GENERAL COURSE STRUCTURE & THEME

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (P) per week	1 Credit

B. ***Tentative Credit Distribution and*** **Second Year to Final Year curriculum structure for the completion of B.Tech. in Information Technology degree with one Minor/Honors/Research:**

Structure of B. Tech.in Information Technology with multidisciplinary minor:

Course Types/ Semester	I	II	III	IV	V	VI	VII	VIII	Total
Basic Science Course	8	8		--	--	--	--	--	16
Engineering Science Course	7	7		--	--	--	--	--	14
Programme Core Course (PCC)	--	2	15	11	11	11	--	--	50
Programme Elective Course (PEC)	--	--	--	--	8	6	6	-	20
Multidisciplinary Minor (MD M)		-	4	3	4	3			14
Open Elective (OE) Other than a particular program	--	--	3	3	2	--	--		8
Vocational and Skill Enhancement Course (VSEC)	2	2	--	2		2	--	--	8
Ability Enhancement Course (AEC -01, AEC-02)		2	--	2	--	--	--	--	4
Entrepreneurship/Economics/ Management Courses	--		2	2				--	4
Indian Knowledge System (IKS)	2			--	--	--	--	--	2
Value Education Course (VEC)	--	--	2	2	--	--	--	--	4
Research Methodology	--	--	--	--	--	--	2	--	2
Comm. Engg. Project (CEP)/Field Project (FP)	--	--	2	--	--	--		--	2
Project	--	--	--	--	--	--	6	--	6
Internship/ OJT	--	---			--	--		12	12
Co-curricular Courses (CC)	2	2		--	--	--	--	-	4
Total Credits / Semester with MDM	**21**	**23**	**28**	**25**	**25**	**22**	**14**	**12**	**170**
Total Credits / Semester with Double MDM	**21**	**23**	**32**	**28**	**29**	**25**	**13**	**12**	**184**
Honors Credits/ Semester						3	9	6	18
Total Credits / Semester with MDM +Honors	**21**	**23**	**28**	**25**	**25**	**25**	**23**	**18**	**188**
Research Credits/ Semester							**9**	**9**	**18**
Total Credits / Semester with MDM+Research	**21**	**23**	**28**	**25**	**25**	**22**	**23**	**21**	**188**

Students can opt for any of the following as per the rules and regulations given by institute:

1. **B.Tech with one Multidisciplinary Minor=Total 170Credits**
2. **B.Tech with one Multidisciplinary Minor and Honor in A.I.M.L. =Total 188 Credits**
3. **B. Tech with one Multidisciplinary Minor and Honor by Research=Total 188 Credits**
4. **B.Tech with two Multidisciplinary Minors=Total 184 Credits**

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SEMESTER- V												
Sr.No	Category	Course Code	Course Title	Hours per week			Credits	Continuous Evaluation in terms of Marks				Total
				L	T	P		ISEI	ISEII	ISEIII	ESE	
1	PCC	ITPCC3001	Artificial Intelligence	3	0	0	3	15	15	10	60	100
2	PCC	ITPCC3002	Design and Analysis of Algorithm	3	0	0	3	15	15	10	60	100
3	PCC	ITPCC3003	Cloud Computing	3	0	0	3	15	15	10	60	100
4	PCC	ITPCC3004	Lab Design and Analysis of Algorithm	0	0	2	1	-	-	25	25	50
5	PCC	ITPCC3005	Lab Cloud Computing	0	0	2	1	-	-	25	25	50
6	PEC	ITPEC3001 ITPEC3003 ITPEC3005	Professional Elective I	2	0	0	2	10	10	-	30	50
7	PEC	ITPEC3002 ITPEC3004 ITPEC3006	Lab-Professional Elective I	0	0	2	1	-	-	25	-	25
8	PEC	ITPEC3007 ITPEC3008	Professional Elective II	2	0	0	2	10	10	-	30	50
9	PEC	ITPEC3011 ITPEC3012 ITPEC3013	Professional Elective III	3	0	0	3	-	-	-	100	100
10	MDM	ITMDM5004 ITMDM6004	Java Programming Introduction to Artificial Intelligence	3	0	0	3	15	15	10	60	100
11	MDM	ITMDM5005 ITMDM6005	Lab Java Programming Lab Python Programming	0	0	2	1	-	-	25	-	25
12	OEC	ITOEC0030	Machine Learning	2	0	0	2	10	10	0	30	50
13		**ITHNC7001**	Data Analytics with Python	3	1		4	15	15	10	60	100
				24	**1**	**8**	**29**	**105**	**105**	**150**	**540**	**900**

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List of Professional Electives (I, II, III)

Professional Elective I	**Professional Elective II**	**Professional Elective III** **NPTEL/ SWAYAM MOOCs Courses (12 weeks)**
ITPEC3001:Internet of Things ITPEC3002: Lab Internet of Things	ITPEC3007:Mathematics for Machine Learning	ITPEC3011:Reinforcement Learning
ITPEC3003:Android Programming ITPEC3004:Lab Android Programming	ITPEC3008Blockchain Technologies	ITPEC3012: Deep Learning for Computer Vision
ITPEC3005:Image Processing ITPEC3006 Lab: Image Processing		ITPEC3013: Cyber Security and Privacy
		Social Networks
		Getting Started with Competitive Programming

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ITPCC3001 :Artificial Intelligence		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 0	**ISE II**	**15 Marks**
Credits:03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course Description:

Course Outcome: After completing the course, students will be able to	
CO1	Comprehend the fundamental concepts of Artificial Intelligence (AI)
CO2	Apply Intelligent Agents and Reasoning Techniques for Problem Solving
CO3	Recognize the characteristics of AI that make it useful to real-world problems.
CO4	Explore Applications and Ethical Implications of AI
CO5	Examine the applicability of algorithms to solve problems.

