1. Faculty	: Dr. Gopal Singh Phartiyal	Course Code: **CSAI 3007**
2. Course	: **Pattern and Anomaly Detection**	L: 3
3. Program	: AI & ML	T: 0
4. Target	:	P: 0
		C: 3

COURSE PLAN

Target	50% (marks)
Level-1	40% (population)
Level-2	50% (population)
Level-3	60% (population)

1. Method of Evaluation

UG
Quizzes/Tests, Assignments (30%)
Mid Examination (20%)
End examination (50%)

2. Passing Criteria

Scale	**UG**
Out of 10 point scale	SGPA – "5.0" in each semester CGPA – "5.0" Min. Individual Course Grade – "C" Course Grade Point – "4.0"

*for UG, passing marks are 35/100 in a paper

3. Pre-requisites: Basic knowledge of machine learning, statistics, and probability

4. Course Objectives:

1. Students should be able to understand the concepts, usage and impact of pattern recognition in various areas.
2. To understand different pattern recognition task using machine learning

3. Pedagogy
- Synchronous and Asynchronous lectures
- Presentations

4. References:

Text Books	1. Introduction to Business Analytics (IBM ICE Publication)
Web resources	1. https://onlinecourses.nptel.ac.in/noc21_ee79/preview (MOOC blended with this course)
Journals	
Reference books	

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<u>GUIDELINES TO STUDY THE SUBJECT</u>

Instructions to Students:

1. Go through the 'Syllabus' in the Black Board section of the web-site(https://learn.upes.ac.in) in order to find out the Reading List.
2. Get your schedule and try to pace your studies as close to the timeline as possible.
3. Get your on-line lecture notes (Content, videos) at <u>Lecture Notes</u> section. These are our lecture notes. Make sure you use them during this course.
4. Check your blackboard regularly
5. Go through study material
6. Check mails and announcements on blackboard
7. Keep updated with the posts, assignments and examinations which shall be conducted on the blackboard
8. Be regular, so that you do not suffer in any way
9. **Cell Phones and other Electronic Communication Devices:** Cell phones and other electronic communication devices (such as Blackberries/Laptops) are not permitted in classes during Tests or the Mid/Final Examination. Such devices MUST be turned off in the class room.
10. **E-Mail and online learning tool:** Each student in the class should have an e-mail id and a pass word to access the LMS system regularly. Regularly, important information – Date of conducting class tests, guest lectures, via online learning tool. The best way to arrange meetings with us or ask specific questions is by email and prior appointment. All the assignments preferably should be uploaded on online learning tool. Various research papers/reference material will be mailed/uploaded on online learning platform time to time.
11. **Attendance:** Students are required to have minimum attendance of 75% in each subject. Students with less than said percentage shall NOT be allowed to appear in the end semester examination.

This much should be enough to get you organized and on your way to having a great semester! If you need us for anything, send your feedback through e-mail to your concerned faculty. Please use an appropriate subject line to indicate your message details.

There will no doubt be many more activities in the coming weeks. So, to keep up to date with all the latest developments, please keep visiting this website regularly.

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RELATED OUTCOMES

1. The expected outcomes of the Program are:

PO1	*Engineering knowledge:* Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
PO2	*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.
PO3	*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.
PO4	*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.
PO5	*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.
PO6	*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.
PO7	*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.
PO8	*Ethics:* Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	*Individual and team-work:* Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	*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.

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PO11	*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.
PO12	*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.

2. The expected outcomes of the Specific Program are:

PSO1	Perform system and application programming using computer system concepts, concepts of Data Structures, algorithm development, problem solving and optimizing techniques.
PSO2	Apply software development and project management methodologies using concepts of front-end and back-end development and emerging technologies and platforms.
PSO3	Ability to develop the understanding of Artificial Intelligence and data analysis techniques and to apply these to real world business problems, communicate findings, and effectively present results for improved decision-making.

3. The expected outcomes of the Course are:

CO 1	Understand the concept of a pattern and the basic approach to the development of pattern recognition and machine intelligence algorithms.
CO 2	Analyze the statistical approaches corresponding to pattern recognition
CO 3	Comprehend the contemporary techniques in machine learning for pattern recognition
CO4	Understand and apply both supervised and unsupervised classification methods to detect and characterize patterns in real-world data
CO5	Apply pattern recognition techniques to real-world problems such as document analysis and recognition

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4. Co-Relationship Matrix

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

PO/CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	1	1									1		2
CO2	2	1	1	1									1		2
CO3	2	2	1	1									1		2
CO4	2	2	1	1									1		2
CO5	2	2	3	2									1		2

5. Course outcomes assessment plan:

components / Course Outcomes	Assignment	Test/Quiz	Mid Semester	End Semester	Swayam MOOC
CO 1	√	√	√	√	√
CO 2	√	√	√	√	√
CO3	√	√		√	√
CO4	√	√		√	√
CO5	√	√		√	√

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OVERVIEW OF COURSE DELIVERY/BROAD PLAN OF COURSE COVERAGE

Course Activities:

Unit	Description	Planned		
		From	**To**	**No. of Sessions**
1	**Unit 1. Introduction**			12
2	**Unit 2. Statistical Approaches for Pattern Recognition**			9
3	**Unit 3. Machine Learning Approaches for Pattern Recognition**			15

Total No. of Instructional periods available for the course: Sessions

Signature of HOD/Dean   **Signature of Faculty**

Date: **D**

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SESSION PLAN: UNIT-I

Session Plan		
Lecture	**Topics to be Covered**	**CO Mapped**
1-3	Introduction to Pattern Recognition and Anomaly Detection	CO1
4-6	Example: Polynomial Curve Fitting Probability Theory	CO1
7-9	Model Selection,	CO1
9-12	The Problem with High Dimensionality, Information Theory	CO1

SESSION PLAN: UNIT-II

Session Plan		
Lecture	**Topics to be Covered**	**CO Mapped**
13-15	Probability Distributions	CO2
16-19	Linear Models for Regression;	CO2
20-21	Linear Models for Classification	CO2

SESSION PLAN: UNIT-III

Session Plan		
Lecture	**Topics to be Covered**	**CO Mapped**
22-25	Neural Networks	CO3, CO4, CO5
26-27	Kernel Methods	CO3, CO4, CO5
28-29	Sparse Kernel Machines	CO3, CO4, CO5
30	Graphical Models	CO3, CO4, CO5
31	Mixture Models and EM	CO3, CO4, CO5
32	Approximate Inference	CO3, CO4, CO5
33	Sampling Methods for Pattern Recognition	CO3, CO4, CO5
34	Continuous Latent Variables	CO3, CO4, CO5
35	Pattern Recognition in Sequential Data	CO3, CO4, CO5
36	Combining Models for Pattern Recognition	CO3, CO4, CO5

Signature of faculty

Date: