DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
DEPARTMENT OF COMPUTER SCIENCE AND
INFORMATION TECHNOLOGY

SCHEME FOR CHOICE BASED CREDIT SYSTEM (CBCS)

M.Sc. Artificial Intelligence

W.E.F. --------, 2021 (ACADEMIC YEAR, 2021 to 2022 Onwards)

The CBCS System

Department of Computer Science and Information Technology adopted a credit based systemunder the Academic Flexibility Program of the University from the academic year 2011-2012.

It is a flexible, cafeteria- type learning system with an inbuilt horizontal mobility for students to all desire units of education in the Department/Departments with provision for even inter Departmental mobility for students. CBCS operates on modular pattern based on module/units called "credits", wherein 'credit' defines the quantum of contents/syllabus prepared for a course/paper and determines the minimum number of teaching learning hours required.

CBCS permits students to: I) Learn at their own pace, II) Choose electives from a wide range of elective courses offered by the department, III) Undergo additional/value added courses and acquire more than the required number of credits, depending upon the learner aptitude, IV) Adopt an interdisciplinary approach in learning, V) Make best use of the expertise of faculty across the Department, beside the particular department faculty and VI) Acquire knowledge, skill and attitude of learning outcomes through participatory teaching and learning and continuous evaluation process.

This provides the flexibility to make the system more responsive to the changing needs of our students, the professionals and society. The credit-based system also facilitates the transfer of credits.

Courses offered by the Department

1. M. Sc. Artificial Intelligence

Admission/ Promotion:

1. **M. Sc. Artificial Intelligence**

Duration: (Four Semesters means Two Academic Years)

Intake: 32

Eligibility: i) B.Sc. Computer Science **OR** B.Sc. IT **OR** B. Sc. Computer Application **OR** B.E/B. Tech. in Computer Science and Engineering/IT.**OR ii)**. Any Science Graduate with at least one Optional Subject asComputer Science.

Objective: The overall objective of this course is to cater the need of computational field. The content of this course is according to the current trends of research in Computer Science field. Some of the objectives of this course are to develop analytical, presentation, strategy formulation and personality development skills among the students, through which the students get prepared and trend for building their carrier in computer science and its related applied technology, research and development.

M. Sc. Artificial Intelligence per Year

Sr. No.	Particular	Fees
1	Student Fees W.F.	10
2	Sport	10
3	Ashwamed & SSI	12
4	E Service	50
5	Avishkar Nidhi	2
6	Apatkalin Nidhi	10
7	Avan Nidhi	3
8	Indradhanusha Nidhi	4
9	ABHIYAN	4
10	NSS (Self Finance)	6
11	Other Charges	100

12	Registration Fees	50
13	Library Fees/ Other Student Acti	5000
14	Admission Fees	200
15	Gym Fees	25
16	Medi Exam	5
17	Lab Fees/ Computer Lab	5850
18	other Fees/Study Tour	0
19	Uniform	0
20	Placement	0
21	Development Fees	0
22	Industrial Placement Internship	0
24	Amount of Tution Fees	15000
25	Other Fees Total	11341
26	Total	26341

Total Rs. 26,341/- Per annum

Note: In second and fourth semesters students should pay only Tuition and Laboratory Fess.

*** Fees likely to be modified as per the university rule and regulation from time to time and will be applicable to the concern students**

Admission to the M. Sc. Artificial Intelligence course in the department will be done on the performance of CET score and on their performance in the qualifying graduate level examination.
The student will apply on the application form of the University provided with the prospectus/e- prospectus. Once the student is admitted to the concern department/ course, he/she will be promoted to next semester with full carryon; subject to the registration of student in every consecutive semester. Dropout student will be allowed to register for respective semester as and when the concerned courses are offered by the department, subject to the condition that his/her tenure should not exceed more than twice the duration of course from the date of first registration at parent department. The admission of concern student will be automatically get cancelled if he/she fails to complete the course in maximum period (Four years/Eight semesters).

Credits and Degrees

i) A candidate who has successfully completed all the core courses, Elective/ Specialized courses and, seminars and project prescribed and or optional service courses approved by the University for the program with prescribed CGPA shall be eligible to receive the degree.

ii) One Credit shall mean one teaching period of one hour per week for one semester (of 15 weeks) for theory courses and two practical/laboratory/field/demonstration hours/ week for one semester.

iii) Every student will have to complete at least 100 credits to obtain the master's degree of M. Sc. Artificial Intelligence (Post graduate degree) out of which 96 credits should be from this Department and four or eight credits of service courses from this or other Department. However the Department can design the curriculum of more credits and it will be compulsory for the students of this Department to complete the credits accordingly.

Courses

(i) Core Course: A core course is a course that a student admitted to M. Sc. Artificial Intelligence program must successfully complete to receive the degree. Normally no theory course shall have more than 4 credits.

(ii) Elective Course: Means an optional course from the basic subject or specialization.

(iii) Service course (SC): The service courses will be offered in third and fourth semesters in the department. Student should complete one service course in any semester mentioned above.

(iv) Each Course shall include lectures / tutorials / laboratory or field work / Seminar / Practical training / Assignments / midterm and term end examinations/ paper / Report writing or review of literature and any other innovative practice etc., to meet effective teaching and learning needs.

(v) Attendance: Students must have 75% of attendance in each Core and Elective course for appearing the examination. However student having 65% attendance with medical certificate may apply to the H.O.D. for commendation of attendance.

Registration for Service Course:-

i) The student will register the service course of his/her interest after the start of semester in the concerned department on official registration form. The teacher in-charge of the respective course will keep the record of the students registered. Maximum fifteen days period will be given from the date of admission for completion of registration procedure. The Departmental Committee shall follow a selection procedure after counseling to the students etc. to avoid overcrowding to particular course(s) at the expense of some other courses.

ii) No student shall be permitted to register for more than one service course in a semester.

iii) The University department shall decide the maximum number of students in each service course taking into account the teachers and Physical facilities available in the Department.

iv) The University may make available to all students a listing of all the courses offered in every semester specifying the credits, the prerequisites, a brief description or list of topics the course intends to cover, the instructor who is giving the courses, the time and place of the classes for the course. This information shall be made available on the University website.

v) Normally no service course shall be offered unless a minimum of 10 Students are registered.

vi) The student shall have to pay the prescribed fee per course per semester/year for the registration as decided by the University.

Departmental Committee:
Every P.G. program of the University/College shall be monitored by a committee constituted for this purpose by the Department. The Committee shall consist of H.O.D. as a Chairman and some/all the teachers of the Department as its members .

Results Grievances Redressal Committee:
The University shall form a Grievance Redressal Committee for each course in each department with the Course Teacher and the HOD. This Committee shall solve all grievances relating to the Assessment of the students.

Grade Awards:-

(i) A ten point rating scale shall be used for the evaluation of the performance of the student to provide letter grade for each course and overall grade for the Master's Program. Grade points are based on the total number of marks obtained by him/her in all the heads of examination of the course. These grade points and their equivalent range of marks are shown separately in Table-I.

Table I: Ten point grades and grade description

Sr. No.	Equivalent percentage	Grade points	Grade	Grade description
1.	90.00-100	9.00-10	O	Outstanding
2.	80.00-89.99	8.00-8.99	A^{++}	Excellent
3.	70.00-79.99	7.00-7.99	A^{+}	Exceptional
4.	60.00-69.99	6.00-6.99	A	Very good
5.	55.00-59.99	5.50-5.99	B^{+}	Good
6.	50.00-54.99	5.00-5.49	B	Fair
7.	45.00-49.99	4.50-4.99	C+	Average
8.	40.01-44.99	4.01-4.49	C	Below average
9.	40	4.00	D	Pass
10.	< 40	0.00	F	Fail

ii.) Non appearance in any examination/ assessment shall be treated as the students have secured zero mark in that subject examination/assessment.

iii.) Minimum D grade (4.00 grade points) shall be the limit to clear /pass the course/subject. A student with F grade will be considered as 'failed' in the concerned course and he/she has to clear the course by reappearing in the next successive semester examinations. There will be no revaluation or recounting under this system.

iv.) Every student shall be awarded Grade points out of maximum 10 points in each subject (based on 10 Point Scale). Based on the Grade points obtained in each subject, Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) shall be computed. Results will be announced at the end of each semester and cumulative Grade card with CGPA will be given on completion of the course.

Computation of SGPA (Semester grade point average) &CGPA (Cumulative grade point average)

The computation of SGPA &CGPA,will be as below:

a. Semester Grade Point Average (SGPA) is the weighted average of points obtained by a student in a semester and will be computed as follows:

$$SGPA = \frac{Sum(CourseCredit * NumberofPointsinconcern\ coursegainedbythestudent)}{Sum(CourseCredit)}$$

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$$SGPA = \sum_i C_i G_i / \sum_i C_i$$

Where, C_i=credit for i^{th} course; G_i=grade point secured by the student.

$\sum$ is overall the courses credited by the student in the semester.

Semester Grade Point Average (SGPA) for all the four semesters will be mentioned at the end ofevery semester.

b. The Cumulative Grade Point Average (CGPA) will be used to describe the overall performance ofa student in all semesters of the course and will be computed as under:

$$CGPA = \frac{Sum(All\ four\ semester\ SGPA)}{Total\ Number\ of\ Semesters}$$

OR

$$CGPA = \sum_k C_k G_k / \sum_k C_k$$

Where, C_k = credit for k^{th} course, G_k = grade point secured by the student.

$\sum$ is overall the courses credited by the student in all the completed semesters.

The SGPA and CGPA shall be rounded off to the second place of decimal.

Evaluation method:

Each theory course will be of 100 Marks and be divided in to internal examination (Sessional) of 20 Marks and Semester end examination of 80 Marks. (20+80 = 100 Marks). Each Practical course will be of 50 marks. Research project if any, will be of 100 marks.

a. Internal Evaluation Method

There shall be two mid semester examinations, first based on 40 percent syllabus taught and second based on 60 percent syllabus taught. The setting of the question papers and the assessment will be done by the concerned teacher who has taught the syllabus. Average score obtained out of two mid semester examinations will be considered for the preparation of final sessional marks/grade.

b. Term end examination and evaluation.

i. Semester end examination time table will be declared by the departmental committee and accordingly the concern course teacher will have to set question paper, conduct theory examination, conduct practical examination with external expert, evaluate, satisfy the objection / query of the student (if any) and submit the result to DC.

ii. The semester end examination theory question paper will have two parts (20+60 = 80 Marks)

Part A will carry short question of 2-3 marks (fill in the blanks/ multiple choice questions/ match columns / state true or false / answer in one sentence) as compulsory questions and it should cover entire syllabus. (20 Marks)

Part B will carry 7 questions out of which there shall be at least one question from each unit, student will have to answer any five questions out of 7

iii. Semester end Practical examinations will be of 50 marks each and students will be examined by one external and one internal examiner. Seminar and Project work (if any) will be evaluated by the external examiners along with guide.

iv. At the end of each semester the Committee of Department shall assign grade points and gradesto the students.

v. The Committee of Department shall prepare the copies of the result sheet in duplicate.

vi. Every student shall have the right to scrutinize answer scripts of Mid semester/Term end semester examinations and seek clarifications from the teacher regarding evaluation of the scripts immediately thereafter or within 3 days of receiving the evaluated scripts.

vii. The Head of the department shall display the grade points and grades for the notice of students.

viii. The head of the department shall send all records of evaluation for Safekeeping to the Controller of Examinations as soon as all the formalities are over.

