication	
	23	A hybrid scheme, distribution of public keys, public announcement of public keys	
	24	publicly available directory, public key authority, public keys certificates.	
4	25	X-509 certificates. Certificates, X-509 version 3, public key infrastructure	20
	26	User Authentication: Remote user Authentication principles, Mutual Authentication	
	27	one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication	
	28	Kerberos, Motivation, Kerberos version 4, Kerberos version 5,	
	29	Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication.	
	30	Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322	
	31	Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services	
	32	Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow	
5	33	IP Security: IP Security overview, applications of IPsec, benefits of IPsec	20
	34	Routing applications, IPsec documents, IPsec services, transport and tunnel modes,	
	35	IP Security policy, Security associations, Security associations database, Security policy database	
	36	IP traffic processing, Encapsulating Security payload, ESP format,	
	37	encryption and authentication algorithms, Padding, Anti replay service,	
	38	Transport and tunnel modes, combining security associations, authentication plus confidentiality,	
	39	basic combinations of security associations, internet key exchange,	
	40	key determinations protocol, header and payload formats, cryptographic suits.	

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		Academic
		Course Plan
		2023-24 ODD

13.0 Assignments, Pop Quiz, Mini Project, Seminars

Sl. No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: Some important University Questions on Module one.	Students study the Topics and write the Answers. Get practice to solve questions	Module one of the syllabus	3	Individual Activity. Witten solutions expected.	Text book
2	Assignment 2: Some important University Questions on Module two	Students study the Topics and write the Answers. Get practice to solve questions	Module two of the syllabus	6	Individual Activity. Witten solutions expected.	Text book
3	Assignment 3: Some important University Questions on module three.	Students study the Topics and write the Answers. Get practice to solve questions	Module three of the syllabus	9	Individual Activity. Witten solutions expected.	Text book
4	Assignment 4: Some important University Questions on and comprehensive questions module four.	Students study the Topics and write the Answers. Get practice to solve questions	Module four of the syllabus	11	Group Activity power point presentation	Text book
5	Assignment 5: Some important University Questions on and comprehensive questions module five.	Students study the Topics and write the Answers. Get practice to solve questions	Module five of the syllabus	13	Group Activity power point presentation	Text book

14.0 QUESTION BANK

MODULE - 1

- Write a note on Elementary substitution ciphers.
- Explain Public key cryptography and Private Key cryptography.
- With neat diagram, explain Fiestel structure.
- What is encryption? Discuss the symmetric & asymmetric encryption methods.
- Explain the Hill Cipher with an example.
- Write a note on Timing Attacks.
- Explain with an example, the One-Time Pad.
- Draw the simplified model of Symmetric encryption and explain it.(Feb-2022)
- With a neat schematic, explain DES encryption algorithm.(Feb-2022)
- Encrypt the plaintext "ELECTRONICS" using the Playfair cipher with a key "INDIA".(Feb-2022)
- Explain the Ceaser Cipher with an example.(Feb-2022).
- Distinguish between Confusion and Diffusion Ciphers and Block and Stream Ciphers. (Feb-2022)

MODULE - 2

- Explain the working of Diffie-Hellman key exchange Algorithm.(Feb-2022)
- Explain key generation in RSA algorithm.
- Explain Man-in-the middle attack on Diffie-Hellman key exchange.
- Write a note on EL Gamal Cryptosystem.(Feb-2022)
- Explain the concept of Elleptic Curve Cryptography.
- In a RSA system, it is given $p=3$ and $q=11$, $l=7$ and $M=5$. Find the cipher text 'C' and also find message 'm' from decryption.(Feb-2022)
- Explain why does RSA work?
- With a neat diagram, explain the six ingredients of public key cryptography.(Feb-2022)
- With a relevant diagram, explain the Authentication and Secrecy of the public key cryptosystem.(Feb-2022)
- Apply the Diffie-Hellman Key Exchange algorithm for $q=71$, its primitive root $a=7$. A's private key is 5 and B's private key is 12. Find i) A's public key ii) B's public key iii) Shared Secret key (Feb-2022)



MODULE - 3

1. Explain the Pseudorandom number generation based on an asymmetric cipher.
2. Explain the Pseudorandom number generation based on RSA. (Feb-2022)
3. Explain a Key Distribution Scenario. (Feb-2022)
4. Explain the Symmetric key distribution using Symmetric Encryption.
5. Explain the Symmetric key distribution using Asymmetric Encryption.
6. Explain the Secret key distribution using with Confidentiality and Authentication.(Feb-2022)
7. Explain Public key Authority and public key certificates techniques for distribution of public keys. (Feb-2022)
8. Explain the distribution of public keys.

