Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25 Onwards

Course Information	
Programme	M.Tech. (Computer Science and Engineering)
Class, Semester	Second Year M. Tech., Sem I
Course Code	7CO691
Course Name	Dissertation Phase-I
Desired Requisites:	Research Methodology, Project management

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	24 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40(POE)	100
		Credits: 12			

Course Objectives

1	To develop the student to apply the knowledge gained to identify problems for research and provide the solutions by self-study and interaction with stakeholders.
2	Share knowledge to tackle real world problems of societal concerns
3	Impart flexibility to the student to have increased control over his/ her learning
4	Enhance a students' learning through increased interaction with peers and colleagues.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Study existing literature and identify research problems.	IV	Analysing
CO2	Design and develop solutions for complex problems	V	Evaluating
CO3	Create new prototypes or models in a specialized field.	VI	Creating
CO4	Apply advanced research methodologies to conduct experiments.	III	Applying

List of Experiments / Lab Activities/Topics

List of Lab Activities:

Students are expected to undertake independent research work on their chosen topic. During this semester, the following tasks should be accomplished:

1. **Independent Research Work:**
   - Initiate and conduct independent research on the chosen topic.
2. **Literature Survey:**
   - Perform an exhaustive literature survey to gain a comprehensive understanding of existing work and identify gaps.
3. **Research Problem Formulation:**
   - Formulate a clear and well-defined research problem based on the literature survey.
4. **Experimental Setup Development/Fabrication (if applicable):**
   - Develop or fabricate the necessary experimental setup required for the research. This may include hardware, software, or computational tools.
5. **Initial Testing and Analysis:**
   - Conduct initial testing using the developed experimental setup.
   - Analyze the preliminary results obtained from the initial tests.
6. **Documentation:**
   - Document all research activities, including literature survey findings, problem formulation, experimental setup, and initial results analysis.

Textbooks	
1	As per the research topic
References	
1	Papers from National and International Journals
Useful Links	
1	Introduction to Research- NPTEL Course: Link
2	Overview of Research – Video: Link
3	Project Management- Course: Link
4	Project Management for Managers- Course: Link

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	1			1		2
CO2	1		1		2	1
CO3		2				1
CO4	1			1		2
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.						

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing (min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Lab activities for Dissertation Phase-I shall encompass a range of research-focused tasks, tailored to support independent research work. These activities may include but are not limited to:

1. **Experiments:**
    - Conducting experiments relevant to the research topic.
    - Performing 8-10 carefully planned experiments to gather initial data.
2. **Mini-Projects:**
    - Working on mini-projects that contribute to the larger dissertation goal.
    - Developing prototypes or models as part of the experimental setup.
3. **Presentations:**
    - Preparing and delivering presentations on research progress.
    - Sharing literature survey findings, problem formulation, and initial results.
4. **Drawings and Schematics:**
    - Creating detailed drawings and schematics for experimental setups or prototypes.
    - Documenting design processes and setup configurations.
5. **Programming:**
    - Writing and testing code required for experiments or simulations.
    - Developing algorithms and software tools needed for research.
6. **Related Activities:**
    - Engaging in other suitable activities that support the research, such as:
        - Data collection and analysis
        - Model simulations
        - Literature reviews and documentation

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AY 2024-25 Onwards

Course Information	
Programme	M.Tech. (Computer Science and Engineering)
Class, Semester	Second Year M. Tech., Sem I
Course Code	7CO611
Course Name	Deep Learning for Computer Vision
Desired Requisites:	Completion of a basic course in Machine Learning (Recommended, but not mandatory) Completion of a course in Deep Learning, or exposure to topics in neural networks Knowledge of basics in probability, linear algebra, and calculus Experience of programming, preferably in Python

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/ week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To provide a comprehensive understanding of fundamental and advanced concepts in computer vision, including image representation, feature extraction, and visual matching techniques.
2	To equip students with the knowledge and skills to implement and utilize various neural network architectures, specifically Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs), for image and video processing tasks.
3	To introduce students to deep generative models and their applications in vision, enabling them to understand and implement Generative Adversarial Networks (GANs) and Variational Autoencoders (VAEs).
4	To familiarize students with recent trends and advancements in computer vision, such as few-shot learning, self-supervised learning, and attention models, and their implications for future research and applications.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Demonstrate an understanding of image representation and fundamental image processing techniques.	II	Understanding
CO2	Implement and utilize various feature extraction and visual matching techniques in computer vision applications.	III	Applying
CO3	Apply and fine-tune neural network architectures, specifically CNNs and RNNs, for tasks such as image classification, object detection, and video understanding.	IV	Analysing
CO4	Develop and implement deep generative models, such as GANs and VAEs, and apply them to various computer vision tasks.	VI	Creating