Grade Card

The University shall issue at the beginning of each semester a grade card for the student, containing thegrades obtained by the student in the previous semester and his Semester Grade Point Average (SGPA). The grade card shall list:

(a) The title of the courses along with code taken by the student
(b) The credits associated with the course,
(c) The grade and grade points secured by the student,
(d) The total credits earned by the student in that semester.
(e) The SGPA of the student,
(f) The total credits earned by the students till that semester and
(g) The CGPA of the student (At the end of the IVth Semester).

Cumulative Grade Card

At the end of the IVth semester, the University shall issue Cumulative Grade Card to the Students showing details of Grades obtained by the student in each subject in all semesters along with CGPA and total credits earned.

M. Sc. Artificial Intelligence Course Structure:

Sem-I	Sem-II	Sem-III	Sem-IV
Constitution of India	Social and Ethical Issues in AI	Reinforcement Learning	Dissertation Review-1
Research Methodology	Exploratory data Analysis	Computer Vision	Dissertation Review-2
Mathematical foundation for AI	Natural Language processing	Cyber Security	Dissertation Review-3
Programming with Python	Artificial Neural Network and Deep Learning	Big Data Analytics	Final Dissertation
Concepts in AI	Image Processing	Elective-II: (select any one from list of elective II) 1. Affective Computing and Interaction 2. Remote Sensing and Its Applications 3. Cognitive Science and Analysis 4. Introduction to Legal aspects of AI	Seminar
Data Visualization using R and python	Elective-I: (select any one from list of elective I) 1. Social, Text and Media Analytics 2. Spatial and Temporal Computing 3. Human Computer Interaction 4. IOT	Service Course	
Fundamentals of Machine learning			

Semester - I

Course Code	Course Title	No. of Credits	No. of Hours / Week	Internal	External	Total
AIC401	Constitution of India	2	2	20	30	50
AIC402	Research Methodology	2	2	10	40	50
AIC403	Mathematical foundation for AI	3	3	20	80	100
AIC404	Programming with Python	3	3	20	80	100
AIC405	Concepts in AI	3	3	20	80	100
AIC406	Data Visualization using R and python	3	3	20	80	100
AIC407	Fundamentals of Machine learning	3	3	20	80	100
AIP403	Practical based on AIC403	2	4 (Per Batch)	-	50	50
AIP404	Practical based on AIC404	2	4 (Per Batch)	-	50	50
AIP405	Practical based on AIC405	2	4 (Per Batch)	-	50	50
AIP406	Practical based on AIC406	2	4 (Per Batch)	-	50	50
AIP407	Practical based on AIC407	2	4 (Per Batch)	-	50	50
Total No of Credits in Sem-I		19+10=29				

Semester - II

Course Code	Course Title	No. of Credits	No. of Hours / Week	Internal	External	Total
AIC408	Social and Ethical Issues in AI	1	1	20	30	50
AIC409	Exploratory data Analysis	3	3	20	80	100
AIC410	Natural Language processing	3	3	20	80	100
AIC411	Artificial Neural Network and Deep Learning	3	3	20	80	100
AIC412	Image Processing	3	3	20	80	100
AIC471-480	Elective I	3	3	20	80	100
AIP409	Practical based on AIC409	2	4 (Per Batch)	-	50	50
AIP410	Practical based on AIC410	2	4 (Per Batch)	-	50	50
AIP411	Practical based on AIC411	2	4 (Per Batch)	-	50	50
AIP412	Practical based on AIC412	2	4 (Per Batch)	-	50	50
AIP471-480	Practical based on Elective I	2	4 (Per Batch)	-	50	50
Total No of Credits in Sem-II		16+10=26			-	

Semester - III

Course Code	Course Title	No. of Credits	No. of Hours / Week	Internal	External	Total
AIC413	Reinforcement Learning	3	3	20	80	50
AIC414	Computer Vision	3	3	20	80	100
AIC415	Cyber Security	3	3	20	80	100
AIC416	Big Data Analytics	3	3	20	80	100
AIC481-490	Elective II	3	3	20	80	100
	Service Course	4	4	20	80	100
AIP413	Practical based on AIC413	2	4 (Per Batch)	-	50	50
AIP414	Practical based on AIC414	2	4 (Per Batch)	-	50	50
AIP415	Practical based on AIC415	2	4 (Per Batch)	-	50	50
AIP416	Practical based on AIC416	2	4 (Per Batch)	-	50	50
AIP481-490	Practical based on Elective II	2	4 (Per Batch)	-	50	50
Total No of Credits in Sem-III		19+10=29				

Semester-IV

Course Code	Course Title	No. of Credits	No. of Hours / Week	Internal	External	Total
AIC417	Dissertation Review-1	3	6	20	30	50
AIC418	Dissertation Review-2	3	6	20	30	50
AIC419	Dissertation Review-3	3	6	20	30	50
AIC420	Final Dissertation	5	10	40	60	100
AIC421	Seminar	2	4	-	50	50
Total No of Credits in Sem-IV		16				

Details of Electives

Course Code	Elective-I	Course Code	Elective-II
AIC471	Social, Text and Media Analytics	**AIC481**	Affective Computing and Interaction
AIC472	Spatial and Temporal Computing	**AIC482**	Remote Sensing and Its Applications
AIC473	Human Computer Interaction	**AIC483**	Cognitive Science and Analysis
AIC474	IOT	**AIC484**	Introduction to Legal aspects of AI

Total credits of the course =29+26+29+16=100

Service Courses:

The student should opt service course of 4 credits either from parent department or from other department.

Course Code	Course Title	No. of Credits	No. of Hours / Week	Total Marks:100	
				External	Internal
CSC441	Introduction to MATLAB	2	2	80	20
CSC442	Practical Based on CSC441	2	4 (Per Batch)	50	-
CSC443	Aptitude	2	2	80	20
CSC444	Practical Based on CSC443	2	4 (Per Batch)	50	-
CSC445	Personality Development	2	2	80	20
CSC446	Practical Based on CSC445	2	4 (Per Batch)	50	-
CSC447	Communication Skill	2	2	80	20
CSC448	Practical Based on CSC447	2	4 (Per Batch)	50	-
CSC449	Programming in VB.NET	2	2	80	20
CSC450	Practical Based on CSC449	2	4 (Per Batch)	50	-

M. Sc. Artificial Intelligence

Detail Syllabus of M. Sc. Artificial Intelligence Semester III

Department of Computer Science and Information Technology

COURSE OBJECTIVE

- To familiarize the students with the basic concepts as well as with the state-of-the-art research literature in deep reinforcement learning.

Course Title	Reinforcement Learning
Course code	AIC413
Number of Credit	3 Theory ,2 Practical

Course Details	Total Contact Hours	Internal exam	External
Theory	3hrs/Week	20	80
Practical	4hrs/Week		50

Prerequisites: There are no perquisites required for attending this course.

Learning Outcomes: Students will be able

- Structure a reinforcement learning problem.
- Understand and apply basic RL algorithms for simple sequential decision making problems in uncertain conditions.
- Evaluate the performance of the solution

Course Outlines

Unit 1:

Foundations: Introduction and Basics of RL, Defining RL Framework and Markov Decision Process, Polices, Value Functions and Bellman Equations, Exploration vs. Exploitation, Code Standards and Libraries used in RL (Python/Keras/Tensorflow)

Unit 2:

Tabular methods and Q-networks: Planning through the use of Dynamic Programming and Monte Carlo, Temporal-Difference learning methods (TD(0), SARSA, Q-Learning), Deep Q-networks (DQN, DDQN, Dueling DQN, Prioritized Experience Replay)

Unit 3:

Policy optimization: Introduction to policy-based methods, Vanilla Policy Gradient, REINFORCE algorithm and stochastic policy search, Actor-critic methods (A2C, A3C),Advanced policy gradient (PPO, TRPO, DDPG)

Unit 4:

Model based RL: Model-based RL approach

Unit 5:

Recent Advances and Applications: Meta-learning, Multi-Agent Reinforcement Learning, Partially Observable Markov Decision Process, Ethics in RL, Applying RL for real-world problems

Reference Books:

1. “Reinforcement Learning: An Introduction", Richard S. Sutton and Andrew G. Barto, 2nd Edition
2. "Probability, Statistics, and Random Processes for Electrical Engineering", 3rd Edition, Alberto Leon-Garcia
3. "Machine Learning: A Probabilistic Perspective", Kevin P. Murphy

E-Resources:

https://cse.iitkgp.ac.in/~adas/courses/rl_aut2020/syllabus.html

https://www.coursera.org/learn/practical-rl

https://www.coursera.org/learn/fundamentals-of-reinforcement-learning

Others resources suggested by instructor

LAB WORK: Students are required to complete minimum 2 practical’s on each unit in addition to the assignments published by the teacher on notice board / during practical’s etc..

COURSE OBJECTIVE

- To understand master theories and methods in the field of computer vision
- Design and develop practical real time computer vision application or systems.

Course Title	Computer Vision
Course code	AIC414
Number of Credit	3 Theory ,2 Practical

Course Details	Total Contact Hours	Internal exam	External
Theory	3hrs/Week	20	80
Practical	4hrs/Week		50

Prerequisites:

Student must have knowledge of Image Processing, Neural Networks and Artificial Intelligence.

Learning Outcomes: students will be able

- To analyze data and use proper feature extraction and segmentation
- To apply Neural network or Machine learning for proper recognition of objects.

Course Outline

Unit 1:

Digital Image Formation and low-level processing: State-of-the-art, fundamentals of image formation. Transformation: orthogonal, Euclidean, affine, projective. Fourier transform, convolution and filtering, image enhancement, restoration, histogram processing. Depth estimation and multi-camera views: perspective, binocular stereopsis: camera and epipolar geometry, homography, rectification, DLT, RANSAC, 3-D reconstruction framework, auto-calibration, apparel.

Unit 2:

Feature extraction: Edges canny, LOG, DOG. Line detectors (Hough Transform), Corners: Harris and Hessian Affine, orientation histogram, SIFT, SURF, HOG, GLOH. Scale-Space Analysis: Image pyramids and Gaussian derivative filters, Gabor filters and DWT.

Unit 3:

Image Segmentation: Region growing, edge based approaches to segmentation, graph-cut, mean-shift, MRFs, texture segmentation, object detection. Clustering: K-Means, K-Medoids, mixture of Gaussians. Classification: Discriminant function, supervised, un-supervised, semi-supervised. Classifiers: Bayes, KNN, ANN models.

Unit 4:
Dimensionality Reduction, Motion Analysis: background subtraction and modeling, optical flow, KLT, spatio-temporal analysis, dynamic stereo, motion parameter estimation. Shape from X: light at surfaces, phong model, reflectance map, Albedo estimation, photometric stereo, use of surface smoothness, constraint, shape from texture, color, motion and edges.

Unit 5:
Applications: CBIR, CBVR, activity recognition, computational photography, biometrics, stitching and document processing. Recent Trends: 3-D Printing, 3-D sensing, simultaneous location and mapping, GPU, edge-computing, augmented reality, virtual reality cognitive models, fusion and super resolution.

Reference Books:

1. Computer Vision: A Modern Approach, Forsyth Ponce , Pearson Education
2. Image Processing, Analysis and Machine Vision, Milan Sonka, Thomson Learning .
3. Machine Vision, Jain R C Kasturi R, McGrawHill .
4. Three Dimensional Computer Vision, Y Shirai, Springer Verlag 3.
5. Computer And Robot Vision Vo I and II, Haralick R M And Shapiro L G, Addison Wesley
6. Computational Vision, Wechsler, Academic Press .
7. Robot Vision, Horn B K P, Cambridge MIT press .
8. Digital Image Processing & Computer Vision, Robert J Schalkoff, John Willey Publication

E-Resources:

https://opencv.org/syllabus/cv1-syllabus.pdf

https://opencv.org/syllabus/cv2-syllabus.pdf

https://www.coursera.org/learn/introduction-computer-vision-watson-opencv

https://yxw.cs.illinois.edu/course/CS598ACV/S21/schedule.html

Others resources suggested by instructor

LAB WORK: Students are required to complete minimum 2 practical's on each unit in addition to the assignments published by the teacher on notice board / during practical's etc.

COURSE OBJECTIVE

- Identify the malicious activities taking place in the system/network.
- Understand Protection mechanism from the cyber-attacks.
- Understand ethics behind hacking and vulnerability discovery

Course Title	Cyber Security
Course code	AIC415
Number of Credit	3 Theory ,2 Practical

Course Details	Total Contact Hours	Internal exam	External
Theory	3hrs/Week	20	80
Practical	4hrs/Week		50

Prerequisites: There are no perquisites required for attending this course.

Learning Outcomes:

- Responding to the Cyber Crime
- Preserving and creating controlled environment for Digital evidence

Course Outline

Unit 1:

Introduction to Cyber Crime: Cyber Crime and Information Security, Classification of Cyber crime-Email Spoofing, Spamming, Internet Time Theft, Salami Attack, Data Hacking, Credit Card Frauds, Identity Theft, Password Sniffing, Software Piracy, Web Jacking, Forgery, Online Frauds.

Information Security Concepts :Information Security Overview , Information Security Services , Goals for Security, E-commerce security, Computer Forensics, Digital Forensics Science, Digital Forensics Life Cycle.

Unit 2:

Phishing and Identity Theft: Methods of Phishing, Phishing Techniques, Spear phishing, Types of phishing scams, Phishing Toolkits and Spy Phishing, Phishing Countermeasures, Identity Theft, Types and Techniques of identity thefts and its counter measures. Security Threats and Vulnerabilities: Overview of Security threats, Attacks, Hacking Techniques, Insecure Network connections.

Unit 3:

Privacy Control Concept: What is Privacy? Methods to control Privacy, Data Collection from Social Networks, Challenges, Opportunities and pitfalls in securities, Credibility and reputation in social system. Privacy policing and preserving. Information Privacy disclosure, revelation and its effect in OSM and networks.
Access Control and Intrusion Detection: Overview of Authentication and Authorization, Overview of Intrusion Detection System, IDS Types and Detection Models, IDS Features and Intrusion Prevention Systems.

Unit 4:
Cybercrimes and Cyber Security: The Legal Perspectives Indian Context, The Indian IT Act – Positive Aspect of the ITA 2000, Weak Areas of ITA 2000.
Legal, Ethical and Professional Issues in Information Security: Laws and Ethics in information Security, Relevant (Indian/US) Laws, Ethics and Information Security, Codes of Ethics and Professional Organization.

Unit 5:
Hands on Open source: IPV4, IPV6, IP assigning, MAC, Bridging, Raid protocols, Linux remote connection: (Remote login, transfer file), Remote session(OpenSSh Configuration), Logs introduction, log files(Messages, dmesg, Audit log), cron.

Reference Books :

1. Rhodes-Ousley, Mark. Information Security: The Complete Reference, Second Edition,
2. Information Security Management: Concepts and Practice. New York, McGraw-Hill, 2013.
3. Whitman, Michael E. and Herbert J. Mattord. Roadmap to Information Security for IT and InfoSec Managers. Boston, MA: Course Technology, 2011.
4. Nina Godbole and SunitBelapure ,Cyber Security, by, Wiley Publication
5. Gray Hat Hacking: The Ethical Hackers' Handbook, Shon Harris, Allen Harper, Chris Eagle and Jonathan Ness, TMH Edition .

E-Resources:

https://www.cyberdegrees.org/resources/free-online-courses/

https://www.coursera.org/specializations/intro-cyber-security

https://www.coursera.org/specializations/pythonforcybersecurity

Others resources suggested by instructor

LAB WORK: Students are required to complete minimum 2 practical's on each unit in addition to the assignments published by the teacher on notice board / during practical's etc.

COURSE OBJECTIVE

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

Course Title	Big Data Analytics
Course code	AIC416
Number of Credit	3 Theory ,2 Practical

Course Details	Total Contact Hours	Internal exam	External
Theory	3hrs/Week	20	80
Practical	4hrs/Week		50

Prerequisites: There are no perquisites required for attending this course.

Learning Outcomes:

- To Understand big data collection, integration and storage
- Learn the big data indexing
- Learn the basics of MapReduce paradigms
- Learn various queries over big data
- Learn the core techniques of processing big data
- Understand different real applications and their techniques that involve big data

Course Outline

Unit 1:

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

Unit 2:

Mining data streams: Introduction To Streams Concepts, Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream Estimating Moments, Counting Oneness in a Window, Decaying Window - Real time Analytics Platform (RTAP) Applications - Case Studies - Real Time Sentiment Analysis- Stock Market Predictions

Unit 3:

Components of Hadoop - Analysing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics Developing a Map Reduce Application- Anatomy of a Map Reduce Job, Scheduling-Shuffle and Sort - Task execution. Case Study: IBM Info Sphere Big Insights and Streams

Unit 4:

Introduction to HBase, File systems for HBase, Client API - The Basics, Hbase clients – REST, Shell Commands, Map Reduce Integration

Unit 5:

Overview Pig, HiveQL: Introduction to Pig, Grunt, pig data model, Pig Latin, Advanced pig latin, developing and testing Pig Latin scripts, Map Reduce Integration Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries, HiveQL views, HiveQL Indexes, functions.

Reference Books:

1.Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley,2013.

2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional,2012.

3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley,2012. Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.

4. Eric Sammer, "Hadoop Operations", O'Reilley,2012.

5. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley,2012.

6. Lars George, "HBase: The Definitive Guide", O'Reilley,2011.

7. Alan Gates, "Programming Pig", O'Reilley,2011.

8. Chris Eaton, Dirk De Roos, Tom Deutsch, George Lapis, Paul Zikopoulos,"Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.

9. Anand Rajaraman and Jeffrey D. Ullman,"Mining of Massive Datasets", Cambridge University Press, 2012.

10. ArshdeepBahga, Vijay Madisetti, "Big Data Science & Analytics: A Hands - On Approach",VPT, 2016

E-Resources:

https://www.coursera.org/learn/big-data-introduction

Others resources suggested by instructor

LAB WORK: Students are required to complete minimum 2 practical's on each unit in addition to the assignments published by the teacher on notice board / during practical's etc.

2020-2021

Elective II

SEM III

COURSE OBJECTIVE

- To understand the various affective computing models.
- To learn emotional recognition techniques.

Course Title	Affective Computing and Interaction
Course code	AIC481
Number of Credit	3 Theory, 2 Practical

Course Details	Total Contact Hours	Internal exam	External
Theory	3hrs/Week	20	80
Practical	4hrs/Week	-	50

Prerequisites: There are no perquisites required for attending this course.

Learning Outcomes:

- To understand the role of emotion and machine interaction.
- To get the understanding of the aesthetic aspect of machine design.
- To develop systems to reduce the emotional gap between humans and machines.

Course outline:

Unit I: Introduction: Affective Computing and the Challenge of mood measurement and forecasting. Affective phenomena: emotion, mood, attitude/sentiment, personality. Computers, robots, smartphones with emotional intelligence.

Unit II: Emotion Theory: Dual-process theories of emotion, Constructivist theories, Appraisal theories. Affective Technology Interaction and Empathy: Computational Appraisal Theory, reinforcement learning based approaches, recognizing emotional context, facial affect recognition,

Unit III: Emotion and Decision-making Ethical issues related to emotion and AI, Emotionally Intelligent Human Computer Interaction, Emotion and Perception, Decision-making, and Creativity, Emotion and Learning, Physiology of Emotion,

Unit IV: Experiment design and modeling: Behavioral game theory, Neurological Mechanisms involved in Emotion, Affect Recognition by Wearable's and other Machines, Communicating Frustration/Stress in Autism and in Customer Experience, Responding to User Emotion to Reduce User Frustration, Inducing Emotion, Robots/Agents that "have" Emotion, Expression of Emotion by Machines/Agents/Synthetic characters, Philosophical, Social

Unit V: Ethical Challenges Implications of Affective Computing, Machine/Mobile Empathy and Emotional Support, Lie Detection and Stress Detection.

Reference Books:

1. Affective Computing and Interaction: Psychological, Cognitive and Neuroscientific Perspectives by DidemGökçay and Gülsen Yildirim, IGI Global.

2. The Encyclopedia of Human-Computer Interaction by Jonas Lowgren, John M. Carroll, Marc Hassenzahl, and Thomas Erickson, Interaction Design Foundation.

3. Affective Computing by R.W. Picard, MIT Press.

4. The Oxford Handbook of Affective Computing by R.A. Calvo, S.K. D'Mello, J. Gratch, and A. Kappas, Oxford University Press.

Others resources suggested by instructor.

LAB WORK: Students are required to complete minimum 2 practical's on each unit in addition to the assignments published by the teacher on notice board / during practical's etc..

COURSE OBJECTIVE

- To understand and be able to articulate the basics of how electromagnetic energy enables remote sensing.
- To be able to explain the concepts of spatial, spectral, radiometric and temporal resolution.

Course Title	Remote Sensing and Its Applications
Course code	AIC482
Number of Credit	3 Theory ,2 Practical

Course Details	Total Contact Hours	Internal exam	External
Theory	3hrs/Week	20	80
Practical	4hrs/Week	-	50

Prerequisites: Have knowledge of image processing

Learning Outcomes:

- To be able to explain and perform fundamental digital image processing tasks including:radiometric preprocessing, and supervised and unsupervised image classification.
- To be able to integrate remote sensing results with other geographic variables to obtain a more comprehensive view of particular area of interest.

Course Outline

Unit-I: Basics of Remote Sensing:
Principles of Remote sensing, History of Remote sensing, Remote sensing in India, Electromagnetic Radiation and Electromagnetic Spectrum, EMR quantities:Nomenclature and Units, Thermal Emission of Radiation, Radiation Principles (Plank's Law, Stephen Boltzmann law) Interaction of EMR with the Earth Surface (Wien's Displacement law, Kirchoffs Law) , Spectral signature, Reflectance characteristics of Earths cover types, Remote sensing systems.

Unit-II: Platforms and Sensors: Platforms, Types of sensors, resolutions sensor, Passive and Active Sensors, Optical sensors, Classification of RS, Selection of Sensor Parameter, Spatial Resolution, Spectral Resolution, Radiometric Resolution, Temporal Resolution. Satellite missions: Landsat series, SPOT series, IRS, Metrological satellites.

Unit-III: Microwave Region & Multispectral, Thermal, and Hyperspectral Sensing: Characteristics of EM radiation in microwave region, passive and active Microwave sensors. Introduction - Electromagnetic spectrum in thermal inferred. Across-Track & Along-Track Scanning. Operating Principles: Across-Track Multi spectral Scanners, Across-Track Thermal Scanning. Thermal Radiation Principles, Interpreting Thermal Scanner Imagery. Geometric Characteristics of Across-Track & Along-Track Scanner Imagery. Radiometric Calibration of Thermal Scanners. Temperature Mapping with Thermal Scanner Data, FLIR Systems, Hyperspectral Sensing, Thermal properties of vegetation, soils, water and snow in thermal domain.

Unit-IV: Interpretation of Remote Sensing Images: Types of interpretation, Interpretation Phase. Visual Interpretation, Criteria for visual interpretation, Elements for visual analysis. Digital image processing enhancement and correction: Structure, Media and data organization, Equipment, visual enhancement, image correction, Radiometric and Geometric corrections. Digital Image Classification

Unit-V: Remote Sensing and Applications: GIS Introduction: Need for GIS, Data Model, Data Entry, Data Analysis, GPS, and Remote Sensing as input for GIS. Integration of Satellite Images and GIS. Spatial Data Infrastructure. Introduction to GNSS, Introduction to GPS, Error Sources and Positioning Types of GPS, Elements of GPS, Global Navigation Satellite System, Operational Remote Sensing, Natural Resource Management, Disaster Management, Planetary Missions.

Reference Books:

1. Fundamentals of Satellite Remote Sensing, Emilio Chuvieco, Alfredo Huete (2010), CRC Press, Taylor& Francis Group.
2. Remote Sensing and Image Interpretation. 6th ed. Lillesand, T.M., Kiefer, R.W. and Chipman.J.W.2008. New York: John Wiley & Sons.
3. Fundamentals of Remote Sensing, George Joseph (2004), Universities Press (India) Private Limited.
4. Remote Sensing Models and Methods for Image Processing, 3rd ed, Robert A. Schowengerdt, Academic Press is an imprint of Elsevier, 2007.
5. Remote Sensing of the Environment - an Earth Resource Perspective 2nd ed. Jensen, J.R. 2007.Upper Saddle River, NJ, Prentice Hall.
6. Remote Sensing Principles and Interpretation, Floyd, F. Sabins, Jr: Freeman and Co., San Franscisco,1978.
7. Manual of Remote Sensing Vol. I&II, 2nd Edition, American Society of Photogrammetry.
8. Remote Sensing: The quantitative approach, P.H. Swain and S.M. Davis, McGraw Hill.
9. Introductory Digital Image Processing: A remote sensing perspective, John R. Jensen, Prentice Hall.
10. Imaging Radar for Resource Survey: Remote Sensing Applications, 3, W Travelt, Chapman & Hall.

Others resources suggested by instructor

LAB WORK: Students are required to complete minimum 2 practical's on each unit in addition to the assignments published by the teacher on notice board / during practical's etc..

COURSE OBJECTIVE

- Understand core theories, models and methodologies from the field of HCI.
- Describe and discuss current research in the field of HCI.

Course Title	Cognitive Science and Analysis
Course code	**AIC483**
Number of Credit	**3 Theory ,2 Practical**

Course Details	Total Contact Hours	Internal exam	External
Theory	3hrs/Week	**20**	80
Practical	4hrs/Week	-	50

Prerequisites: There are no perquisites required for attending this course.