MODULE - 4

1. Explain the different authentication procedures in X.509 certificate.
2. Write the summary of Kerberos version 5 message exchange.
3. With a neat diagram, explain the network security model.
4. List out the differences between Kerberos version 4 & 5.
5. Describe briefly the various security attacks & specific security mechanisms covered by X.800.
6. With the help of a neat diagram, explain the general format of X.509 public key certificate. (Feb-2022)
7. Explain the Kerberos version 4 message exchanges. (Feb-2022)
8. What are passive & active security attacks?
9. Describe simple & more secure authentication dialogue, along with hypothetical dialogue.
10. With a neat diagram, explain the digital signature service provided by PGP.
11. Explain the different MIME content types. With flow chart, explain the process of transmission & reception of PGP messages.
12. Describe S/MIME functionality.
13. Describe the S/MIME certificate processing method.
14. Describe the steps involved in providing authentication & confidentiality by PGP.
15. Discuss the limitations of SMTP/RFC 822 & how MIME overcomes these limitations.
16. Explain the PGP message generation & reception processes.
17. Explain how the PGP provides the following services with a schematic diagram: (Feb-2022)
 - i) Authentication
 - ii) Confidentiality
18. What is meant by S/MIME? List & explain various functions provided in S/MIME.
19. With the relevant diagram, explain the DKIM functional flow.(Feb-2022)
20. Describe the various header fields defined in MIME.(Feb-2022)

MODULE – 5


1. Explain the format of ESP packet in IP security. (Feb-2022)
2. Why does ESP include a padding field?
3. Give an example of an aggressive Oakley key.
4. Give the general structure of IPSec authentication header. Also explain the anti-replay attack.
5. With neat diagrams, discuss the basic combinations of security associations.
6. Describe the SA parameters & SA selectors in detail.
7. Describe Oakley Key determination protocol.
8. Describe the features of IPSec.
9. What is security association? Briefly explain the SA parameters.
10. Describe the transport & tunnel modes of IPSec AH header.
11. Why do you need IP level security? Explain the benefits & applications of IPSec.
12. What are transport & tunnel modes of operations in ESP?
13. Draw a diagram to illustrate IP security scenario and also explain the benefits of IPSec.(Feb-2022)
14. List the important features of IKE Key Determination Algorithm.(Feb-2022)
15. Draw and explain the IP traffic processing model for inbound and outbound packets.(Feb-2022)
16. With relevant diagram, describe IKEheader and payload format. (Feb-2022)



15.0 University Result

Examination	FCD	FC	SC	% Passing
Feb-2022	12	20	11	100
Feb-2023	12	24	15	100

Prepared by	Checked by		
Prof. Aruna A. Daptardar	Prof. S. V. Manjaragi	HOD	Principal

	S J P N Trust's		Dept. of CSE
	Hirasugar Institute of Technology, Nidasoshi		Academic
	<i>Inculcating Values, Promoting Prosperity</i>		Course Plan
	Approved by AICTE, New Delhi, Permanently Affiliated to VTU, Belagavi Recognized under 2(f) & 12B of UGC Act, 1956 Accredited at 'A' Grade by NAAC & Programmes Accredited by NBA: CSE & ECE		2023-24 ODD

Subject Title	ENERGY AND ENVIRONMENT		
Subject Code	18ME751	IA Marks	40
No of Lecture Hrs + Tutorial Hrs / Week	03	Exam Marks	60
Total No of Lecture + Tutorial Hrs	40	Exam Hours	03
CREDITS – 03			

FACULTY DETAILS:

Name: Dr. M. M. Shivashimpi	Designation: Associate Professor	Experience: 16 Years
No. of times course taught: 02	Specialization: Thermal Power Engineering	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
1	Common to all	I/II	Chemistry
2	Common to all	I/II	Physics
3	Common to all	V	Environmental Studies

2.0 Course Objectives

1. To understand the fundamentals of energy sources, energy use, energy efficiency, and resulting environmental implications of various energy supplies.
2. To learn about methods of energy storage, energy management and economic analysis
3. To understand the causes and remedies related to social issues like global warming, ozone layer depletion, climate change etc.
4. To understand environment and its ecosystems.
5. To introduce various aspects of environmental pollution and its control. To introduce various acts related to prevention and control of pollution of water and air, forest protection act, wild life protection act etc.

