Innovations by the Faculty in Teaching and Learning

Innovations by the Faculty in Teaching and Learning

Novel Teaching-Learning process has a pivotal role in improving the quality of education, enhancing employability and accomplishing the goals of the individuals that will contribute to the nation's growth. Apart from the conventional teaching method, the current and next generation students expect innovative methods of teaching such as multimedia-oriented tools, problem-based learning and usage of various e-learning tools for better visualization and deeper understanding. The innovative and creative methods of teaching processes highly focus on attaining the course outcomes and to surge the students to be ready for the future, better equipped to solve complex multidisciplinary problems, able to bring fresh perspectives to global challenges, and motivated to become leaders in their chosen field.

The faculty at **Department of Networking and Communications,** SRMIST have been actively embracing innovative teaching and learning strategies to enhance student engagement, foster deeper understanding, and improve learning outcomes. Here are some key innovations that have been adopted:

Department of Networking and Communications aims at implementing various teaching methodologies that cater to the needs of the students as part of the curriculum. The following are some of the approaches, which have been identified and implemented throughout the semester.

1. Model based Teaching Learning Process

2. Application Oriented Teaching and Learning

3. Interactive Java Applets for Self-Learning

4. Lecture Videos

I. MODEL BASED TEACHING LEARNING PROCESS (MBTLP)

The Model-Based Teaching and Learning Process is a structured approach that emphasizes the use of models and simulations to enhance the understanding of complex concepts in various specializations. The model-based approach incorporates Problem-Based Learning, where students work on real-world challenges and case studies related to their specialization.

Real-time prototypes are developed by teams of faculty members (from specific research groups) and students for each specialization offered by the department, such as Information Technology, Computer Networking, Cloud Computing, Internet of Things and Cybersecurity. These prototypes facilitate rapid understanding and assimilation of the concepts.

1. Computer Networking:

Cisco Packet Tracer has emerged as a powerful tool that enables educators to create an immersive learning environment. This tool provides students with a hands-on experience in designing, configuring, and troubleshooting networks, helping them develop a deeper understanding of theoretical concepts through practical application. Cisco Packet Tracer models, which closely emulate a real-time scenario, are developed for courses like Computer Networks, Wireless Networks, Mobile and Wireless Security, Network Security, Information Security which are offered for second- and third-year students.

Here are the key areas for which Cisco Packet Tracer-based simulation models are developed and provided to students during regular classes to help them better understand theoretical concepts:

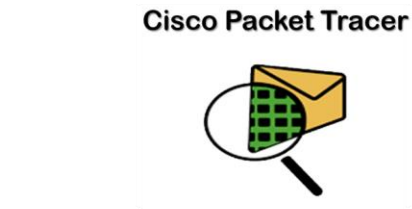
- **Routing Protocols**: Includes RIP, OSPF, EIGRP, and BGP.
- **Switching Concepts and VLANs**: Covers the operation of switches, spanning tree protocols (STP), and Virtual LANs (VLANs).
- **Network Security**: Focuses on firewalls, access control lists (ACLs), Virtual Private Networks (VPNs), and other security measures.

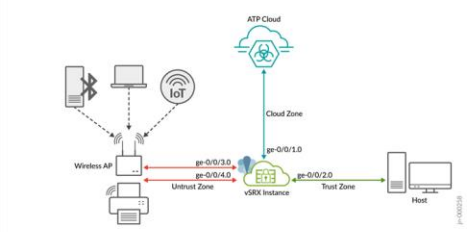
- **Wireless Networking**: Involves WLAN design, wireless security protocols, Frame Relay, MPLS, and access point configurations.

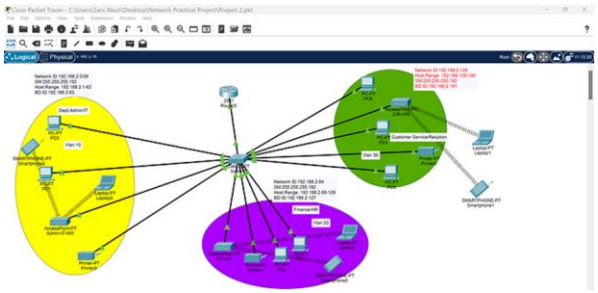
2. Internet of Things (IoT):

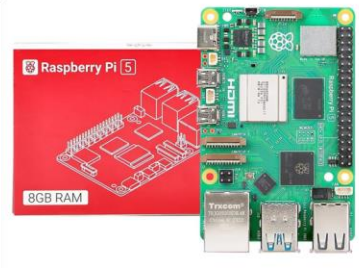
IoT is a rapidly growing field that connects devices, sensors, and systems, enabling them to communicate and share data seamlessly. To effectively teach IoT concepts, a model-based teaching-learning process can be highly beneficial. This approach uses real-world simulations and practical models to help students grasp the complexities of IoT, from basic device connectivity to advanced data analytics and automation.

- **Configure IoT devices** such as sensors, actuators, and microcontrollers using Arduino, Raspberry Pi.
- **IoT Protocols Implementation-** Zigbee, Z-Wave, LoRaWAN, and Bluetooth Low Energy (BLE).
- **Collecting and analyzing IoT data-** using ThingSpeak, Node-RED or cloud services.
- **IoT with cloud and edge computing-** AWS IoT, Microsoft Azure IoT Hub, Google Cloud IoT.









II. APPLICATION ORIENTED TEACHING AND LEARNING

Department of Networking and Communications continues to impart quality technical knowledge to students using the following initiatives for application-oriented teaching learning process.