Learning Outcomes:

- To be able to use critical thinking to evaluate and interpret evidence,
- To be able to apply cognitive science concepts, theories, and research findings to individual, social, and cultural issues.
- To be able to apply basic research methods in cognitive science, with sensitivity to ethical principles

Course Outline

Unit I:

The Cognitive Approach I: History, Vision, and Attention: Some History First: The Rise of Cognitive Psychology, The Cognitive Approach: Mind as an Information Processor, Modularity of Mind, Theories of Vision and Pattern Recognition, Theories of Attention, Evaluating the Model-Building Approach, In Depth: Biederman's Recognition-by-Components Theory of Pattern Recognition, Minds On Exercise: Silhouettes and Object Constancy

The Cognitive Approach II: Memory, Imagery, and Problem Solving, Types of Memory, Memory Models, Visual Imagery, Problem Solving, Overall Evaluation of the Cognitive Approach, In Depth: Search in Working Memory,

Unit II:

The Neuroscience Approach: Mind As Brain: The Neuroscience Perspective, Methodology in Neuroscience, The Small Picture: Neuron Anatomy and Physiology, The Big Picture: Brain Anatomy, The Neuroscience of Visual Object Recognition, The Neuroscience of Attention, The Neuroscience of Memory, Neural Substrates of Working Memory, Neural Substrates of Long-Term Memories, The Neuroscience of Executive Function and Problem Solving, Overall Evaluation of the Neuroscience Approach.

Outline: The Network Approach: Mind as a Web: The Network Perspective, Principles Underlying Artificial Neural Networks, Characteristics of Artificial Neural Networks, Early Conceptions of Neural Networks, Back Propagation and Convergent Dynamics, Artificial Neural

Network Typologies, Evaluating the Connectionist Approach, Semantic Networks: Meaning in the Web, Characteristics of Semantic Networks.

Unit III:

The Evolutionary Approach: Change Over Time: The Evolutionary View, Evolutionary Psychology, A Little Background: Selection, Evolved Psychological Mechanisms, Evolution and Cognitive Processes, Sex Differences in Cognition, Evolutionary Computing, Artificial Life, Neural Darwinism, Evaluating Evolutionary Psychology.

The Linguistic Approach: Language and Cognitive Science: The Linguistic Approach: The Importance of Language, The Nature of Language, Language Use in Primates, Language Acquisition, Language Deprivation, Philosophy and Linguistics: The Linguistic Relativity Hypothesis, Cognition and Linguistics: The Role of Grammar, Neuroscience and Linguistics: The Wernicke-Geschwind Model, Artificial Intelligence and Linguistics: Natural Language Processing, Speech Recognition.

Unit IV:

Artificial Intelligence I: Definitional Perspective: Introduction, Historical and Philosophical Roots, Defining Artificial Intelligence (AI), AI Methodologies, the Computer as the Tool of AI Research, Programming, Alan Turing and the Great Debate.

Artificial Intelligence II: Operational Perspective: Introduction, The Practical World of Artificial Intelligence, Approaches to the Design of Intelligent Agents, Machine Intelligence, Knowledge, and Machine Reasoning, Machine Reasoning, Logical Reasoning (Deduction, Abduction, Induction), Inductive Reasoning, Expert Systems, Fuzzy Logic, Artificial Neural Nets (ANNs).

Unit V:

Robotics: The Ultimate Intelligent Agents: Introduction, Some Robotic Achievements, Evaluating Robotic Potentials, Biological and Behavioral Foundations of Robotic Paradigms, Foundations of Robotic Paradigms, Robotic Paradigms.

Reference Books:

1. COGNITIVE SCIENCE an Introduction to the Study of Mind Jay Friedenberg, Gordon Silverman.
2. Cognitive Science an Introduction to the Science of the Mind 3rd Edition by José Luis Bermúdez, Texas A & M University.

Others resources suggested by instructor.

LAB WORK: Students are required to complete minimum 2 practical's on each unit in addition to the assignments published by the teacher on notice board / during practical's etc..

COURSE OBJECTIVE

- The purpose of the course is to help students understand the legal implications related to the design and use of artificial intelligence systems,
- To providing an overview of the risks and legal protections required for AI Products.

Course Title	Introduction to Legal aspects of AI
Course code	AIC484
Number of Credit	3 Theory ,2 Practical

Course Details	Total Contact Hours	Internal exam	External
Theory	3hrs/Week	20	80
Practical	4hrs/Week	-	50

Prerequisites: There are no perquisites required for attending this course.

Learning Outcomes: Students will be

- Learn about long-standing theory in law and artificial intelligence
- Study the rise of diverse computational law methods and processes

Course Outline

Unit I: Introduction to Artificial intelligence: Introduction to AI and Machine Learning, Where Is AI Developed and Deployed? Why AI "Policy"?

Unit II: Artificial Intelligence, Law and legal issues:

AI and Antidiscrimination, Liability of AI Actors, Can algorithmic discrimination be fixed?: Humans vs the machines, Technical fixes and Legal hurdles to technical fixes

Unit III: Artificial Intelligence and Liability:

Justice and Equity, Inequality in Application, Consequential Decision-Making, Use of Force

Safety and Certification: Setting and Validating Safety Thresholds, Certification, Cyber security

Unit IV: Artificial Intelligence and Intellectual Property:

AI and Patent Law, AI and Public Policy, Ownership of Training Data, AI and Autonomous Vehicles

Unit V: Artificial Intelligence and risks to fundamental rights:

AI as judge and jury: Robo-jurors in the democratic process and. Technical solutions to legal problems, AI Authors, and Lawyers.

Reference books:

1. AI and the Law by Karen Kilroy,Released February 2021,Publisher(s): O'Reilly Media, Inc.ISBN: 9781492091820
2. Artificial Intelligence: Law And Policy Implications,byPurviPokhariyal, Amit K. Kashyap and Arun B. Prasad,Publisher: Eastern Book Company, ISBN: 9789389656954.

Others resources suggested by instructor

LAB WORK: Students are required to complete minimum 2 practical's on each unit in addition to the assignments published by the teacher on notice board / during practical's etc..