Module	**Module Contents**	**Hours**

I	Introduction and Overview: ● Course Overview and Motivation; History of Computer Vision; Image Representation; Linear Filtering, Correlation, Convolution; Image in Frequency Domain ● (Optional) Image Formation; Image Sampling Visual Features and Representations: ● Edge Detection; From Edges to Blobs and Corners; Scale Space, Image Pyramids and Filter Bank; SIFT and Variants; Other Feature Spaces ● (Optional) Image Segmentation, Human Visual System	6
II	Visual Matching: ● Feature Matching; From Points to Images: Bag-of-Words and VLAD Representations; Image Descriptor Matching; From Traditional Vision to Deep Learning ● (Optional) Hough Transform; Pyramid Matching Deep Learning Review: ● Neural Networks: A Review; Feedforward Neural Networks and Backpropagation; Gradient Descent and Variants; Regularization in Neural Networks; Improving Training of Neural Networks	7
III	Convolutional Neural Networks (CNNs): ● Convolutional Neural Networks: An Introduction; Backpropagation in CNNs; Evolution of CNN Architectures for Image Classification; Recent CNN Architectures; Finetuning in CNNs Visualization and Understanding CNNs: ● Explaining CNNs: Visualization Methods; Early Methods (Visualization of Kernels; Backprop-to-image/Deconvolution Methods); Class Attribution Map Methods (CAM,Grad-CAM, Grad-CAM++, etc); Going Beyond Explaining CNNs ● (Optional) Explaining CNNs: Recent Methods	7
IV	CNNs for Recognition, Verification, Detection, Segmentation: ● CNNs for Object Detection; CNNs for Segmentation; CNNs for Human Understanding: Faces ● (Optional) CNNs for Human Understanding: Human Pose and Crowd; CNNs for Other Image Tasks Recurrent Neural Networks (RNNs): ● Recurrent Neural Networks: Introduction; Backpropagation in RNNs; LSTMs and GRUs; Video Understanding using CNNs and RNNs	7
V	Attention Models: ● Attention in Vision Models: An Introduction; Vision and Language: Image Captioning; Self-Attention and Transformers ● (Optional) Beyond Captioning: Visual QA, Visual Dialog; Other Attention Models Deep Generative Models: ● Deep Generative Models: An Introduction; Generative Adversarial Networks; Variational Autoencoders; Combining VAEs and GANs ● (Optional) Beyond VAEs and GANs: Other Deep Generative Models	6
VI	Variants and Applications of Generative Models in Vision: ● GAN Improvements; Deep Generative Models across Multiple Domains; Deep Generative Models: Image Application ● (Optional) VAEs and Disentanglement; Deep Generative Models: Video Applications Recent Trends: ● Few-shot and Zero-shot Learning; Self-Supervised Learning; Adversarial Robustness; Course Conclusion ● (Optional) Pruning and Model Compression; Neural Architecture Search	6
Textbooks		

1	Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, 2016
2	Michael Nielsen, Neural Networks and Deep Learning, 2016
3	Yoshua Bengio, Learning Deep Architectures for AI, 2009
4	David Forsyth, Jean Ponce, Computer Vision: A Modern Approach, 2002.
References	
1	Richard Szeliski, Computer Vision: Algorithms and Applications, 2010.
2	Simon Prince, Computer Vision: Models, Learning, and Inference, 2012.
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc24_cs89/preview

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	3	2	1	1	2	1
CO2	3	3	2	1	3	1
CO3	3	3	3	2	3	1
CO4	3	3	3	2	3	1
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.						

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2024-25 Onwards

Course Information	
Programme	M.Tech. (Computer Science and Engineering)
Class, Semester	Second Year M. Tech., Sem I
Course Code	7CO612
Course Name	Reinforcement Learning
Desired Requisites:	Mathematical Foundation of Computer Science

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To understand the fundamental principles of reinforcement learning (RL) and multi-armed bandit problems
2	To explore various bandit algorithms and their applications
3	To delve into Markov Decision Processes (MDPs) and dynamic programming methods
4	To study advanced RL techniques and their implementations

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain the fundamental principles of reinforcement learning and multi-armed bandit problems.	II	Understanding
CO2	Apply various bandit algorithms such as UCB, PAC, Median Elimination, and Policy Gradient to solve decision-making problems.	III	Applying
CO3	Analyze and solve Markov Decision Processes (MDPs) using dynamic programming methods like Bellman Optimality, TD Methods, and Eligibility Traces.	IV	Analyzing
CO4	Develop and implement advanced reinforcement learning techniques including Function Approximation, Least Squares Methods, Fitted Q, DQN, Policy Gradient for Full RL, Hierarchical RL, and POMDPs.	VI	Creating