Detailed Syllabus:

Unit 1	**Introduction to Artificial Intelligence:** Definition and Scope of AI, History and Evolution of AI, Agents and Environments: Intelligent Agents, Structure of Intelligent Agents, Problem-Solving as Search: Problem-Solving Agents, Uninformed Search Strategies: Breadth-First Search (BFS), Depth-First Search (DFS), Uniform Cost Search, Informed Search Strategies: Greedy Best-First Search, A* Search
Unit 2	**Knowledge Representation and Reasoning:** Knowledge-Based Agents, Wumpus World, Propositional Logic: Syntax and Semantics, Inference and Proof Systems, First-Order Logic: Syntax, Semantics, Resolution in First-Order Logic, Reasoning Systems: Forward and Backward Chaining, Probabilistic Reasoning: Bayesian Networks
Unit 3	**Planning and Search Algorithms:** Planning in AI: Classical Planning Problems, STRIPS Representation, Partial-Order Planning, Planning Graphs, Local Search Algorithms: Hill-Climbing, Simulated Annealing, Genetic Algorithms and Evolutionary Computation
Unit 4	**Reasoning Under Uncertainty:** Probabilistic Reasoning: Bayesian Inference, Hidden Markov Models (HMMs), Fuzzy Logic: Membership Functions and Operations, Temporal Reasoning: Time and Event Calculus, Dynamic Bayesian Networks
Unit 5	**Expert System and AI Applications:** Definition and Applications, Characteristics of Expert systems, Architecture of a typical Expert System **Overview of AI Applications in Various Fields:** Healthcare (Diagnostics, Personalized Medicine), Finance (Fraud Detection, Trading Systems), Education (Intelligent Tutoring Systems), Gaming and Entertainment, Robotics and Automation, Ethics and Social Impacts of AI

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Text Books & Reference Books

1.Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" 3rd Edition. (Unit: 1,2,3,4,5)

2.I. Bratko, Prolog "Programming for Artificial Intelligence", 3rd ed. Harlow, UK: Addison-Wesley, 2001(Unit: 2,3)

3.I. Goodfellow, Y. Bengio, and A. Courville, "Deep Learning". Cambridge, MA, USA: MIT Press, 2016.

Web Resources

1.https://nptel.ac.in/courses/106102220Prof. Mausam, IIT Delhi

2.https://onlinecourses.nptel.ac.in/noc24_ge47/preview Prof. Shyamanta M. Hazarika, IIT Guwahati

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	3	2												
CO2	3	3			2										
CO3	1	3	2	3											
CO4	2	1	3		3										
CO5	2	3	2	3											

3– High 2 – Medium 1 - Low

Assessment:

ISE I / ISE II /ISE III:

In Semester Evaluation can be based on:

1) Class Test
2) Powerpoint presentation
2) Question & answer / Numerical solution
3) Surprise test
4) Any other activity suggested by course coordinator

ESE: End Semester Examination as per guidelines

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	05	00	00	10
K2	Understand	10	05	00	20
K3	Apply	00	10	05	20
K4	Analyze	00	00	05	10
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

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Assessment table:

Assessment Tool	**K1**	**K2**	**K3**
	CO1	CO2,CO3	CO4,CO5
ISE I (15 Marks)	10	05	00
ISE II (15 Marks)	05	05	05
ISE III (10 Marks)	00	05	05
ESE Assessment (60 Marks)	20	20	20
Total Marks 100	35	35	30

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ITPCC3002: Design and Analysis of Algorithm		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 0	**ISE II**	**15 Marks**
Credits:03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course Description: The course design and analysis of algorithms is an introduction to algorithms. It covers various algorithm design techniques and methods to find time and space complexity of algorithms.

Course Outcome: After completing the course, students will be able to	
CO1	Analyse the best, average and worst case performance of algorithms using asymptotic notations
CO2	Solve recurrence relations using substitution, recursion tree, and master's theorem methods
CO3	Apply divide and conquer, greedy, and dynamic programming strategies to solve algorithmic problems efficiently
CO4	Choose appropriate traversal techniques, dynamic programming, backtracking, and branch and bound methods
CO5	Identify NP Hard and NP Complete problems

Detailed Syllabus:

Unit 1	**Introduction** Algorithm concepts, need for analysis, time and space complexities, asymptotic notations for algorithms, Recurrence relations for analysis of recursive algorithms using Substitution method, Recursion tree method and Masters theorem, Best, average and worst case time complexity of algorithms such as bubble sort, merge sort, insertion sort, Quick sort
Unit 2	Divide and conquer: Basic strategy and its complexity, binary search, finding maximum and minimum, heap sort, Strassen's matrix multiplication. Greedy method: Basic strategy and its complexity, application to job sequencing with deadlines problem, minimum cost spanning trees, knapsack problem, optimal merge pattern, single source shortest paths
Unit 3	**Dynamic Programming:** Basic strategy and its complexity, principle of optimality, multistage graphs, all pairs shortest path, travelling salesman problem, Chained matrix multiplication, 0/1 Knapsack, Longest common subsequence **Traversal and Search Techniques:** Connected components and spanning trees, biconnected Components and DFS
Unit 4	**Backtracking**: Basic strategy, N-Queens problem, graph coloring, sum of subsets, Hamiltonian Cycles. **Branch and Bound:** The method of branch and bound, 0/1 Knapsack problem, Traveling salesperson problem
Unit 5	**NP Hard and NP Complete Problems:** Non deterministic algorithms, classes NP Hard and NP complete, **NP Hard Graph Problems:** clique decision problem, node cover decision problem chromatic number decision problem, AND/ OR graph decision problem, **NP Hard Scheduling Problems:** Flow Shop scheduling and Job Shop Scheduling

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Text Books & Reference Books

1. Computer Algorithms: Horowitz, Sahani, Rajasekhara, Galgotia Publications Pvt. Ltd
2. Introduction to Algorithms: Cormen T.H. et.al: Prentice Hall of India
3. Fundamentals of Algorithms: Brassard, Bratley, Prentice Hall

Web Resources

4. https://onlinecourses.swayam2.ac.in/cec22_cs13/preview
5. https://onlinecourses.nptel.ac.in/noc22_cs27/preview
6. https://www.coursera.org/specializations/algorithms
7. https://archive.nptel.ac.in/noc/courses/noc15/SEM1/noc15-cs02/

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2			2						2	2	1	1	1
CO2	3	2			2						2	2	1	1	1
CO3			3	2	2						2	2	2	2	2
CO4			3	2	2						2	2	2	2	2
CO5			3	2	2						2	2	1	1	1

3– High 2 – Medium 1 - Low

Assessment:

ISE I / ISE II /ISE III:

In Semester Evaluation can be based on:

1. Class Test
2. Powerpoint presentation
3. Question & answer / Numerical solution
4. Surprise test
5. Any other activity suggested by course coordinator

ESE: End Semester Examination as per guidelines

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5	2	10
K2	Understand	7	7	3	20
K3	Apply	3	3	5	20
K4	Analyze	-	-	-	10
K5	Evaluate	-	-	-	-
K6	Create	-	-	-	-
Total Marks 100		15	15	10	60

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Assessment table:

Assessment Tool	**K1**	**K2**	**K3**
	CO1	CO2,CO3	CO4,CO5
ISE I (15 Marks)	6	7	2
ISE II(15 Marks)	2	8	5
ISE III (10 Marks)	2	5	3
ESE Assessment (60 Marks)	10	40	10
Total Marks 100	20	60	20

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ITPCC3003 :Cloud Computing		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 0	**ISE II**	**15 Marks**
Credits:03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course Description: Cloud Computing course provides a comprehensive introduction to the fundamental concepts, technologies, and services behind cloud computing. Designed for beginners and IT professionals alike, the course explores the core principles of cloud infrastructure, service models (IaaS, PaaS, SaaS), deployment models (public, private, hybrid), and leading cloud platforms such as Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP).
Students will gain hands-on experience with cloud-based services and tools, learn how to deploy and manage scalable applications, and understand key concepts like virtualization, storage, networking, security, and pricing models in the cloud environment.

Course Outcome: After completing the course, students will be able to	
CO1	Define the fundamental ideas behind Cloud Computing and its architectures applicability, benefits, as well as current and future challenges
CO2	Illustrate cloud services to deploy various applications and get exposure to advanced clouds
CO3	Classify virtualization technologies and how this has enabled the development of cloud computing.
CO4	Explore, cloud storage technologies, NoSQL databases and demonstrate their use in storage systems such as Amazon S3 and HDFS
CO5	Evaluate the security issues related to cloud computing and handle the security threats.

Detailed Syllabus:

Unit 1	Introduction: The need for cloud computing, defining cloud computing, model architecture and computing environments, cloud deployment models, essential cloud characteristics, challenges, and risks. Service oriented architecture (SOA) and cloud computing reference architecture.
Unit 2	Cloud computing service models: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service(PaaS)Software-as-a-Service(SaaS),XaaS,Business-Process-as-a-service (BPaaS),Identity-as- as service(IDaaS),Communication-as-a-service (CaaS), Monitoring-as-a-service (MaaS), Storage as a service, Web services: SOAP and REST ,Case studies of Amazon EC2/Microsoft Azure, Google App Engine, SalesForce.com….
Unit 3	Virtualization: Techniques to design virtual machine monitors, Hypervisors, full virtualization, paravirtualization, Hardware-assisted CPU virtualization, Memory virtualization techniques, I/O virtualization techniques Case studies of X86, Xen, KVM/QEMU.
Unit 4	Storage and Security: Cloud storage: key-value stores: Dynamo, semi-structured data storage, cloud security challenges, network, host and application level Infrastructure security, data security, security management in the cloud, data privacy, IAM in AWS.
Unit 5	Cloud Applications: Cloud Platforms in Industry, Scientific Applications, Healthcare: ECG Analysis in the Cloud, Business and Consumer Applications, CRM and ERP, Big Data on Cloud, AWS DevOps, Index Search dark web.

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Text Books & Reference Books

1. Cloud computing Bible by Barrie Sosinsky,Wiley India Pvt Ltd (2011)
2. Enterprise Cloud Computing: Technology, Architecture, Applications by GautamShroff, Cambridge University Press.
3. Cloud Computing Implementation, Management, and Security By John W. Ritting house,James F. Ransome , CRC Press.
4. Mastering Cloud Computing Rajkumar Buyya, ChristianVecchiola,S.Thamarai Selvi Dr.KumarSaurabh,"CloudComputing",WileyPublication
5. Borko Furht,"Hand book of Cloud Computing",Springer
6. Venkata Josyula,"Cloud computing–Automated virtualized datacenter",CISCOPress
7. GregSchulr,"Cloud and virtual data storage networking",CRCPress
8. MarkCarlson,"Cloud data management and storage",McGraw hill
9. LizheWang,"CloudComputing:Methodology,SystemandApplications",CRCPress
10. Cloudcomputing:DataIntensiveComputingandSchedulingbyChapmanHall/CRC

Web Resources

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2. https://www.shiksha.com/online-courses/cloud-computing-basics-by-nptel-course-nptel2
3. https://www.linkedin.com/pulse/successfully-completed-nptel-course-cloud-computing-key-ramkumar-j3g3c

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3												2		
CO2		1			3									2	
CO3			3			1									2
CO4										2	1	2		1	2
CO5								1	2						1

3– High 2 – Medium 1 - Low

Assessment:

ISE I / ISE II /ISE III:

In Semester Evaluation can be based on:

1. Class Test
2. Powerpoint presentation
3. Question & answer / Numerical solution
4. Surprise test
5. Any other activity suggested by course coordinator

ESE: End Semester Examination as per guidelines

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Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5	2	10
K2	Understand	7	7	3	20
K3	Apply	3	3	5	20
K4	Analyze				10
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1**	**K2**	**K3**
	CO1	CO2,CO3	CO4,CO5
ISE I (15 Marks)	3	5	7
ISE II(15 Marks)	5	4	6
ISE III (10 Marks)	2	4	4
ESE Assessment (60 Marks)	10	30	20
Total Marks 100	20	43	37

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ITPCC3004: Lab Design and Analysis of Algorithm		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I(Term Work)**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcome: After completing the course, students will be able to	
CO1	Experiment with recursive and iterative algorithms
CO2	Make use of divide and conquer approach and greedy algorithmic methods
CO3	Write programs using dynamic programming techniques and traversal techniques
CO4	Write programs on backtracking approach and branch and bound techniques

List of the Experiments:
The student shall perform minimum ten experiments of the following using Java

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all) **Implement programs on Fundamentals of Python/ Java/ C/ C++ Programming**				
1	Implement recursive and iterative algorithms for specific problems.	S2	1	2
2	Implementation of sorting methods using recursion.	S2	1	2
3	Write a program for Tower of Hanoi problem	S2	1	2
4	Write a program for finding maximum and minimum using divide and conquer approach	S2	2	2
5	Implement merge sort using divide and conquer approach	S2	2	2
Level: Medium				
6	Implement the Greedy Knapsack problem	S2	2	2
7	Write a program for finding minimal spanning Trees using Prim's/ Kruskal's Greedy approach	S2	2	2
8	Write a program for finding shortest path using multistage graph problem.	S2	3	2
9	Implement the all-pairs shortest path problem using dynamic programming approach	S2	3	2
10	Implement graph coloring problem using backtracking	S3	4	2
Level: Complex				
11	Illustrate 8-Queens problem using general backtracking method and recursive backtracking method	S3	4	2
12	Implement a program for 0/1 Knapsack algorithm using Branch and Bound approach	S3	4	3

Assessment:
ISE I (Term Work): In-Semester Evaluation will be based on practical assig

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and timely submission

End Semester Evaluation:The ESE will be based on oral / practical performance of the students

Assessment Table:

Assessment Tool	**S1**	**S2**	**S3**
	CO1	CO2, CO3	CO4
ISE I (Term Work)	05	13	07
End Semester Evaluation (Practical Examination & Viva Voce)	00	10	15

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**End Semester Examination**
S1	Imitation	05	05
S2	Manipulation	10	10
S3	Precision	10	10
S4	Articulation	00	00
S5	Naturalization	00	00
	Total Marks	25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes:

Course outcome	**Program Outcomes**												**PSO's**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	2	3	2	1						1	2	3	2	1
CO2	2	2	3	2	1						1	2	3	2	1
CO3	2	2	3	2	1						1	2	3	2	1
CO4	2	2	3	2	1						1	2	3	2	1

3 – High 2 – Medium 1 – Low

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ITPCC3005: Lab Cloud Computing		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I(Term Work)**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcome: After completing the course, students will be able to	
CO1	Create web applications to deploy on a Cloud.
CO2	Analyze Platform as a Service, Infrastructure as a Service and Software as a Service
CO3	Apply virtualization techniques for various applications.
CO4	Installation of Google app Engine to create warehouse applications. Develop advanced applications using cloud services and cloud service providers.

List of the Experiments:

The student shall perform minimum ten experiments of the following using netbeans,aws,all time internet

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Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all)				
1	Introduction to cloud computing using web services.	S1	CO1	02
2	Implementation of SOAP and Restful Web services in Java# and oracle.	S2	CO1 CO2	02
3	Implementation of Para-Virtualization using VMware's Workstation/Oracle's Virtual Box and Install a C compiler in the virtual machine created using virtual box and execute simple programs.	S2	CO1 CO2	02
Level: Medium				
4	Find a procedure to transfer the files from one virtual machine to another virtual machine	S2, S3	CO2 CO3	02
5	Install Google App Engine. Create a hello world app and other simple web applications using python/java**.**	S2, S3	CO4	03
6	Use GAE launcher to launch the web applications.	S2, S3	CO4 CO5	02
7	Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.	S2, S4	CO2t to CO5	03
8	Install OpenStack and use it as Infrastructure as a Service and use technology own Cloud.	S2, S3, S4	CO2 CO3 CO4	02
Level: Complex				
9	Installing and using security feature of own Cloud.	S2	CO4	02
10	Case Study: Amazon Web Services	S4,S5	CO2 to CO4	03
11	Case study on Microsoft azure	S4,S5	CO2 to CO4	02

Assessment:
ISE I (Term Work) : In-Semester Evaluation will be based on practical assignments completed and timely submission

End Semester Evaluation:The ESE will be based on oral / practical performance of the students

Assessment Table:

Assessment Tool	**S1**	**S2**	**S3**
	CO1	CO2, CO3	CO4
ISE I (Term Work)	00	15	10
End Semester Evaluation (Practical Examination & Viva Voce)	05	10	10

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Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	05	05
S2	Manipulation	10	10
S3	Precision	10	10
S4	Articulation	00	00
S5	Naturalization	00	00
	Total Marks	25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1			2		3								1	2	
CO2	3		2	1		3		2					3		3
CO3		3					2						3	1	3
CO4											3	2	3	1	1

3 – High 2 – Medium 1 - Low

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Professional Elective I ITPEC3001 Internet of Things		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs/ week	**ISE I**	**10 Marks**
Tutorial: 0	**ISE II**	**10 Marks**
Credits:02	**End Semester Examination**	**30 Marks**

Course Description: Now-days, the Internet of Things has received enormous attention. It has the potential to optimize the performance of systems and processes, deliver solutions that dramatically improve energy efficiency, security, health, education and improves quality of life. For enterprises, IoT can underpin solutions that improve decision-making and productivity in manufacturing, retail, agriculture and other sectors. This course is aimed to familiarize the students with the concept of IoT and includes IoT architecture, protocol and analytics. Also, this course covers Web of Things, Cloud of Things, security and privacy for IoT, and applications of IoT.

Course Outcome: After completing the course, students will be able to	
CO1	Understand and explore the concepts of Internet of Things
CO2	Describe architecture, building blocks, and communication Technologies of IoT
CO3	Interpret Web of Things and Cloud of Things architectures.
CO4	Summarize security issues and security services of IoT
CO5	Use IoT protocols and analytics to design an IoT application.

Detailed Syllabus:

Unit 1	Introduction to Internet of Things - Introduction to IoT, Overview of IoT, What is IoT,Why IoT, Vision of IoT, Characteristics of IoT, Four Pillars of IoT, Challenges and requirements of IoT, Opportunities for IoT, Introduction to M2M, M2M to IoT, An Emerging industrial structure for IoT- Industry 4.0
Unit 2	IoT Architecture&Protocol - IoT Layered Architecture, Building blocks of IoT, Networking and Communication, Wired & Wireless connectivity and technology, IoT Communication Models and APIs, Wireless Sensor Network, IoT Communication technologies, NFC, RFID, ZigBee, IoT Protocol stack, TCP/IP Protocol stack vs IoT Protocol Stack, IoT Protocol Standardization, IoT Protocols- MQTT, CoAP, AMQP, DDS, REST,XMPP,
Unit 3	Web of Things and Security :Cloud Computing in IoT- IoT with Cloud Architecture, IoT Analytics, Data visualization and its importance in IoT , IoT front end interface, Internet of Things and Big Data, Web of Things versus Internet of Things, Two Pillars of the WebArchitecture, Standardization for WoT, Platform Middleware for WoT, Need of IoT Security, Issues in IoT security,Security andPrivacy, IoT Applications,

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Text Books & Reference Books

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos,David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014, ISBN: 978-0-12-407684-
2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)",1stEdition, VPT, 2014, ISBN: 978-0996025515
3. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013, ISBN-13: 978-1430257400
4. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017, ISBN: 978-9352605224

Web Resources

1. https://onlinecourses.nptel.ac.in/noc22_cs53/preview
2. https://nptel.ac.in/courses/106105166

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1				1	2	2				1		1		1
CO2	1					2	1								
CO3	1			1											
CO4						2		2						2	
CO5	3			1									1		3

3– High 2 – Medium 1 - Low

Assessment:

ISE I / ISE II /ISE III:

In Semester Evaluation can be based on:

3) Class Test
4) Power point presentation
2) Question & answer / Numerical solution
3) Surprise test
4) Any other activity suggested by course coordinator

ESE: End Semester Examination as per guidelines

Assessment Pattern:

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Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	05			05
K2	Understand	05	05		10
K3	Apply		05		05
K4	Analyze				10
K5	Evaluate				
K6	Create				
Total Marks 50		10	10		30

Assessment table:

Assessment Tool	K1	K2	K3
	CO1	CO2,CO3	CO4,CO5
ISE I (10 Marks)	05	05	10
ISE II(10 Marks)	05	05	05
ESE Assessment (30 Marks)	05	05	05
Total Marks 50	15	15	20

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Professional Elective I ITPEC3003 : Android Programming		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs/ week	**ISE I**	**10 Marks**
Tutorial: 0	**ISE II**	**10 Marks**
Credits:02	**End Semester Examination**	**30 Marks**

Course Description:

This course provides a comprehensive introduction to Android application development, covering fundamental concepts and practical skills. Students will learn the Android architecture, core components like Activities, Intents, Services, and Fragments, and how to build and debug applications using Android Studio. The curriculum includes working with UI elements, data storage options including SQLite, and connectivity features like SMS, Bluetooth, and Google Maps. Learners will also explore multithreading using AsyncTask and working with web services. By the end, students will be equipped to build, test, and publish Android applications. The course will combine lectures, student presentations and in-class exercises.

Course Outcome: After completing the course, students will be able to	
CO1	Understand the fundamentals of the Android operating system, its architecture, and development environment including the role of the Dalvik Virtual Machine (DVM). (K2)
CO2	Apply the Android Activity lifecycle and UI components such as layouts and widgets to design and develop interactive user interfaces. (K3)
CO3	Implement core Android components like Activities, Intents, Services, Broadcast Receivers, Fragments, and Content Providers for building mobile applications. (K3)
CO4	Develop Android applications that utilize data storage techniques (internal/external storage, SQLite), device features (SMS, GPS, Bluetooth) and networking concepts (AsyncTask, web services, data downloading) (K3)

Detailed Syllabus:

Unit 1	Introduction of Android, Features of Android, Architecture of Android, Dalvik Virtual Machine (DVM), Installing required software's, Creating Android Virtual Devices (AVDs), Creating First Android application - "Hello World", Anatomy of Android Application
Unit 2	Debugging Android Application, Publishing Android Application: Generating a Signed APK,Android Activity life cycle, UI Layouts, Working with UI Widgets/controls
Unit 3	Android Core Building Blocks: Activity, Intent, Services, Broadcast Receivers, Fragments, Content Providers, Manifest file Storing Data to internal and external storage Creating and Using Databases (SQLite)

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Text Books & Reference Books

1. Beginning Android® Programming with Android Studio, J. F. DiMarzio, Publication- John Wiley & Sons, Inc.
2. Android Programming Cookbook, Chrissy Alfieri, Evelix's Media P.C., 2016
3. Android™ 4 Application Development, Wei-Meng Lee, John Wiley & Sons, Inc.
4. Programming the Mobile Web, Maximiliano Firtman, O'Reilly Media, Inc

Web Resources

- Video Lectures– https://onlinecourses.swayam2.ac.in/nou21_ge41/preview
- https://developer.android.com
- www.tutorialspoint.com
- https://www.javatpoint.com/android-tutorial
- https://www.geeksforgeeks.org/android-tutorial/

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1										2	1	
CO2	3	2	2										2	3	
CO3	1	2	3										3	3	
CO4	1	2	3										3	3	

3– High 2 – Medium 1 - Low

Assessment:

ISE I / ISE II /ISE III:

In Semester Evaluation can be based on:

1. Class Test
2. Powerpoint presentation
3. Question & answer / Numerical solution
4. Surprise test
5. Any other activity suggested by course coordinator

ESE: End Semester Examination as per guidelines

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	End Semester Examination
K1	Remember	00	00	05
K2	Understand	05	05	15
K3	Apply	05	05	10
K4	Analyze	00	00	00
K5	Evaluate	00	00	00
K6	Create	00	00	00
Total Marks 50		10	10	30

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Assessment table:

Assessment Tool	**K1**	**K2**	**K3**
	CO1	CO2,CO3	CO4,CO5
ISE I (10 Marks)	05	05	00
ISE II(10 Marks)	00	05	05
ESE Assessment (30 Marks)	05	15	10
Total Marks 50	10	10	10

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Professional Elective I ITPEC3005 Image Processing		
Teaching Scheme	**Examination Scheme**	
Lectures: 02hrs/ week	**ISE I**	**10 Marks**
Tutorial: 0	**ISE II**	**10 Marks**
Credits:02	**End Semester Examination**	**30 Marks**

Course Description: To learn and understand the fundamentals of digital image processing, Image Enhancement Techniques, Image restoration Techniques and methods, image compression and Segmentation used in digital image processing

Course Outcome: After completing the course, students will be able to	
CO1	Explain the fundamentals of digital images and their representation in various formats.
CO2	Apply image enhancement techniques in spatial and frequency domains
CO3	Analyze image restoration techniques for noise removal and image correction.
CO4	Illustrate image segmentation, morphological operations, and feature extraction techniques.
CO5	Demonstrate different image compression and color image processing techniques.

Detailed Syllabus:

Unit 1	**Fundamentals of Digital Image Processing:** Introduction to Digital Image Processing, Applications of Image Processing, Image Sensing and Acquisition, Image Sampling and Quantization, Basic Relationships Between Pixels, Color Models: RGB, CMY, HSV, HIS, Image File Formats (JPEG, PNG, BMP, TIFF)
Unit 2	**Image Enhancement:** Spatial Domain Techniques: Intensity Transformations (Contrast Stretching, Log, Power-Law), Histogram Processing (Equalization, Specification), Smoothing and Sharpening Filters (Mean, Median, Laplacian, etc.) **Frequency Domain Techniques:** Fourier Transform and its Applications in Image Processing, Frequency Domain Filtering (Low-pass, High-pass, Band-pass)
Unit 3	**Image Restoration and Color Processing:** Image Degradation Model, Noise Models (Gaussian, Salt-and-Pepper, Speckle), **Restoration Techniques:** Inverse Filtering, Wiener Filtering, Constrained Least Squares Filtering **Color Image Processing:** Pseudocolor and Full-Color Image Processing, Color Transformations, Color Image Smoothing and Sharpening, Image Segmentation

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Text Books & Reference Books

1. Rafael C Gonzalez and Richard E Woods, "Digital Image Processing'', Pearson Education, 3rd Edition, 2009
2. Anil Jain, "Fundamentals Of Digital Image Processing", Anil Jain PHI, 1989
3. B. Chanda, D Dutta Majumder, "Digital Image Processing and Analysis'', Prentice-Hall, India, 2002
4. J.G. Proakis, "Introduction to Digital Signal Processing", PHI, 2007.
5. S. Sallivahanan, "Digital Signal Processing", Tata McGraw Hill, 2001.
6. William Pratt, "Digital Image Processing", John Willey & Sons Inc, 2007.

Web Resources

1. https://archive.nptel.ac.in/courses/117/105/117105135/
2. https://nptel.ac.in/courses/117105079

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	3	3	3						2	2	1	3	2
CO2	2	2	3	3	3						2	2	1	3	2
CO3	2	2	3	3	3						2	2	1	3	2
CO4	2	2	3	3	3						2	2	1	3	2
CO5	2	2	3	3	3						2	2	1	3	2

3– High 2 – Medium 1 - Low

Assessment:

ISE I / ISE II /ISE III:

In Semester Evaluation can be based on:

1) Class Test
2) Powerpoint presentation
3) Question & answer / Numerical solution
4) Surprise test
5) Any other activity suggested by course coordinator

ESE: End Semester Examination as per guidelines

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**ISE II**	**End Semester Examination**
K1	Remember	2	2	10
K2	Understand	5	5	10
K3	Apply	3	3	10
K4	Analyze	-	-	00
K5	Evaluate	-	-	-
K6	Create	-	-	-
Total Marks 50		10	10	30

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Assessment table:

Assessment Tool	**K1**	**K2**	**K3**
	CO1	CO2, CO3	CO4, CO5
ISE I (10 Marks)	4	4	2
ISE II(10 Marks)	2	3	5
ESE Assessment (30 Marks)	10	10	10
Total Marks 50	16	17	17

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Professional Elective I- Lab ITPEC3002: Lab Internet of Things		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I(Term Work)**	**25 Marks**
Credits:01	**End Semester Evaluation**	

Course Outcome: After completing the course, students will be able to	
CO1	Implement interfacing of I/O devices with Arduino/ Raspberry Pi.
CO2	Implement interfacing of various sensors, shield with Arduino/Raspberry Pi.
CO3	Implement different protocols using Arduino/ Raspberry Pi.
CO4	Design and implement IoT system for real time applications.

List of the Experiments:

The student shall perform minimum ten experiments of the following using Java

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all) **Implement programs on Fundamentals of IOT**				
1	Implement a program using Arduino IDE for Blink LED.	S2	CO1	2
2	Implement a program for RGB LED using Arduino.	S2	CO1	2
3	Implement interfacing of ultrasonic sensor with Arduino	S2,S3	CO1, CO2	2
Level: Medium				
6	Implement RFID, NFC using Arduino/Rasberry Pi	S2	CO1, CO3	2
7	**Implement MQTT protocol using Arduino.**	S2	CO1, CO3	2
8	Build Google Assistant with Raspberry Pi.	S2	CO1, CO3	3
9	Create a simple web interface for Raspberry Pi board to control the connected LEDs remotely through the interface	S2	CO1, CO2, CO3	3
Level: Complex				
11	Implement Zigbee Protocol using Arduino / Raspberry Pi.	S2	CO1, CO3	4
12	Implement a weather monitoring system using humidity, temperature and raindrop sensor and Raspberry Pi/Arduino board.	S2,S3,S4	CO1, CO2, CO4	4
13	Write an application using Raspberry Pi/Arduino for traffic signal monitoring and control system.	S2,S3,S4	CO1, CO2, CO4	4

Assessment:

ISE I (Term Work) : In-Semester Evaluation will be based on practical assig

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and timely submission

End Semester Evaluation:The ESE will be based on oral / practical performance of the students

Assessment Table:

Assessment Tool	**S1**	**S2**	**S3**
	CO1	CO2, CO3	CO4
ISE I (Term Work)	00	10	15
End Semester Evaluation (Practical Examination & Viva Voce)	00	10	15

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**End Semester Examination**
S1	Imitation	05	05
S2	Manipulation	10	10
S3	Precision	10	10
S4	Articulation	00	00
S5	Naturalization	00	00
	Total Marks	25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes:

Course outcome	**Program Outcomes**												**PSO's**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3								1				1	1	
CO2	3								1			1	1	1	
CO3	3								1			1	1	1	
CO4	3	2	2	1	2	2	2	2	2	1	1	1	2	2	2

3 – High 2 – Medium 1 – Low

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Professional Elective I-Lab ITPEC3004: Lab Android Programming		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I(Term Work)**	**25 Marks**
Credits:01	**End Semester Evaluation**	

Course Outcome: After completing the course, students will be able to	
CO1	Interpret architecture of Android operating systems (S2)
CO2	Develop android applications comprising of various UI controls, layouts with event handling (S3)
CO3	Construct android applications to work with SMS message, database connectivity, internal storage android core building blocks etc. (S3)
CO4	Experiment with web services through android applications (S3)
CO5	Design and implement android applications for real world requirements (S4)

List of the Experiments:

The student shall perform minimum ten experiments of the following using Android (Java).

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all)				
1	To study Android OS architecture, Android Studio Installation and to create "Hello World" program.	S1	CO1	1
2	To create an application to demonstrate Android Activity Lifecycle	S1	CO1	1
3	To create an android application with UI controls/Widgets with event handling	S2	CO2	1
4	To create an android application various Android Layouts	S3	CO2	2
Level: Moderate (any four)				
6	To develop an application to Send SMS message	S3	CO3	2
7	To develop an android application to save data to internal storage as text file	S3	CO3	2
8	To develop an android application for database operations using SQLite Database	S3	CO3	2
9	To develop an android application to implement Broadcast Receivers/Android Service	S3	CO3	2
10	To develop an android application to implement Android Fragments/Intents	S3	CO3	2
Level: Complex (any two)				
11	To develop an android application to locate the user's current location and to show map information (Latitude and Longitude)	S4	CO4	3

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Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
12	To Develop a web service and consume it in android application	S4	CO4	3
12	To develop an android web application with which accepts data from user application and store it on server	S4	CO4	3

Assessment:
ISE I (Term Work) : In-Semester Evaluation will be based on practical assignments completed and timely submission

End Semester Evaluation:The ESE will be based on oral / practical performance of the students

Assessment Table:

Assessment Tool	S1	S2	S3
	CO1	CO2, CO3	CO4,CO5
ISE I (Term Work)	00	10	15
End Semester Evaluation (Practical Examination & Viva Voce)	00	10	15

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	05	05
S2	Manipulation	10	10
S3	Precision	10	10
S4	Articulation	00	00
S5	Naturalization	00	00
	Total Marks	25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes:

Course Outcome	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	2	3										1	3	3
CO2		2	1	3									1	3	3
CO3		3	2		1								1	3	3
CO4			3	1	2								1	3	3
CO5						2			1	2	3		1	3	3

3 – High 2 – Medium 1 – Low

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Professional Elective I-Lab ITPEC3006: Lab Image Processing		
Teaching Scheme	**Examination Scheme**	
Practical: 2 Hrs/Week	**ISE I (Term Work)**	**25 Marks**
Credits: 01	**End Semester Evaluation**	

Course Outcome: After completing the course, students will be able to	
CO1	Apply basics of Image Processing to find solutions to problems
CO2	Analyze the output of different filtering methods
CO3	Select edge detection methods to detect edges of an image
CO4	Experiment with data compression using Huffman coding

List of the Experiments:

The student shall perform minimum ten experiments of the following using Java

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all) **Implement programs on Fundamentals of Java Programming**				
1	Perform Point processing in spatial domain a. Negation of an image b. Thresholding of an image c. Contrast Stretching of an image	S2	1	2
2	Perform experiments for histogram equalization	S2	1	2
3	Reducing the Number of Intensity Levels in an Image.	S2	1	2
4	Perform Zooming and Shrinking Images by Pixel Replication.	S2	2	2
5	Perform Zooming and Shrinking Images by Bilinear Interpolation.	S2	2	2
Level: Medium				
6	Implement Filtering in spatial domain a. Low Pass Filtering b. High Pass Filtering c. Median filtering	S2	2	2
7	Implement Filtering in frequency domain a. Low pass filter b. High pass filter	S2	2	2
8	Implement edge detection using derivative filter mask a. Prewitt b. Sobel c. Laplacian	S2	3	2
9	Implement boundary extraction algorithm	S2	3	2
10	Implement different morphological operations	S3	4	2
Level: Complex				
11	Implement data compression using Huffman coding	S3	4	2
12	Write a program to extract image features using different techniques	S3	4	3

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Assessment:
ISE I (Term Work): In-Semester Evaluation will be based on practical assignments completed and timely submission

End Semester Evaluation: The ESE will be based on oral / practical performance of the students

Assessment Table:

Assessment Tool	**S1**	**S2**	**S3**
	CO1	CO2, CO3	CO4
ISE I (Term Work)	05	13	07
End Semester Evaluation (Practical Examination & Viva Voce)	00	10	15

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**End Semester Examination**
S1	Imitation	05	05
S2	Manipulation	10	10
S3	Precision	10	10
S4	Articulation	00	00
S5	Naturalization	00	00
	Total Marks	25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes:

Course outcome	**Program Outcomes**												**PSO's**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	3	3	3						1	2	1	2	3
CO2	3	2	3	3	3						1	2	1	2	3
CO3	3	2	3	3	3						1	2	1	2	3
CO4	3	2	3	3	3						1	2	1	2	3

3 – High 2 – Medium 1 – Low

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ITPEC3007 : Mathematics For Machine Learning		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs/ week	**ISE I**	**10 Marks**
Tutorial: 0	**ISE II**	**10 Marks**
Credits:02	**ISE III**	
	End Semester Examination	**30 Marks**

Course Description:

Course Outcome: After completing the course, students will be able to	
CO1	Introduce students to Singular Value Decomposition, PCA, LDA.
CO2	Understand the Linear and Multiple Regression, Logistic Regression
CO3	Understand the Gradient Descent and other optimization algorithms in machine
CO4	Apply and understand the concept of joint probability and covariance, SVM

Detailed Syllabus:

Unit 1	Vectors in Machine Learning: Basics of Matrix Algebra, Eigenvalues and Eigenvectors, Special Matrices and Properties.Singular Value Decomposition, Low Rank Approximations, Python Implementation of SVD and Low-rank Approximation., Principal Component Analysis, Python Implementation of PCA, Linear Discriminant Analysis, Python Implementation of LDA.
Unit 2	Least Square Approximation and Minimum Norm Solution: Linear and Multiple Regression, Logistic Regression., Classification Metrics, Gram Schmidt Process, Polar Decomposition, Minimal Polynomial and Jordan Canonical Form, Some more Matrices Applications in Machine Learning.
Unit 3	Numerical Optimization in Machine Learning: Gradient Descent and other optimization algorithms in machine learning, Optimization using Python,Bayes theorem,Introduction to SVM, Error minimizing LPP., Lagrangian Multiplier method.

Text Books & Reference Books

1. W. Cheney, Analysis for Applied Mathematics. New York: Springer Science + Business Medias, 2001.
2. S. Axler, Linear Algebra Done Right (Third Edition). Springer International Publishing, 2015.
3. J. Nocedal and S. J. Wright, Numerical Optimization. New York: Springer Science + Business Media, 2006.
4. J. S. Rosenthal, A First Look at Rigorous Probability Theory (Second Edition). Singapore: World Scientific Publishing, 2006.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

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Course Outcomes	Program Outcomes														
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1	2	2	0	0	0	0	0	0	3	0	2	1	3	1
CO2	2	2	3	0	0	0	0	0	0	0	0	1	2	3	1
CO3	3	2	1	0	0	3	0	2	0	0	0	3	0	2	3
CO4	1	3	3	0	0	0	1	0	0	1	0	2	2	0	2

3– High 2 – Medium 1 - Low

Assessment:

ISE I / ISE II /ISE III:

In Semester Evaluation can be based on:

1) Class Test
2) Powerpoint presentation
3) Question & answer / Numerical solution
4) Surprise test
5) Any other activity suggested by course coordinator

ESE: End Semester Examination as per guidelines

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember				
K2	Understand				
K3	Apply				
K4	Analyze				
K5	Evaluate				
K6	Create				
Total Marks 100					

Assessment table:

Assessment Tool	K1	K2	K3
	CO1	CO2,CO3	CO4,CO5
ISE I (15 Marks)			
ISE II (15 Marks)			
ISE III (10 Marks)			
ESE Assessment (60 Marks)			
Total Marks 100			

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ITPEC3008 : Blockchain Technology		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs/ week	**ISE I**	**10 Marks**
Tutorial: 0	**ISE II**	**10 Marks**
Credits:02	**End Semester Examination**	**30 Marks**

Course Description: This course provides a comprehensive introduction to blockchain technology, the underlying framework behind cryptocurrencies like Bitcoin and Ethereum. Students will explore the technical foundations, cryptographic principles, and decentralized architecture that make blockchain secure and reliable. The course covers core concepts including distributed ledgers, consensus mechanisms, smart contracts, and token economies.