1. Project-Based Learning

- Students work on projects that address real-world problems or industry-specific challenges. Projects can range from developing software applications, creating databases, to designing network solutions.

2. Industry Collaboration

- Partnering with industry professionals and organizations to provide students with insights into real-world practices and current technological trends.

3. Case Studies and Real-World Scenarios

- Analyzing case studies and solving problems based on real-world scenarios to apply theoretical knowledge in practical contexts.

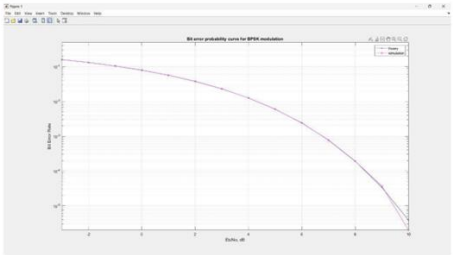
4. Hands-On Laboratories and Simulations

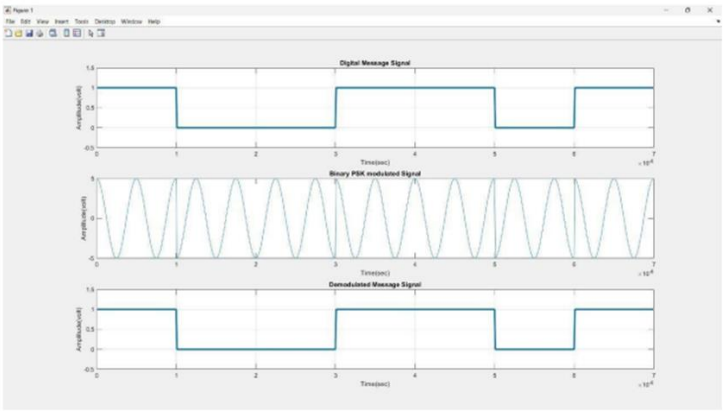
- Utilizing labs and simulation tools to provide hands-on experience with hardware and software.

1. To simulate the generation and detection of Frequency Shift Keying (FSK) modulation scheme using MATLAB.

2. To simulate the generation, detection and signal constellation of Binary Phase Shift Keying (BPSK) modulation scheme using MATLAB.

3. To simulate the generation and signal constellation of Quadrature Phase Shift Keying (QPSK) modulation scheme using MATLAB.





III. INTERACTIVE JAVA APPLETS FOR SELF-LEARNING

The course instructors utilize a customized software applet like Java based applets for making the students to understand the complex concepts which involves visualizing a virtual concept. Learners can tune several parameters provided in the applet to gain broader insight on the subjects which require additional efforts from teaching and learning communities.

Interactive Java applets provide a dynamic and engaging way to learn various concepts through self-paced exploration and experimentation. These applets are small, web-based applications that can be used to visualize algorithms, data structures, computer networks and other core areas of computer science. By interacting with these applets, students can gain a deeper understanding of theoretical concepts and develop problem-solving skills in an intuitive and user-friendly manner. JAVA applets are employed for the following courses

(i) Data structures

- Sorting algorithms **(**Quick Sort, Merge Sort, Bubble Sort), searching algorithms (e.g., Binary Search, Linear Search), and graph algorithms (e.g., Dijkstra's, A*, Prim's).
- https://cs.brynmawr.edu/Courses/cs206/spring2004/lafore.html

(ii) Computer Networks

- Applets for computer networking concepts, such as packet switching, routing protocols (e.g., RIP, OSPF), network topologies, TCP/IP protocol suite, and flow control mechanisms.
- **https://gaia.cs.umass.edu/kurose_ross/interactive/**

(iii) Operating Systems

- Applets for process scheduling, memory management, synchronization (semaphores and monitors), deadlock detection and avoidance, and file systems.
- https://users.cs.duke.edu/~rodger/tools/jflap/indexold.html

(iv) Formal Language of Automata

- Visualizing abstract concepts in the theory of computation, such as finite automata, Turing machines, regular expressions, context-free grammars and parsing techniques.
- **https://users.cs.duke.edu/~rodger/tools/jflap/indexold.html**

(v) Database Management Systems (DBMS)

- Applets can simulate SQL query execution, database normalization, indexing, transaction management, and concurrency control.

(vi) Software Engineering and UML Diagrams

- Applets designed for software engineering can help students understand UML diagrams, software design patterns, and architectural styles.

(vii) Discrete Mathematics and Logic

- Interactive applets for discrete mathematics can cover topics such as set theory, combinatorics, graph theory, logic gates, Boolean algebra, and probability.

IV. LECTURE VIDEOS

Faculty members have prepared a handful of lecture videos and uploaded those videos in their YouTube channels. These videos serve as a last mile support for students who have missed out their regular classes.