3.0 Course Outcomes

The student, after successful completion of the course, will be able to

CO	Course Outcome	RBT level	POs
C413.1	Summarize the basic concepts of energy, its distribution and general Scenario.	L1,L2	PO1, PO2, PO3, PO4, PO6, PO7, PO8, PO9, PO12
C413.2	Explain different energy storage systems, energy management, audit and economic analysis.	L1, L2, L3	PO1, PO2, PO3, PO4, PO6, PO7, PO8, PO9, PO12
C413.3	Summarize the environment eco system and its need for awareness.	L1,L2	PO1, PO2, PO3, PO4, PO6, PO7, PO8, PO9, PO12
C413.4	Identify the various types of environment pollution and their effects.	L1,L2	PO1, PO2, PO3, PO4, PO6, PO7, PO8, PO9, PO12
C413.5	Discuss the social issues of the environment with associated acts.	L1,L2	PO1, PO2, PO3, PO4, PO6, PO7, PO8, PO9, PO12
Total Hours of instruction		40	

4.0 Course Content

Module-1: Basic Introduction to Energy: Energy and power, forms of energy, primary energy sources, energy flows, world energy production and consumption, Key energy trends in India: Demand, Electricity, Access to modern energy, Energy production and trade, Factors affecting India's energy development: Economy and demographics Policy and institutional framework, Energy prices and affordability, Social and environmental aspects, Investment. **(8 Hours)**



Module-2: Energy storage systems: Thermal energy storage methods, Energy saving, Thermal energy storage systems Energy Management: Principles of Energy Management, Energy demand estimation, Energy pricing Energy Audit: Purpose, Methodology with respect to process Industries, Characteristic method employed in Certain Energy Intensive Industries. **(8 Hours)**

Module-3: Environment: Introduction, Multidisciplinary nature of environmental studies- Definition, scope and importance, Need for public awareness. Ecosystem: Concept, Energy flow, Structure and function of an ecosystem. Food chains, food webs and ecological pyramids, Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems, Ecological succession. **(8 Hours)**

Module-4: Environmental Pollution: Definition, Cause, effects and control measures of - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards, Solid waste Management, Disaster management Role of an individual in prevention of pollution, Pollution case studies. **(8 Hours)**

Module-5: Social Issues and the Environment: Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation. Group assignments: Assignments related to e-waste management; Municipal solid waste management; Air pollution control systems; Water treatment systems; Wastewater treatment plants; Solar heating systems; Solar power plants; Thermal power plants; Hydroelectric power plants; Bio-fuels; Environmental status assessments; Energy status assessments etc. **(8 Hours)**

5.0 Relevance to future subjects/Career

Sl. No	Semester	Subject	Topics / Relevance
01	VII & VIII	Project Phase-1 & Pahse-2	All modules
02	After graduation	Energy and Pollution Analysis and resolving related problems	All modules

6.0 Relevance to Real World

SL. No	Real World Mapping
01	Electrical Engineering and Automobile Engineering
02	Power plant engineering, thermal power plant
03	Environmental Science

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	nptel.ac.in	E- Learning
02	VTU, E- learning	E- Learning
03	Open courseware	E- Learning

8.0 Books Used and Recommended to Students

Text Books
1. Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education by University grant commission and Bharathi Vidyapeeth Institute of environment education and Research ,Pune
2. De, B. K., Energy Management audit & Conservation, 2nd Edition, Vrinda Publication, 2010.
Reference Books
1. Turner, W. C., Doty, S. and Truner, W. C., Energy Management Hand book, 7th edition, Fairmont Press, 2009.
2. Murphy, W. R., Energy Management, Elsevier, 2007.
3. Smith, C. B., Energy Management Principles, Pergamum, 2007
4. Environment pollution control Engineering by C S rao, New Age International, 2006, reprint 2015, 2 nd edition
5. Environmental studies, by Benny Joseph, Tata McGraw Hill, 2008, 2nd edition.