Module	**Module Contents**	**Hours**
I	Introduction Bandit algorithms – UCB, PAC	6
II	Bandit algorithms –Median Elimination, Policy Gradient Full RL & MDPs	7
III	Bellman Optimality Dynamic Programming & TD Methods	7
IV	Eligibility Traces Function Approximation	7
V	Least Squares Methods Fitted Q, DQN & Policy Gradient for Full RL	6
VI	Hierarchical RL POMDPs	6

Textbooks

1	R. S. Sutton and A. G. Barto. Reinforcement Learning - An Introduction. MIT Press. 1998.

References	
1	R. S. Sutton and A. G. Barto. Reinforcement Learning - An Introduction. MIT Press. 1998.

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc24_cs102/preview

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	3	1	1	1	2	1
CO2	3	2	2	1	3	1
CO3	3	3	3	2	3	1
CO4	3	3	3	2	3	1
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.						

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2024-25 Onwards

Course Information

Programme	M.Tech. (Computer Science and Engineering)
Class, Semester	Second Year M. Tech., Sem I
Course Code	7CO613
Course Name	Multi-Core Computer Architecture
Desired Requisites:	Second-year undergraduate or above or any level of postgraduates in Computer Science and related fields (like ECE, EEE, IT etc.). A basic understanding of digital logic, microprocessors, computer organization will be added advantage.

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To understand the fundamental concepts of computer organization and instruction set architecture
2	To explore advanced pipelining techniques and their impact on processor performance
3	To analyze and optimize memory systems, with an emphasis on cache memory design and optimization
4	To investigate the architecture and design of multi-core processors and network-on-chip (NoC) systems

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain the fundamental concepts of computer organization, instruction set architecture, and memory and I/O addressing	II	Understanding
CO2	Analyze pipeline hazards and branch prediction techniques to improve instruction pipeline performance.	IV	Analyzing
CO3	Apply advanced techniques for cache memory design and optimization, including block replacement strategies and cache coherence protocols.	III	Applying
CO4	Develop and evaluate multi-core processor and network-on-chip (NoC) architectures for energy efficiency and quality of service.	V	Evaluating

Module	**Module Contents**	**Hours**
I	Basic Computer Organization: Review of Basic Computer Organization, Basic operational concepts, fundamental of program execution, memory and I/O addressing, Instruction set architecture- addressing modes, instruction set, instruction encoding and formats. CISC vs RISC ISA. Instruction Pipeline Principles: Performance Evaluation Methods, Introduction to RISC Instruction Pipeline, Instruction Pipeline and Performance.Pipeline Hazards and Analysis	6

II	Pipeline Hazards and Branch Prediction Techniques: Pipeline Hazards Management Techniques,Branch Prediction, MIPS Pipeline for Multi-Cycle Operations. Pipeline Scheduling and Speculative execution: Compiler Techniques to Explore Instruction Level Parallelism, Dynamic Scheduling with Tomasulo's Algorithm, Speculative Execution	6
III	Superscalar Processors and GPU architectures: Advanced Pipelining, Multithreading and Hyperthreading, Superscalar Processors, GPU Architectures. Cache Memory Principles Introduction to Cache Memory, Block Replacement Techniques and Write Strategy, Design Concepts in Cache Memory.	7
IV	Cache Memory Optimizations Design issues for improving memory access time, Basic and Advanced Optimization Techniques in Cache Memory Cache Coherence Protocols Cache coherence and memory consistency, Snoop Based and Directory Based Cache coherence Protocols	7
V	Primary Storage Systems Introduction to DRAM System, DRAM organization, DRAM Controllers and Address Mapping. Tiled Chip Multi-Core Processors & Network-on-Chip Tiled Chip Multicore Processors (TCMP), Network on Chips (NoC), Routing Algorithms, NoC router – architecture, Routing and flow control	7
VI	Energy Efficient NoCs Introduction to deflection routing, Energy Efficient Buffer-less NoC Routers, Side-buffered Deflection Routers Quality of Service for TCMPs QoS of NoC and Caches in TCMPs, Emerging Trends in Network On Chips, Domain Specific Accelerators	6

Textbooks	
1	Computer Architecture - A Quantitative Approach-5e John L. Hennessy, David A. Patterson Morgan Kaufman.
2	Cache, DRAM and Disk Bruce Jacob, Spencer W. Ng, David T. Wang Morgan Kaufman.
References	
1	Principles and Practices of Interconnection Networks William J. Dally, Brian P. Towles Elsevier
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc24_cs93/preview