S.No	Name of the teacher	Name of the module	Date of launching e- content	Link to the relevant document
1	Dr. M. Mahalakshmi	21CSC206T-Artificial Intelligence- Topic: Planning	Jan 30, 2024	https://drive.google.com/file/d/14sludm3ZuVdXURNxRsyvc01CBkPc5l6v/view?usp=drive_link
2	Mrs. Asha Abraham	21CSC206T-Artificial Intelligence- Topic:planningproblem-	Jan 30, 2024	https://drive.google.com/file/d/17FjtCP91a6RUrBBTDUiH80OGk52Z2K5V/view?usp=drive_link
3	Mrs. R. Preethi	21CSC206T-Artificial Intelligence- Topic: Block Worlds Problem -	Jan 30, 2024	https://drive.google.com/file/d/1Y33ZNE8rTRwrCjUDcYV9bN9JAK_u4C26/view?usp=drive_link
4	Mrs. R. Dhwarithaa	21CSC206T-Artificial Intelligence- Topic: Simple planning agent	Jan 30, 2024	https://drive.google.com/drive/folders/1Gil2IJ9EsS2toBBCcaVdtf_SwvP8CO9f?usp=drive_link
5	Dr. M. Nivethitha	21CSC206T-Artificial Intelligence- Mean Ends Analysis learning-	Jan 30, 2024	https://drive.google.com/file/d/1Q-hzaDGql3OvwkJ2hmtAtESeSOWAv6vh/view?usp=drive_link
6	Dr. S. Ramesh	21CSC206T-Artificial Intelligence- Topic: Supervised learning-	Jan 30, 2024	https://drive.google.com/file/d/1ICxif6G8jEHJLRQj6KsEdw6qHUEVeVkr/view?usp=drive_link
7	Dr. K. Varun kumar	21CSC206T-Artificial Intelligence- Topic: Un Supervised learning -	Jan 30, 2024	**https://drive.google.com/file/d/1RpqXryBlLcPRn5K4JVx1PVWollMykJ7y/view?usp=drive_link**
8	Dr.R. Prabhu	21CSC206T-Artificial Intelligence- Topic: Reinforcement learning-	Jan 30, 2024	**https://drive.google.com/drive/folders/1GzrDTE1Hd5qLKWr5H-rZiUSWUjqXCzxt?usp=drive_link**
9	Dr. D. Saveetha	21CSC206T-Artificial Intelligence- Topic: Introduction to expert system Architecture to Expert System-	Jan 30, 2024	**https://drive.google.com/file/d/1Ezwd6_mu3IpzHC5O6SUSUffCaklkTVjR/view?usp=drive_link**

S.No	Name of the teacher	Name of the module	Date of launching e- content	Link to the relevant document
10	Dr. V. Rajaram	21CSS201T- Computer Organisation and Architecture- 1's and 2's compliment	Aug 9, 2023	https://youtu.be/RiMyrVJbi8w?feature=shared
11	Dr. V. Rajaram	21CSS201T- Computer Organisation and Architecture- 1's and 2's compliment	Aug 9, 2023	https://youtu.be/wBFg4BYFJi4?feature=shared
12	Dr. M. Arun	18CSC302J- Computer Networks-Topic: Byte Ordering in Networking	Aug 17, 2023	https://youtu.be/DKAi952E-Vo?feature=shared
13	Dr.M.Jeyaselvi	18CSC302J- Computer Networks-Topic : TCP client server communication	Aug 17, 2023	https://youtu.be/AzCfOn8OIjc?feature=shared
14	Dr J Godwin Ponsam	18CSC302J- Computer Networks-Topic : User Datagram Protocol	Aug 18, 2023	https://youtu.be/Dm4xYL6KICg?feature=shared
15	Dr. M.Safa	18CSC302J-Computer Networks-Topic: Distance Vector Routing	Jul 15, 2023	https://youtu.be/vrd-rNVOgAA?feature=shared

S.No	Name of the teacher	Name of the module	Date of launching e- content	Link to the relevant document
16	Dr.Radhika R	18CSC302J- Computer Networks-Topic :System Calls , Socket, Iterative and Concurrent Server	Aug 18, 2023	https://youtu.be/PZS0rZoyZKo?feature=shared
17	Dr.Radhika R	21CSS201J-DSA-Topic: Dijkstra's Algorithm	Aug 20, 2023	https://youtu.be/roFX4iYKJOs?feature=shared

Best Practices in Innovative Teaching Pedagogy Adopted by Faculty at NWC

Innovative Teaching Pedagogy:

In today's rapidly changing educational landscape, innovative teaching pedagogies are essential to equip learners with the skills, knowledge, and mindsets needed for the 21st century. Traditional teaching methods, often characterized by rote memorization and passive learning, are no longer sufficient to prepare students for complex problem-solving, critical thinking, and collaborative work. Innovative pedagogy integrates new ideas, technology, and approaches, making learning more engaging, personalized, and effective.

Various Methods of Innovative Pedagogy

1. Student-Centered Learning

- This approach shifts the focus from the teacher as the **central figure to students, encouraging them to take ownership** of their learning.
- **Activities are designed** to engage students actively, with the teacher acting as a facilitator.

2. Flipped Classroom

- In a flipped classroom, traditional lecture and homework are reversed. Students first **engage with new content at home through videos, reading, or interactive online material.**
- Classroom time is then used for **discussions, problem-solving,** and practical application of knowledge.
- This method maximizes classroom interaction, providing opportunities for **deeper learning and individual support.**

3. Project-Based Learning (PBL)

- **Project-Based Learning** is an experiential approach where students work on **real-world problems or projects over an extended period.**
- The projects are often interdisciplinary, requiring students to apply a variety of skills and knowledge to achieve a final product or **solution.**
- PBL encourages **creativity, collaboration, and critical thinking,** while also making learning more relevant and meaningful.

4. Collaborative Learning

- Emphasizing teamwork, collaborative learning encourages students to **work together** to solve problems, complete projects, or discuss ideas.
- It promotes **communication skills, group decision-making,** and shared responsibility.
- By working in groups, students learn from one another, helping them **build interpersonal and leadership skills** essential for modern workplaces.

5. Gamification

- Incorporating game-like elements into learning activities can boost engagement and motivation.
- **Points, badges, leaderboards, and challenges** can make learning fun while encouraging students to achieve specific goals.
- Gamification taps into students' intrinsic motivation, **enhancing focus, and encouraging perseverance.**

6. Blended Learning and Technology Integration

- Blended learning combines traditional face-to-face instruction with **online or digital learning**
- It provides flexibility for students to learn at their **own pace** while still benefiting from **in-person guidance and interaction**.
- Digital tools such as **Learning management systems (LMS), multimedia resources, and online platforms** are used to create a dynamic learning experience. This approach caters to diverse learning preferences and improves engagement.

Best Practices in Innovative Teaching Pedagogy Adopted by Faculty at NWC

Department of Networking and Communications aims at implementing various teaching Pedagogy that cater to the needs of the students as part of the curriculum. The following are some of the approaches, which have been identified and implemented throughout the semester.

1. Student-Centred Learning:

Activities:

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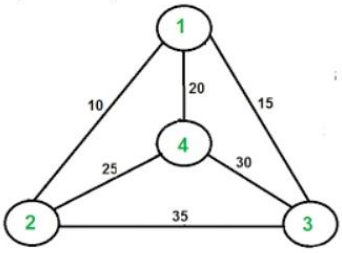
21CSE206T– ARTIFICIAL INTELLIGENCE

Q2 Section - Best Practices in Class - Activity Sheet – 1

1. How do we measure forty-five minutes using two identical wires, each of which takes an hour to burn? We have matchsticks with us. Solve this problem
2. Geeta Mohan walked 20 m towards the north. Then she turned right and walked 30 m. Then she turns right and walks 35 m. Then she turns left and walks 15 m. Finally, she turns left and walks 15 m. In which direction and how many meters is she from the starting position? Solve this problem
3. You have an 8-litre jug full of water and two smaller jugs, one that contains 5 litres and the other 3 litres. None of the jugs have markings on them, nor do you have any additional measuring device. You have to divide the 8 litres of water equally between your two best friends so that each gets 4 litres of water. How can you do this?
4. Imagine each rider as a location and each available driver as another location. The "distance" between them could be a combination of factors like physical distance, time it takes to reach the rider, and driver detour. Help the ride-sharing service, Uber to match drivers with passengers and optimize pickup and drop-off locations. Start from 1.



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21CSE206T– ARTIFICIAL INTELLIGENCE

Best Practices in Class – Activity 4

Think – Pair – Share Activity

Name: P. M. P. Gautham Register Number: RA2211028010211

Topic 1: Imagine you are in a maze, represented by a graph where each room is a node and each door is an edge connecting two nodes. The task is to find a path from the entrance of the maze to the exit. Nodes represent rooms in the maze. Edges represent doors connecting the rooms.

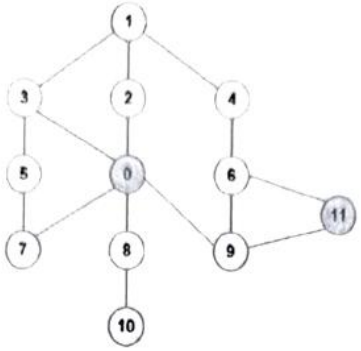
What do I think	What does my partner think	What we decided to share
A - B - C - Exit	D - E - F - Exit	D - E - F - Exit

Topic 2: You are given a social network represented by a graph. Each node in the graph represents a person, and each edge represents a friendship connection between two people. Your task is to find the shortest path of friendships between two given individuals.

A & I

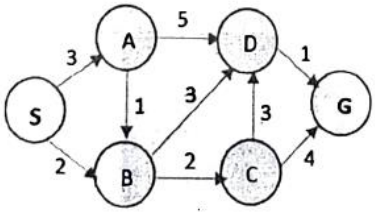
What do I think	What does my partner think	What we decided to share
DFS A → C → G → I	DFS ~~A B D~~ A → C → G - I	DFS A → C → G → I Only common connections of nodes through shortest way possible.

Topic 3: You are standing at your house (1) and you have multiple ways to go from your house to the grocery store (9). Select your path to reach the grocery store.



What do I think	What does my partner think	What we decided to share
1 → 2 → 0 → 9	1 → 4 → 6 → 9	1 → 2 → 0 → 9 Backtracking and reaching other places is feasible.

Topic 4: You are planning a trip from City S to City G, with layovers in City A, B,C and D. Each flight segment has a cost (in dollars) and a duration (in hours). You want to find the cheapest route from City S to City G, considering both the total cost and the total travel time.



What do I think	What does my partner think	What we decided to share
S → B → D → G 2 + 3 + 1 = 6	S → B → C → G 2 + 2 + 4 = 8	S → B → D → G 2 + 3 + 1 = 6 shortest :: least cost

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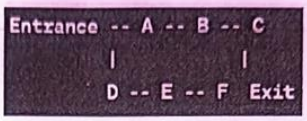
21CSE206T– ARTIFICIAL INTELLIGENCE

Best Practices in Class – Activity 4

Think – Pair – Share Activity

Name: Amilasha Salaria Register Number: RA2211028010211

Topic 1: Imagine you are in a maze, represented by a graph where each room is a node and each door is an edge connecting two nodes. The task is to find a path from the entrance of the maze to the exit. Nodes represent rooms in the maze. Edges represent doors connecting the rooms.

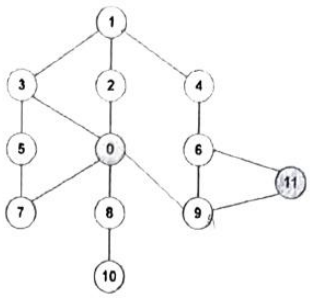


What do I think	What does my partner think	What we decided to share
D-E-F-exit	D→E-F	D→E→F (shortest path)

Topic 2: You are given a social network represented by a graph. Each node in the graph represents a person, and each edge represents a friendship connection between two people. Your task is to find the shortest path of friendships between two given individuals.

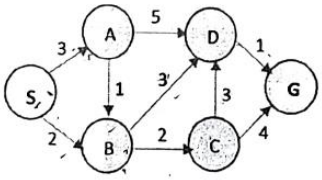
What do I think	What does my partner think	What we decided to share
A→C→G→I	A→B→C→D→E→F→G→H→I [DFS]	A→C→G→I (DFS) goal is to reach faster

Topic 3: You are standing at your house (1) and you have multiple ways to go from your house to the grocery store (9). Select your path to reach the grocery store.

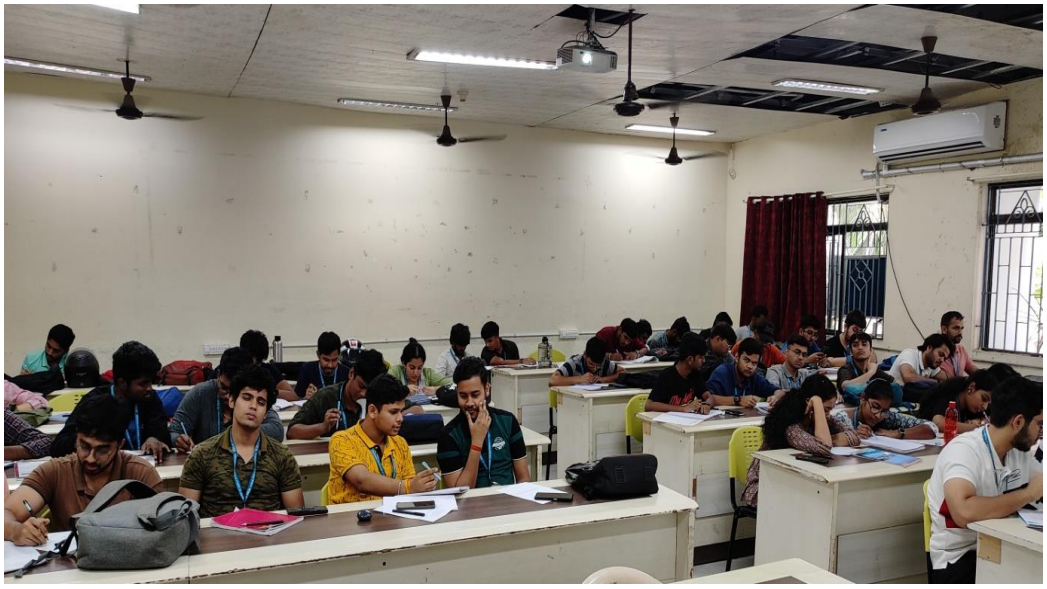


What do I think	What does my partner think	What we decided to share
1→4→6→9	1→2→0→9	1→2→0→9 (shortest ~~path~~ cost

Topic 4: You are planning a trip from City S to City G, with layovers in City A, B,C and D. Each flight segment has a cost (in dollars) and a duration (in hours). You want to find the cheapest route from City S to City G, considering both the total cost and the total travel time.



What do I think	What does my partner think	What we decided to share
S→B→D→G 2+3+1=6	S→B→C→D→G Path cost = 8.	S→B→D→G 2+3+1=6 Dijkstra's algo



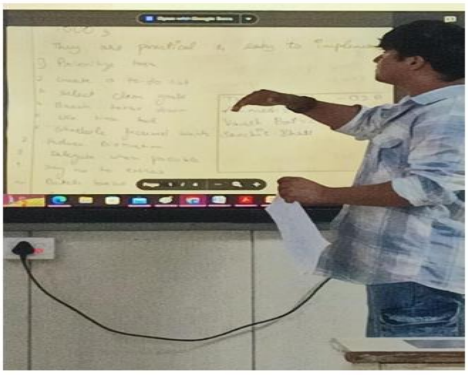
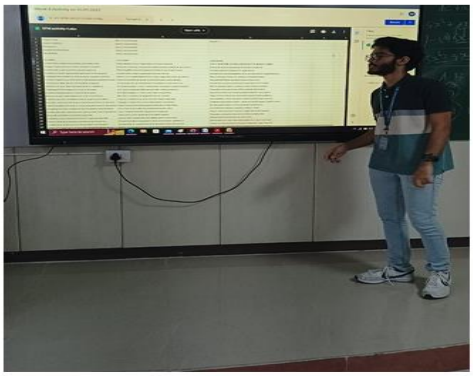

DATA SCIENCE
DATA SCIENCE

2. Flipped Classroom

The flipped classroom is a learner-centric model where students are introduced to new concepts through pre-recorded lectures, readings, or videos before class. Classroom time is then devoted to collaborative activities like problem-solving, discussions, and hands-on exercises.

Sample: The students were given the information about the AI problem solving before the class and asked to come up with innovative ideas to represent the problem during the class hours.

AI problem solving

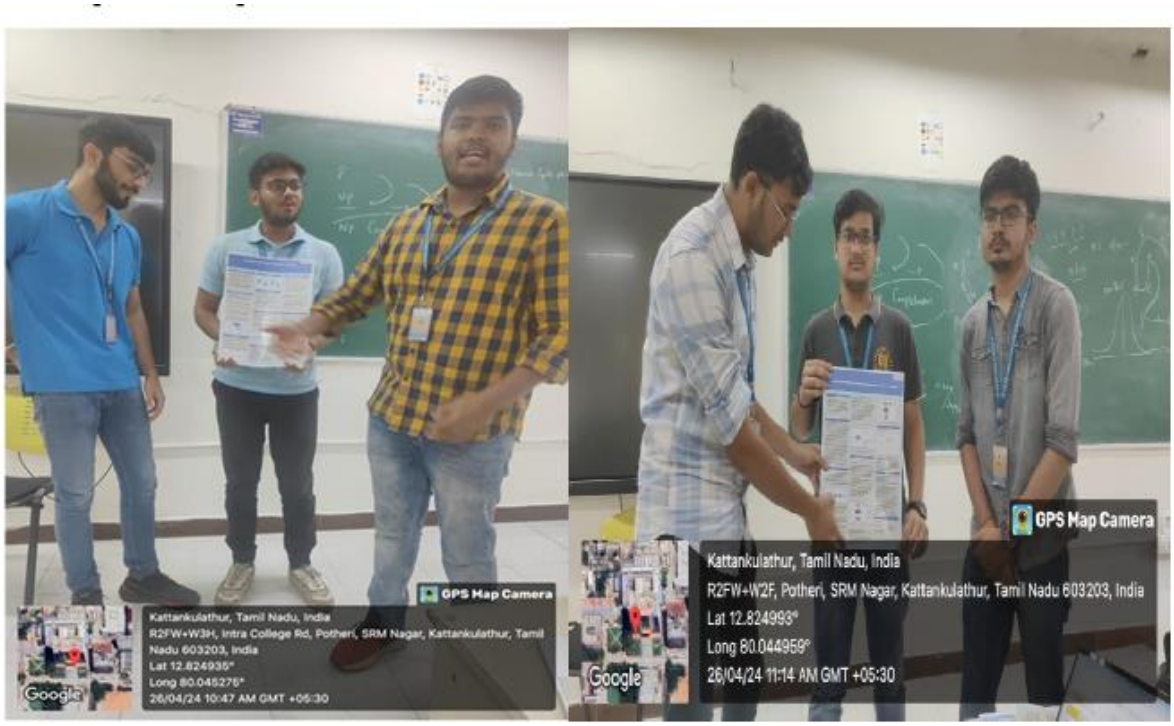
Trends in AI

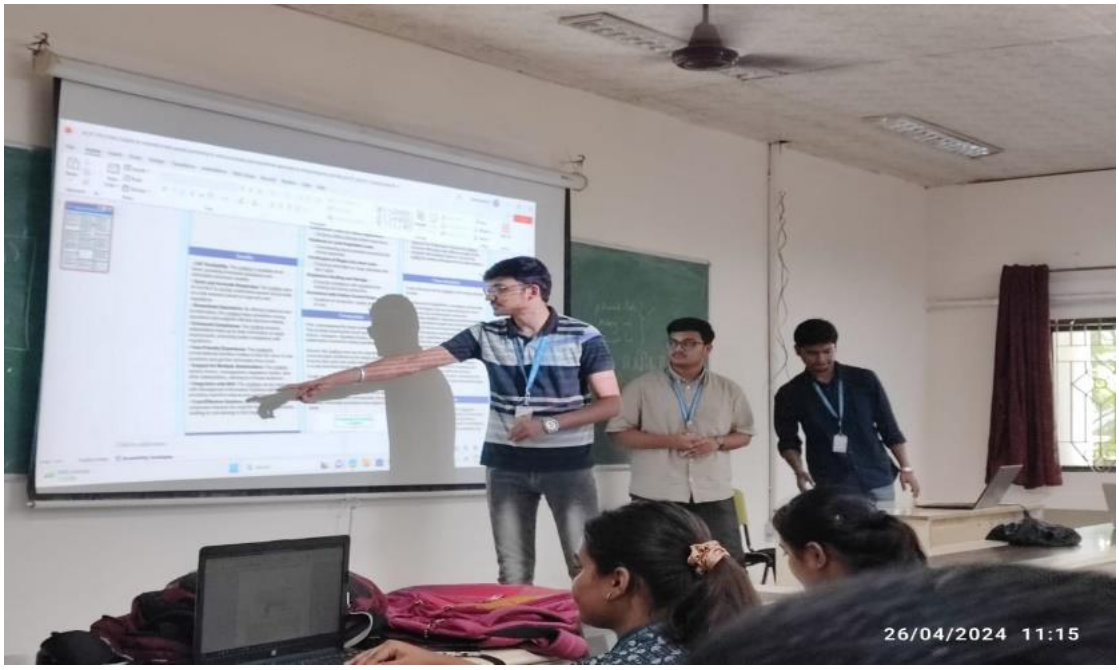
Flip class- semantics and knowledge base building - inferences – reasoning patterns in propositional logic


3. Project-Based Learning (PBL)

Sample: Poster Presentation

The students were given a set of real-world problems to come with ideas to solve them and represent as posters

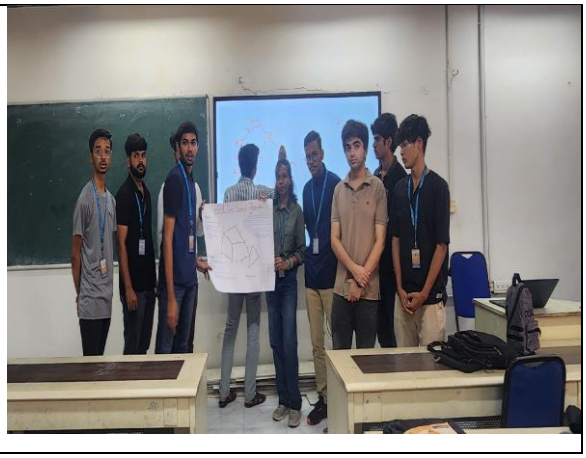




4. Collaborative Learning:

Group activity:

Demonstration of Role of AI in Image Processing

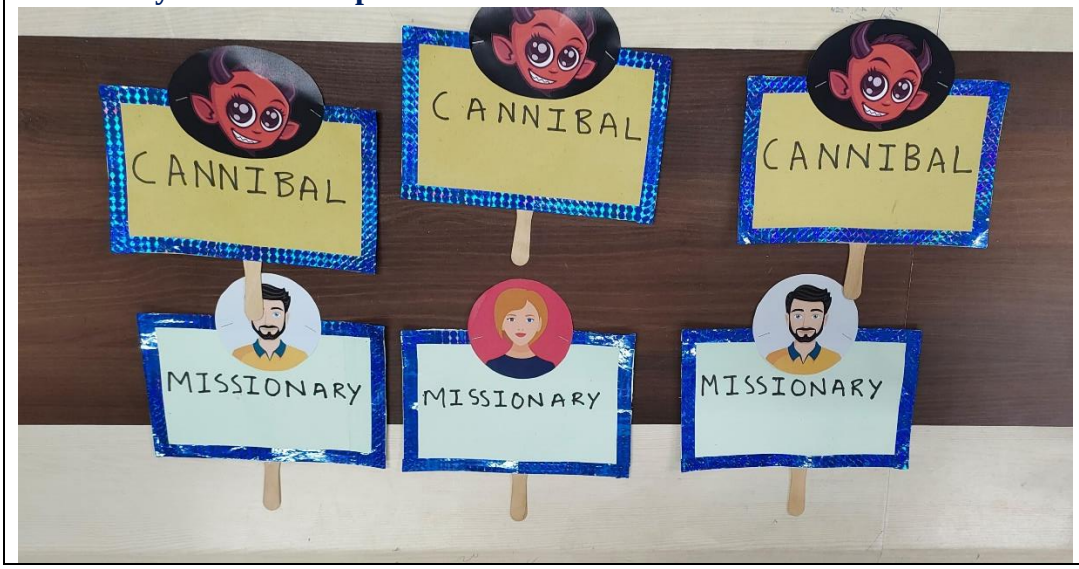


5. Gamification

Stack and Queue concept

Puzzle play- CSP problem, A* problem

Missionary and Canibal problems



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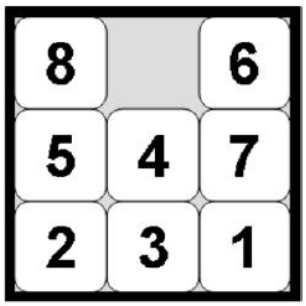
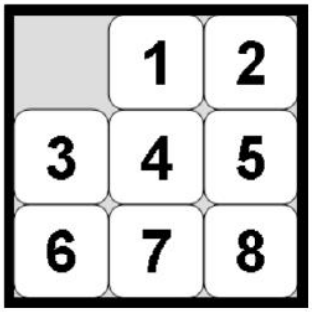
21CSE206T– ARTIFICIAL INTELLIGENCE

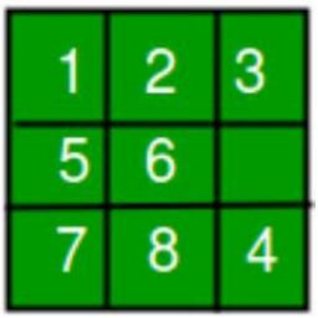
Q2 Section - Best Practices in Class - Activity Sheet – 2