Additional Study material & e-Books

- Nptel.ac.in
- VTU, E- learning
- India Energy Outlook 2015(www.iea.org/.../IndiaEnergyOutlook_WEO2015.pdf)
- Open courseware

9.0

Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References

1. <http://www.nptel.ac.in>
2. www.iea.org

10.0

Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	Elsevier	https://www.journals.elsevier.com/renewable-energy
2	Environmental Sciences Journals	https://www.omicsonline.org/environmental-sciences-journals

11.0

Examination Note

Internal Assessment: 40 Marks

Theoretical aspects as well as relevant sketches should be drawn neatly for questions asked in Internal Assessments

Scheme of Evaluation for Internal Assessment

Internal Assessment test in the same pattern as that of the main examination (Better of the two Tests):40marks.

SCHEME OF EXAMINATION:

- There are five modules two questions from each module
- Student has to answer any five question choosing at least one questions from each module.
- Max. Marks: 60Marks

12.0

Course Delivery Plan

Module No.	Lecture No.	Content of Lecture	% of Portion
1		Basic Introduction to Energy:	20
	1	Energy and power, forms of energy, primary energy sources	
	2	Energy flows, world energy production and consumption	
	4	Key energy trends in India: Demand	
	5	Electricity, Access to modern energy,	
	6	Energy production and trade, Factors affecting India's energy development	
	7	Economy and demographics Policy and institutional framework	
	8	Energy prices and affordability, Social and environmental aspects, Investment	
2		Energy storage systems, Energy Management, Energy Audit, Economic Analysis	20
	1	Thermal energy storage methods,	
	2	Energy saving, Thermal energy, storage systems	
	3	Principles of Energy Management, Energy demand.	
	4	Energy estimation, Energy pricing, Energy Audit: Purpose	
	5	Methodology with respect to process Industries,	
	6	Characteristic method employed in Certain Energy Intensive Industries	
	7	Economic Analysis: Scope	
8	Characterization of an Investment Project		



3	Environment, Ecosystem:		20
	1	Environment: Introduction, Multidisciplinary nature of environmental studies- Definition, scope and importance.	
	2	Need for public awareness.	
	3	Ecosystem: Concept, Energy flow Structure and function of an ecosystem.	
	4	Food chains, food webs and ecological pyramids	
	5	Forest ecosystem, Grassland ecosystem,	
	6	Desert ecosystem and Aquatic ecosystems,	
	7	Desert ecosystem and Aquatic ecosystems	
	8	Ecological succession	
4	Environmental Pollution:		20
	1	Environmental Pollution definition, Cause and effects	
	2	Control measures of - Air pollution,	
	3	Water pollution, Soil pollution,	
	4	Marine pollution, Noise pollution.	
	5	Thermal pollution and Nuclear hazards ,	
	6	Solid waste Management, Disaster management	
	7	Role of an individual in prevention of pollution	
	8	Pollution case studies	
5	Social Issues and the Environment:		20
	1	Climate change, global warming, acid rain, ozone layer depletion	
	2	Nuclear accidents and holocaust. Case Studies.	
	3	Wasteland reclamation, Consumerism and waste products	
	4	Environment Protection Act	
	5	Air (Prevention and Control of Pollution) Act	
	6	Water (Prevention and control of Pollution) Act, Wildlife Protection Act,	
	7	Forest Conservation Act,	
	8	Issues involved in enforcement of environmental legislation	

13.0 Assignments, Pop Quiz, Mini Project, Seminars

Sl. No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: University Questions	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 1 syllabus	3	Individual Activity and submission of hard copy.	Book 1 and all the reference book
2	Assignment 2: University Questions	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 2 syllabus	6	Individual Activity and submission of hard copy.	Book 1 and all the reference book
3	Assignment 3: University Questions	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 3 syllabus	9	Individual Activity and submission of hard copy.	Book 1 and all the reference book
4	Assignment 3: University Questions	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 4 syllabus	12	Individual Activity and submission of hard copy.	Book 1 and all the reference book
5	Assignment 3: University Questions	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 5 syllabus	15	Individual Activity and submission of hard copy.	Book 1 and all the reference book

14.0 QUESTION BANK

Sl. No	Questions
Module-I	1. Interpret World Energy Scenario with respect to production and consumption using relevant statistics 2. Define Energy and Power. Differentiate the same. 3. Outline the factors that affect India's energy development. 4. Explain the various key energy trends in India. 5. With relevant statistics, enumerate the primary energy production trend for India.