CO-PO Mapping

	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1			3	2	1	
CO2	3	3				2
CO3		2	2			
CO4				2	2	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2024-25 Onwards

Course Information	
Programme	M.Tech. (Computer Science and Engineering)
Class, Semester	Second Year M. Tech., Sem I
Course Code	7CO614
Course Name	Ethical Hacking
Desired Requisites:	Basic concepts in programming and networking

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	Understand the principles and ethical implications of ethical hacking.
2	Gain foundational knowledge of computer networking and the TCP/IP protocol stack.
3	Learn IP addressing, routing, and the significance of IPv6.
4	Use tools for vulnerability assessment and penetration testing.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Apply ethical hacking principles responsibly.	III	Applying
CO2	Configure and troubleshoot network settings.	III	Applying
CO3	Implement and understand routing protocols and IPv6.	IV	Analysing
CO4	Conduct vulnerability assessments and penetration tests using various tools.	IV	Analysing

Module	**Module Contents**	**Hours**
I	Introduction to ethical hacking. Fundamentals of computer networking. TCP/IP protocol stack. IP addressing and routing. TCP and UDP. IP subnets.	6
II	Week 3: Routing protocols. IP version 6. Installation of attacker and victim system. Information gathering using advanced google search, archive.org, netcraft, whois, host, dig, dnsenum and NMAP tool.	6
III	Vulnerability scanning using NMAP and Nessus. Creating a secure hacking environment. System Hacking: password cracking, privilege escalation, application execution. Malware and Virus. ARP spoofing and MAC attack. Introduction to cryptography, private-key encryption, public-key encryption.	7
IV	Cryptographic hash functions, digital signature and certificate, applications. Steganography, biometric authentication, network-based attacks, DNS and Email security.	6
V	Packet sniffing using wireshark and burpsuite, password attack using burp suite. Social engineering attacks and Denial of service attacks. Elements of hardware security: side-channel attacks, physical inclinable functions, hardware trojans.	7

VI	Different types of attacks using Metasploit framework: password cracking, privilege escalation, remote code execution, etc.Attack on web servers: password attack, SQL injection, cross site scripting. Case studies: various attacks scenarios and their remedies.	7

Textbooks	
1	Data and Computer Communications -- W. Stallings.
2	Data Communication and Networking -- B. A. Forouzan
3	TCP/IP Protocol Suite -- B. A. Forouzan
4	UNIX Network Programming -- W. R. Stallings
References	
1	Introduction to Computer Networks and Cybersecurity -- C-H. Wu and J. D. Irwin
2	Cryptography and Network Security: Principles and Practice -- W. Stallings
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc24_cs94/preview
2	

CO-PO Mapping

	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	3		3			1
CO2		3			2	
CO3		3		1	2	
CO4			3			1

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2024-25 Onwards

Course Information	
Programme	M.Tech. (Computer Science and Engineering)
Class, Semester	Second Year M. Tech., Sem I
Course Code	7CO615
Course Name	Applied Accelerated Artificial Intelligence
Desired Requisites:	Prior knowledge of Computer Organization, High-Performance; Computing, Machine Learning and Deep learning is desirable

Teaching Scheme		Examination Scheme (Marks)			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To provide comprehensive knowledge of AI systems hardware, including accelerators and GPUs, and their role in computational efficiency for AI applications.
2	Understanding of operating systems, virtualization, and cloud computing, essential for deploying and managing AI systems in diverse environments.
3	To deploy and scale AI services effectively.
4	It will delve into deep learning frameworks such as PyTorch and TensorFlow, optimizing training and inference processes crucial for AI model development and deployment

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	gain knowledge of AI accelerators and GPUs, their architectures, and their application in accelerating AI workloads.	II	Understanding
CO2	demonstrate proficiency in operating systems, virtualization technologies, and cloud computing, essential for deploying and managing AI applications.	III	Applying
CO3	master containerization technologies such as Docker and Kubernetes for deploying and scaling AI services efficiently.	IV	Analysing
CO4	develop expertise in deep learning frameworks like PyTorch and TensorFlow, optimizing deep learning model training and inference processes.	V	Evaluating

Module	Module Contents	Hours
I	Introduction to AI Systems Hardware part 1,Introduction to AI Systems Hardware part 2,Introduction to AI Accelerators,GPUs,Introduction to Operating Systems, Virtualization, Cloud part 1,Introduction to Operating Systems, Virtualization, Cloud part 2 Introduction to Containers and IDE Dockers part1,Introduction to Containers and IDE Dockers part 2,Scheduling and Resource Management part 1,Scheduling and Resource Management part 2,DeepOps: Deep Dive into Kubernetes with deployment of various AI based Services Part 1,DeepOps: Deep Dive into Kubernetes with deployment of various AI based Services Part 2	8

II	DeepOps: Deep Dive into Kubernetes with deployment of various AI based Services Session II part 1, DeepOps: Deep Dive into Kubernetes with deployment of various AI based Services Session II part 2, Design principles for Building High Performance Clusters part 1, Design principles for Building High Performance Clusters part 2, Design principles for Building High Performance Clusters part 3, Design principles for Building High Performance Clusters part 4 Introduction to Pytorch part 1,Introduction to Pytorch part 2,Introduction to Pytorch part 3,Introduction to Pytorch part 4,Profiling with DLProf Pytorch Catalyst part 1,Profiling with DLProf Pytorch Catalyst part 2	8
III	Week 5: Introduction to TensorFlow part 1,Introduction to TensorFlow part 2,Accelerated TensorFlow,Accelerated TensorFlow,Accelerated TensorFlow - XLA Approach,Accelerated TensorFlow - XLA Approach Optimizing Deep learning Training: Automatic Mixed Precision part 1,Optimizing Deep learning Training: Automatic Mixed Precision part 2,Optimizing Deep learning Training: Transfer Learning part 1,Optimizing Deep learning Training: Transfer Learning part 2	7
IV	Week 7: Fundamentals of Distributed AI Computing Session 1 Part 1, Fundamentals of Distributed AI Computing Session 1 Part 2, Fundamentals of Distributed AI Computing Session 2 Part 1, Fundamentals of Distributed AI Computing Session 2 Part 2, Distributed Deep Learning using Tensorflow and Horovod Challenges with Distributed Deep Learning Training Convergence, Fundamentals of Accelerating Deployment part 1, Fundamentals of Accelerating Deployment part 2	7
V	Accelerating neural network inference in PyTorch and TensorFlow part 1, Accelerating neural network inference in PyTorch and TensorFlow part 2, Accelerated Data Analytics part 1, Accelerated Data Analytics part 2, Accelerated Data Analytics part 3, Accelerated Data Analytics part 4, Accelerated Machine Learning Introduction to NLP part 1 ,Introdcution to NLP part 2	6
VI	Applied AI: Smart City (Intelligent Video Analytics) Session 1 part 1,Applied AI: Smart City (Intelligent Video Analytics) Session 1 part 2,Applied AI: Smart City (Intelligent Video Analytics) Session 2 Deepstream part 1,Applied AI: Smart City (Intelligent Video Analytics) Session 2 Deepstream part 2 Introduction to word embedding,Text classification using word embedding	6

Textbooks	
1	"Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig
2	"Operating System Concepts" by Abraham Silberschatz, Peter B. Galvin, and Greg Gagne
3	"Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl
4	"Docker Deep Dive" by Nigel Poulton
References	
1	"Accelerating Deep Learning with GPU" by Bharath Ramsundar, Reza Zadeh
2	"TensorFlow for Deep Learning: From Linear Regression to Reinforcement Learning" by Bharath Ramsundar and Reza Bosagh Zadeh
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc24_cs104/preview
2	
CO-PO Mapping	
	Programme Outcomes (PO)

	1	2	3	4	5	6
CO1	2		1	1		
CO2		2	1	1	2	
CO3	2		1	2		
CO4			1	1		2

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2024-25 Onwards

Course Information	
Programme	M.Tech. (Computer Science and Engineering)
Class, Semester	Second Year M. Tech., Sem I
Course Code	7CO616
Course Name	Social Network Analysis
Desired Requisites:	Python programming, Probability and Statistics, Machine Learning

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	Develop fundamental skills in network analysis using NetworkX and graph visualization tools.
2	Gain practical experience in applying network measures and growth models.
3	Explore advanced topics in graph theory, including representation learning for deep learning applications.
4	Apply network analysis techniques to solve real-world problems and study their effects in cascade behavior and anomaly detection.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	understand fundamental concepts of network analysis, including network measures, growth models, and link analysis.	II	Understanding
CO2	apply NetworkX and graph visualization tools effectively to analyze and visualize networks.	III	Applying
CO3	explore advanced topics such as graph representation learning and its applications in deep learning.	IV	Analysing
CO4	demonstrate proficiency in applying network analysis techniques to real-world scenarios, including link prediction, community detection, and anomaly detection.	V	Evaluating

Module	**Module Contents**	**Hours**
I	Introduction ; Tutorial 1: Introduction to Python/Colab ; Tutorial 2: Introduction to NetworkX - Part I Network Measures ; Tutorial 3: Introduction to NetworkX - Part II	8
II	Network Growth Models Link Analysis	7
III	Tutorial 4: Graph Visualization Tools ; Community Detection - Part I Community Detection - Part II	7
IV	Link Prediction Cascade Behavior and Network Effects	6
V	Anomaly Detection Introduction to Deep Learning ; Graph Representation Learning - Part I	6
VI	Graph Representation Learning - Part II ; Tutorial: Coding on Graph Representation Learning Applications and Case Studies ; Conclusion	6