1. Below is a Eight Puzzle, Take it for a spin

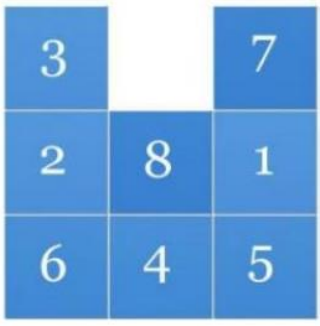


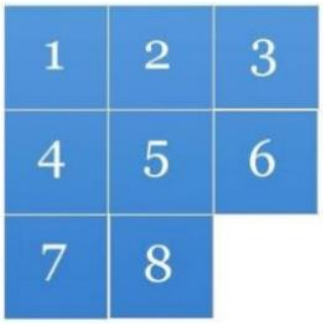


2. Below is a Eight Puzzle, Give it a shot

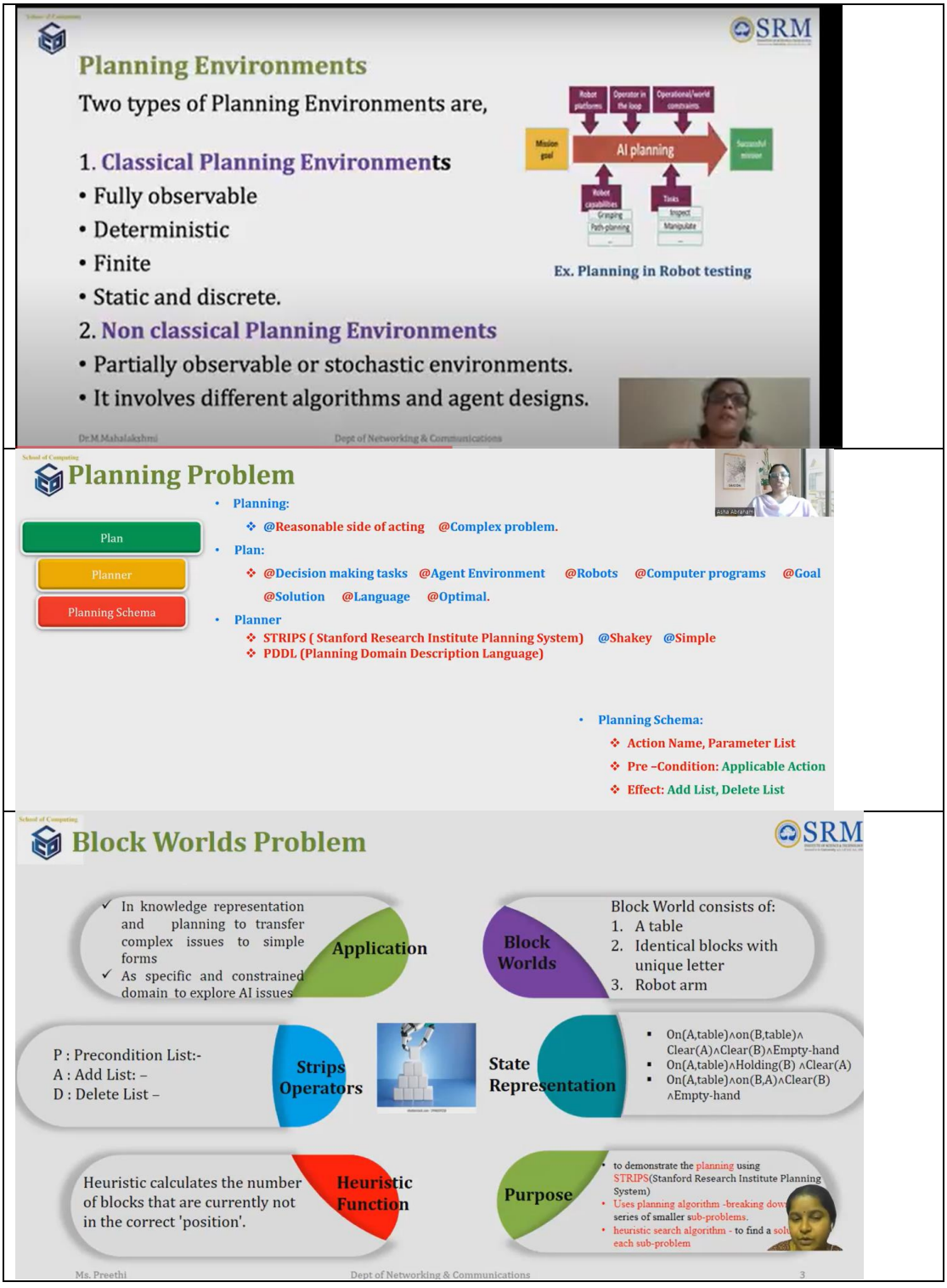


3. Below is a Eight Puzzle, Try it out





5. Blended Learning and Technology Integration- Lecturers of faculty



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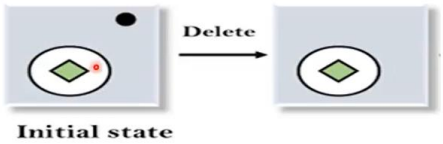
Mean Ends Analysis Learning

MEA – Solved Example

- Find the operators that can be applied to the current state to get a new state.
- In the first stage, we can apply the delete operator to remove the black smaller circle



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Regression in Supervised Machine Learning

Definition
Predicting continuous numerical values for input data

Dataset

Regression

$f($  $)= 20500.50$

Algorithms
- Linear Regression,
- Polynomial Regression,
- Support Vector Regression,
- etc.

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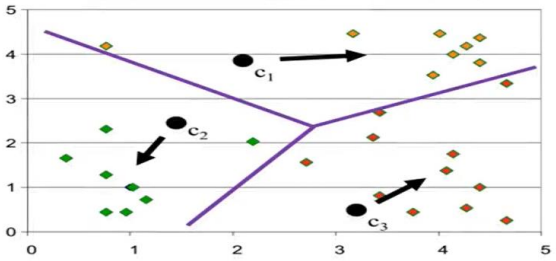
Steps of K-means

K-means clustering example — step 3

Re-estimate cluster centers (adapt synaptic weights)



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Q-Learning Algorithm

- For each **s, a** initialize the table entry $\hat{Q}(s, a)$ to zero.
- Observe the current state **s**
- Do forever:
  - Select an action **a** and execute it
  - Receive immediate reward **r**
  - Observe the new state **s'**
  - Update the table entry for $\hat{Q}(s, a)$ as follows:

$$\hat{\mathbf{Q}}(\mathbf{s}, \mathbf{a}) = \mathbf{r} + \boldsymbol{\gamma} \max_{\mathbf{a}'} \hat{\mathbf{Q}}(\mathbf{s}', \mathbf{a}')$$

  - s← s'

Introduction to Planning Agent

- A planning agent will construct plans to achieve its goals, and then execute them.
- Analyze a situation in which it finds itself and develop a strategy for achieving the agent's goal.
- Achieving a goal requires finding a sequence of actions that can be expected to have the **desired** outcome

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Architecture of Expert System contd..

The various components are

- User
- User Interface
- Inference Engine
- Knowledge Base
- Knowledge Engineer
- Human Expert