Module-II	<ol style="list-style-type: none"> 1. Explain in the detail the various phases of energy audit methodology. 2. List the various thermal energy storage methods. Explain sensible heat and latent heat storage methods. 3. Define Energy audit. Explain the need for energy audit. 4. Write a short note on energy demand estimation. 5. Calculate the cost of generation per kWh for a power station having the following data: Installed capacity of the plant = 200 MW , Capital cost = Rs 400 crores ,Rate of interest and depreciation = 12% , Annual cost of fuel, salaries and taxation = Rs 5 crores Load factor = 50% Also estimate the saving in cost per kWh if the annual load factor is raised to 60%. 6. Explain in the detail the various phases of energy audit methodology 7. Elaborate the benefits of thermal energy storage.
Module-III	<ol style="list-style-type: none"> 1. What is an ecosystem? Discuss forest ecosystem. Explain how conservation of forest can be done. 2. Discuss how oxygen cycle is utilized in the ecosystem. 3. Write a short note on (i) ecological succession (ii) food chain, food web and ecological pyramid. 4. Elaborate how the nitrogen cycle ecosystem operates. 5. Enumerate the utilization of carbon in ecosystem. 6. Describe grassland ecosystem. What are its types? How conservation of grassland can be made 7. Discuss how oxygen cycle is utilized in the ecosystem 8. Define Environment. Mention its scope. Discuss the need for public awareness
Module-IV	<ol style="list-style-type: none"> 1. Discuss briefly the causes, effects and control measures of air pollution. 2. Discuss Solid Waste Management techniques. 3. Elaborate the causes, effects and control measures of (i) Soil Pollution (ii) Noise Pollution (iii) Thermal Pollution 4. Enumerate the role of an individual in prevention of pollution. 5. Enumerate the water pollution causes and its effects. Mention the control measures that can be initiated for mitigating the same. 6. Discuss any two case studies related to pollution of environment in detail. 7. Elaborate the causes, effects and control measures of (i) Soil Pollution (ii) Noise Pollution (iii) Thermal Pollution 8. Discuss Solid Waste Management techniques.
Module-V	<ol style="list-style-type: none"> 1. What is acid rain? What are its effects? 2. Explain the salient features of Air Pollution act. 3. Explain about Environment Impact Assessment (EIA). 4. Discuss (i) Wildlife Protection act (ii) Forest Conservation act 5. Write a note on ozone layer depletion. 6. Express the need for reclaiming the wasteland and its development 7. What are the regulations governing water pollution prevention act? 8. Enumerate the impact of global warming on our mother nature.

15.0 University Result

Year	S, A, B (FCD)	C (FC)	C,D,E (SC)	%age of passing
January / February 2023 (CSE)	41	05	05	100
January / February 2023 (ECE)	25	03	01	100
January / February 2023 (EEE)	01	00	00	100

Prepared by	Checked by		
Dr. M. M. Shivashimpi	Dr. K. M. Akkoli	HOD	Principal



Subject Title	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LABORATORY		
Subject Code	18CSL76	IA Marks	40
Number of Lecture Hrs / Week	0:0:2	Exam Marks	60
Total Number of Lecture Hrs	40	Exam Hours	03
CREDITS – 02			

FACULTY DETAILS:

Name: Dr. Mahesh G. Huddar	Designation: Associate Professor	Experience: 14 Years
No. of times course taught: 06	Specialization: Computer Science and Engineering	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Computer Science and Engineering	I/II	Programming in C and Data Structures
02	Computer Science and Engineering	VI	Application Development using

2.0 Course Objectives

This course will enable students to

1. Implement and evaluate AI and ML algorithms in and Python programming language.

3.0 Course Outcomes


Having successfully completed this course, the student will be able to:

CO	Course Outcome	Cognitive Level	POs
C412.1	Implement and demonstrate AI and ML algorithms.	L2	PO1-PO5, PO8- PO10, PO12
C412.2	Evaluate different algorithms.	L3	PO1-PO5, PO8- PO10, PO12
Total Hours of instruction			40

4.0 Course Content

PART – A

1.	Implement A* Search algorithm.
2.	Implement AO* Search algorithm.
3.	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
4.	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
5.	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
6.	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
7.	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
8.	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
9.	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs

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		Academic
		Course Plan
		2023-24 ODD

5.0 Relevance to future subjects

Sl. No.	Semester	Subject	Topics
01	VII	Final year projects	Classification, Regression and Clustering Algorithms

6.0 Relevance to Real World

Sl. No.	Real World Mapping
01	Can become data scientist
02	Can be used to solve real world problems

7.0 Gap Analysis and Mitigation

Sl. No.	Delivery Type	Details
01	YouTube Videos	Machine Learning Videos

8.0 Books Used and Recommended to Students

Additional Reference	
1.	Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.
2.	Pattern Recognition and Machine Learning, Bishop, Christopher, Springer nature publications
3.	Hands-On Machine Learning with Scikit-Learn and TensorFlow, Concepts, Tools, and Techniques to Build Intelligent Systems, Aurélien Géron, O'Reilly Media, March 2017.

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References	
1.	https://www.kaggle.com/kanncaa1/machine-learning-tutorial-for-beginners
2.	https://www.toptal.com/machine-learning/machine-learning-theory-an-introductory-primer
3.	https://pythonprogramming.net/machine-learning-tutorial-python-introduction/
4.	https://machinelearningmastery.com/start-here/
5.	https://www.tutorialspoint.com/mahout/mahout_machine_learning.htm

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	Website
1	Machine Learning	https://www.springer.com/computer/ai/journal/10994
2	Artificial Intelligence an International Journal	https://www.journals.elsevier.com/artificial-intelligence

11.0 Examination Note

Conduction of Practical Examination:

Experiment distribution

- For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
- For laboratories having PART A and PART B: Students are allowed to pick one experiment from

PART A and one experiment from PART B, with equal opportunity.

- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.



- Marks Distribution (*Courseed to change in accordance with university regulations*)
 - a. For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
 - b. For laboratories having PART A and PART B
 - i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
 - ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

12.0 Course Delivery Plan

Expt. No.	Lab. No.	Content of Experiment	% of Portion
1	1	Implement A* Search algorithm.	11
2	2	Implement AO* Search algorithm.	11
3	3	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.	11
4	4	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	11
5	5	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.	11
6	6	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.	11
7	7	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.	11
8	8	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.	11
9	9	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs	11

13.0 QUESTION BANK

1. What is machine learning?
2. Explain Find-S algorithm.
3. What is the difference between supervised and unsupervised machine learning?
4. How is KNN different from k-means clustering?
5. What is Bayes' Theorem? How is it useful in a machine learning context?
6. What's the difference between Type I and Type II error?
7. What's the difference between probability and likelihood?
8. When should you use classification over regression?
9. What is gradient descent?
10. Explain dimensionality reduction, where it's used, and its benefits?
11. Explain Principal Component Analysis (PCA)?
12. Why is naive Bayes so 'naive' ?
13. Explain prior probability, likelihood and marginal likelihood in context of naive Bayes algorithm?
14. How is kNN different from kmeans clustering?
15. What is the difference between covariance and correlation?
16. How do you choose an algorithm for a classification problem?
17. What are some methods of reducing dimensionality?
18. How do classification and regression differ?
19. What is decision tree classification?
20. What is a recommendation system?



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Academic
Course Plan
2023-24 ODD

14.0 University Result

Examination	FCD	FC	SC	Fail	% Passing
Jan/Feb 2023	43	06	02	00	100
Jan/Feb 2022	35	08	00	00	100

Prepared by	Checked by		
Dr. Mahesh Huddar	Dr. Mahesh Huddar	HOD	Principal