Textbooks	
1	Social Network Analysis, Tanmoy Chakraborty, Wiley, 2021
2	Network Science, Albert-Lazzlo Barabasi
3	
4	

References	
1	Social Network Analysis: Methods and Applications, Stanley Wasserman, Katherine Faus
2	

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc24_cs90/preview
2	

CO-PO Mapping

	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	3			2		
CO2		3				1
CO3			3			1
CO4				3		1

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25 Onwards

Course Information	
Programme	M.Tech. (Computer Science and Engineering)
Class, Semester	Second Year M. Tech., Sem I
Course Code	7CO617
Course Name	Introduction to Industry 4.0 and Industrial Internet of Things
Desired Requisites:	Basic knowledge of computer and internet

Teaching Scheme		Examination Scheme (Marks)			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	Understand the Foundations of Industry 4.0 and IIoT
2	Gain proficiency in Cyber Physical Systems, next-generation sensors, AI, Big Data analytics, and their application in smart factories and industrial processes
3	Address IIoT Security and Infrastructure
4	Explore IIoT Business Models and Case Studies

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Gain in-depth knowledge of Industry 4.0 principles and Industrial IoT technologies, including sensing, communication, and networking in industrial environments.	II	Understanding
CO2	Develop skills in Cyber Physical Systems, AI, Big Data analytics, and AR/VR applications relevant to smart factories and industrial automation.	III	Applying
CO3	Acquire expertise in IIoT cybersecurity, industrial IoT processes, and implementation of secure networks using technologies like Software Defined Networks (SDN).	IV	Analysing
CO4	Apply IIoT business models, reference architectures, and analyze real-world case studies to solve practical challenges in industrial IoT deployments and operations.	IV	Analysing

Module	Module Contents	Hours
I	Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories	7
II	Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems.	7
III	IIoT-Introduction, Industrial IoT: Business Model and Referece Architerture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II. Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.	6

IV	Industrial IoT- Layers: IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III. Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.	6
V	Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II. Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.	6
VI	Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management. Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies : Case study - I : Milk Processing and Packaging Industries Case study - II: Manufacturing Industries - Part I Case study - III : Manufacturing Industries - Part II Case study - IV : Student Projects - Part I Case study - V : Student Projects - Part II Case study - VI : Virtual Reality Lab Case study - VII : Steel Technology Lab	7

Textbooks	
1	S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press.
2	
3	
4	

References	
1	S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.
2	

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc24_cs95/preview
2	https://www.amazon.in/Introduction-IoT-Sudip-Misra/dp/1108959741/ref=sr_1_1?dchild=1&keywords=sudip+misra&qid=1627359928&sr=8-1

CO-PO Mapping

	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	2		2	1	1	
CO2	2					
CO3		2		1		
CO4	1		1			

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Course Information	
Programme	M.Tech. (Computer Science and Engineering)
Class, Semester	Second Year M. Tech., Sem I
Course Code	7CO618
Course Name	Algorithmic Game Theory
Desired Requisites:	Knowledge of algorithms

Teaching Scheme		Examination Scheme (Marks)			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	Learn basic and advanced game theory concepts, including non-cooperative games and Nash equilibrium.
2	Master minmax strategies, potential games, and correlated equilibria for strategic decision-making.
3	Understand complexity classes like FNP, TFNP, and PPAD in relation to game theory algorithms.
4	Apply game theory to design mechanisms such as Bayesian games, VCG mechanisms, and stable matching for real-world scenarios.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Understand fundamental concepts of game theory, including Nash equilibrium and non-cooperative games.	II	Understanding
CO2	Analyze strategic scenarios using advanced techniques like minmax strategies, potential games, and correlated equilibria.	III	Analyzing
CO3	Apply game-theoretic principles to design mechanisms such as VCG mechanisms and stable matching for practical problem-solving.	IV	Applying
CO4	Evaluate the computational complexity of game-theoretic problems, considering complexity classes like FNP, TFNP, and PPAD.	V	Evaluating

Module	Module Contents	Hours
I	Introduction to game theory: Non-cooperative game theory, Zero sum and general sum games, Minmax strategies, Nash equilibrium	7
II	Yao's Lemma, Special Classes Games Potential Games, Local Search	7
III	:Complexity Classes: FNP, TFNP, PPAD Correlated Equilibrium, Coarse Correlated Equilibrium, Multiplicative Weight	7
IV	No Regret Dynamics, No Swap Regret Selfish Routing, Selfish Load Balancing	7
V	Bayesian Games, Extensive Form Games, Mechanism Design Gibbard Satterwaite Theorem, Quasi-Linear Environment	6
VI	VCG Mechanism, Knapsack Mechanism Stable Matching, House Allocation	6

Textbooks	
1	Nisan/Roughgarden/Tardos/Vazirani (eds), Algorithmic Game Theory, Cambridge University, 2007
2	Game Theory by Michael Maschler, Eilon Solan, and Shmuel Zamir
3	
4	

References	
1	Game Theory by Michael Maschler, Eilon Solan, and Shmuel Zamir.
2	

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc24_cs109/preview
2	

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	2					
CO2		2				
CO3			1			
CO4					1	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2024-25 Onwards

Course Information	
Programme	M.Tech. (Computer Science and Engineering)
Class, Semester	Second Year M. Tech., Sem II
Course Code	7CO692
Course Name	Dissertation Phase-II
Desired Requisites:	Research Methodology, Project management

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	34 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40(POE)	100
		Credits: 17			

Course Objectives

1	Develop advanced problem-solving skills through independent research and stakeholder collaboration.
2	Apply research findings to address real-world societal challenges effectively.
3	Promote flexible learning and peer interaction to enhance research autonomy.
4	Foster interdisciplinary collaboration for comprehensive knowledge exchange and skill development.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Analyse existing literature critically to identify emerging research gaps and formulate precise research questions.	IV	Analysing
CO2	Evaluate and refine solutions for complex research problems using advanced methodologies and theoretical frameworks	V	Evaluating
CO3	Apply advanced research methodologies to design and execute experiments, ensuring robust data collection and analysis.	III	Applying
CO4	Create innovative prototypes or models in a specialized field, integrating theoretical insights with practical applications.	VI	Creating

List of Experiments / Lab Activities/Topics

List of Lab Activities:

Students are expected to undertake independent research work on their chosen topic. During this semester, the following tasks should be accomplished:

Independent Research Advancement:

Independently advance and refine research on the chosen topic.

Advanced Literature Review:

Conduct an in-depth literature review to consolidate knowledge and identify advanced research avenues.

Refined Research Problem Definition:

Refine and articulate a well-defined research problem based on an updated literature review and Phase-I findings.

Advanced Experimental Setup Development:

Develop or enhance the experimental setup, incorporating advanced hardware, software, or computational tools as necessary.

Comprehensive Testing and Analysis:

Conduct comprehensive testing using the refined experimental setup.

Analyze and interpret detailed results obtained from extensive testing phases.

Thorough Documentation and Reporting:

Document all research phases comprehensively, including literature updates, refined problem statements, advanced experimental setups, and detailed analysis of results.

Textbooks	
1	As per the research topic
References	
1	Papers from National and International Journals
Useful Links	
1	Introduction to Research- NPTEL Course: Link
2	Overview of Research – Video: Link
3	Project Management- Course: Link
4	Project Management for Managers- Course: Link

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	1			1		2
CO2	1		1		2	1
CO3		2				1
CO4	1			1		2
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.						

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing (min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Lab activities for Dissertation Phase-I shall encompass a range of research-focused tasks, tailored to support independent research work. These activities may include but are not limited to:

- **Advanced Experimentation:**
  - Conduct advanced experiments aligned with refined research objectives.
  - Execute 8-10 experiments to gather detailed and conclusive data.
- **In-depth Mini-Projects:**
  - Undertake mini-projects integral to dissertation objectives, emphasizing prototype development and experimental refinement.
- **Strategic Presentations:**
  - Prepare and deliver presentations showcasing updated research progress and findings.
  - Communicate comprehensive insights from literature reviews, refined problem statements, and advanced results analysis.
- **Detailed Design Documentation:**
  - Create meticulous drawings and schematics of experimental setups, ensuring clarity in design and configuration documentation.
- **Advanced Programming and Simulation:**
  - Develop and validate complex algorithms and software tools critical for experimental execution and data analysis.
- **Additional Supportive Activities:**
  - Engage in supplementary tasks such as extensive data analysis, advanced model simulations, and detailed literature synthesis to bolster research outcomes.

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AY 2024-25 Onwards

Course Information

Programme	M.Tech. (Computer Science and Engineering)
Class, Semester	Second Year M. Tech., Sem II
Course Code	7CO645
Course Name	Internship
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	4 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-			100	100
		Credits: 2			

Course Objectives

1	To provide students with hands-on experience in a professional setting.
2	To apply theoretical knowledge in real-world scenarios.
3	To develop technical, analytical, and problem-solving skills.
4	To understand professional and ethical responsibilities in the workplace.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Demonstrate practical skills relevant to their field of study.	III	Applying
CO2	Analyze and solve complex engineering problems.	IV	Analysing
CO3	Communicate effectively in a professional environment.	V	Evaluating
CO4	Work effectively in teams.	VI	Creating

List of Experiments / Lab Activities/Topics

Orientation:

- Introduction to the organization.
- Overview of the company's projects and technologies.
- Assignment of a mentor/supervisor.

Project Work:

- **Phase 1: Understanding the Project**
  - Research and gather information about the project.
  - Define project goals and deliverables.
  - Create a project plan and timeline.
- **Phase 2: Implementation**
  - Apply technical skills to complete assigned tasks.
  - Participate in regular progress meetings with the mentor.
  - Document progress and any challenges faced.
- **Phase 3: Testing and Evaluation**
  - Test the developed solution.
  - Evaluate the project against predefined goals.
  - Make necessary improvements.

Professional Development:

- Attend seminars/workshops (if available).
- Network with professionals in the field.
- Participate in team meetings and discussions.

Textbooks	
1	As per the requirement of Internship
References	
1	As per the requirement of Internship
Useful Links	
1	As per the requirement of Internship

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	3		3	3		
CO2	3		3	3		
CO3		3			3	
CO4						3
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.						

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing (min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

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AY 2024-25 Onwards

Course Information

Programme	M.Tech. (Computer Science and Engineering)
Class, Semester	Second Year M. Tech., Sem II
Course Code	7CO646
Course Name	Student Portpholio
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	1 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-			100	100
		Credits: 1			

Course Objectives

1	To record and evaluate student performance in co-curricular and extracurricular activities over four years.
2	To encourage student participation in activities that develop leadership, teamwork, coordination, time management, communication, and interviewing skills.
3	To promote social responsibility through involvement in community service and awareness projects.
4	To motivate students to become active members of technical and professional organizations.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Demonstrate improvement in leadership skills through participation in student-led projects and organizations.	IV	Analysing
CO2	Exhibit enhanced communication skills through regular presentations and participation in debates.	III	Applying
CO3	Reflect on personal and professional development through periodic self-assessment and peer feedback.	V	Evaluating
CO4	Develop time management strategies by balancing academic, co-curricular, and extracurricular activities.	III	Applying

List of Experiments / Lab Activities/Topics

Module 1: Introduction and Overview

In Module 1, students will gain an understanding of co-curricular and extracurricular activities, distinguishing between the two and recognizing their significance in personal and professional development. The module will introduce the course objectives, emphasizing the expected outcomes and how they will be assessed throughout the program.

Module 2: Leadership and Teamwork Skills

Module 2 focuses on developing leadership and teamwork abilities essential for effective collaboration. Students will explore various leadership styles and theories, learn practical skills such as delegation, decision-making, and problem-solving. They will also delve into the dynamics of teamwork, understanding roles within teams, and techniques for managing conflicts. Practical exercises and team projects will reinforce these concepts.

Module 3: Communication Skills

Module 3 centers on enhancing communication skills crucial for effective interaction in professional settings. Students will refine both verbal and non-verbal communication techniques, practice public speaking and presentation skills, and hone their writing proficiency in professional and technical contexts, including emails and reports.

Module 4: Time Management and Organizational Skills

Module 4 addresses the importance of time management and organizational skills in balancing academic, co-curricular, and extracurricular activities. Students will learn principles of effective time management, develop strategies for setting priorities and goals, create and maintain schedules, and utilize tools to enhance productivity and organization.

Module 5: Social Responsibility and Community Engagement

Module 5 emphasizes social responsibility and community engagement. Students will explore the concept of social responsibility, understand its significance in contributing to society, and engage in community service projects aimed at addressing local needs. They will also learn to advocate for social causes through awareness campaigns and utilize platforms like social media for social good.

Module 6: Professional Development and Networking

Module 6 focuses on professional development and networking. Students will be introduced to various professional organizations relevant to their field of study, exploring the benefits of membership and opportunities for career growth. They will develop networking skills, build and maintain professional relationships, participate in networking events, and engage in activities that support lifelong learning and career advancement. Additionally, the module will cover self-assessment techniques, reflective practices for personal growth, and the importance of peer feedback and mentorship in professional development.

Textbooks	
1	As per the requirement of Activity
References	
1	As per the requirement of Activity
Useful Links	
1	As per the requirement of Activity

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	1	1	1	3	1	1
CO2	1	1	1	1	1	1
CO3	1	1	1	1	1	1
CO4	1	1	1	1	1	3
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.						

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing (min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40