Course Outcome: After completing the course, students will be able to	
CO1	Understand basics and working of blockchain technology
CO2	Compare the working of different blockchain platforms
CO3	Explore platforms in blockchain : Ethereum
CO4	Interpret the working of Hyper ledger.
CO5	Identify relative applications where block chain technology can be effectively used and implemented as well risks involved in blockchain.

Detailed Syllabus:

Unit 1	Introduction to Blockchain Technology: Role of cryptography in blockchain, cryptographic algorithms ,hashing SHA-256, Scrypt, What is bitcoin, Mechanics of Bitcoin, bitcoin transaction, Introduction of blockchain, block chain technology definition, Types of BlockChain
Unit 2	Blockchain Platforms: Ethereum: blockchain Platform introduction, what is Ethereum, Ethereum feature, components of Ethereum, introduction to tokenization: what is token, technology behind tokenization, how blockchain tokenization can help in enterprise systems, consensus in blockchain
Unit 3	Blockchain Platforms and Applications: Hyper ledger: What is hyper ledger, features of a hyper ledger blockchain, Selection criteria for blockchain platform for applications, Blockchain and enterprise, Blockchain for Health Insurance.

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Text Books & Reference Books

1. Imran Bashir," Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks", Packt Publishing Limited, ISBN-13: 978-1787125445
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies", Princeton University Press, ISBN: hardcover9780691171692 ebook: 9781400884155
3. Kumar Saurabh, Ashutosh Saxena, "Blockchain Technology: Concepts and Applications", Wiley publication, First Edition, ISBN: 978-8126557660.
4. Melanie Swan," Blockchain Blueprint for a New Economy", O'Reilly Media, Print ISBN: 9781491920497, 1491920491eText ISBN: 9781491920459, 1491920459

Web Resources

1. BLOCKCHAIN, Cybrosys Limited Edition, E-book https://www.studocu.com/co/document/universidad-eia/calculo-integral/cybrosys-limited edition-e-book-criptomonedas/14736261
2. https://www.lopp.net/pdf/princeton_bitcoin_book.pdf
3. Online Course by NPTEL https://nptel.ac.in/courses/106104220 https://drive.google.com/file/d/1PtYaDmWYaqPVGjKDnMYGWO5eoI5wMPtJ/view
4. https://nptel.ac.in/courses/106/105/106105184/

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcomes	Program Outcomes														
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1			2									2		
CO2				1										1	
CO3					1		2	2						1	
CO4											2	1	2		1
CO5									2	2	2	1		2	1

3– High 2 – Medium 1 - Low

Assessment:

ISE I / ISE II :

In Semester Evaluation can be based on:

1. Class Test
2. Powerpoint presentation
3. Question & answer / Numerical solution
4. Surprise test
5. Any other activity suggested by course coordinator

ESE: End Semester Examination as per guidelines

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	End Semester Examination
K1	Remember	02	02	05
K2	Understand	04	04	15
K3	Apply	04	04	10
K4	Analyze	00	00	00
K5	Evaluate	00	00	00
K6	Create	00	00	00
Total Marks 50		10	10	30

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Assessment table:

Assessment Tool	K1	K2	K3
	CO1	CO2,CO3	CO4, CO5
ISE I (10 Marks)	02	04	04
ISE II (10 Marks)	02	04	04
ESE Assessment (30 Marks)	05	15	10
Total Marks 50	09	23	18

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ITHNC7001 : Data Analytics with Python		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 1	**ISE II**	**15 Marks**
Credits:03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course Description:

Course Outcome: After completing the course, students will be able to	
CO1	Comprehend the fundamental concepts of data analytics with python.
CO2	Apply probability techniques for data analytics.
CO3	Recognize the characteristics sampling and its distributions.
CO4	Explore Applications of data Analytics with Python
CO5	Examine the applicability of tests by using ANOVA

Detailed Syllabus:

Unit 1	**Introduction to data analytics and Python fundamentals:** Types of data analytics, Data visualization, build your data analytics toolkit with Python.
Unit 2	**Introduction to probability:** Why Probability? Terminologies Used in Probability Theory, Sample Space and Events, Probability Distributions, Applications in Data Science.
Unit 3	**Sampling and sampling distributions:** What is Sampling? Types of Sampling Methods, Simple demonstration of different sampling methods using Python, What is a Sampling Distribution? Key Concepts in Sampling Distributions, Importance of Sampling Distributions.
Unit 4	**Hypothesis testing**: Defining Hypotheses, Key Terms of Hypothesis Testing, Types of Hypothesis Testing, Selecting the Proper Test
Unit-5	**Two sample testing and introduction to ANOVA:** Hypothesis Testing, One and Two Sided Tests, Basic Framework of ANOVA, Assumptions of ANOVA, Examples.

Text Books & Reference Books

1. McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc.".
2. Swaroop, C. H. (2003). A Byte of Python. Python Tutorial.
3. Ken Black, sixth Editing. Business Statistics for Contemporary Decision Making. “John Wiley & Sons, Inc”.
4. Anderson Sweeney Williams (2011). Statistics for Business and Economics. “Cengage Learning”.

Web Resources

1. https://onlinecourses.nptel.ac.in/noc21_cs45/preview
2. https://github.com/Yash-Kavaiya/data-analytics-with-python-nptel

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Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	3	2												
CO2	3	3			2										
CO3	1	3	2	3											
CO4	2	1	3		3										
CO5	2	3	2	3											

3– High 2 – Medium 1 - Low

Assessment:
ISE I / ISE II /ISE III:
In Semester Evaluation can be based on:

5) Class Test
6) Powerpoint presentation
2) Question & answer / Numerical solution
3) Surprise test
4) Any other activity suggested by course coordinator

ESE: End Semester Examination as per guidelines

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**ISE II**	**ISE III**	**End Semester Examination**
K1	Remember	05	00	00	10
K2	Understand	10	05	00	20
K3	Apply	00	10	05	20
K4	Analyze	00	00	05	10
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1**	**K2**	**K3**
	CO1	CO2,CO3	CO4,CO5
ISE I (15 Marks)	10	05	00
ISE II (15 Marks)	05	05	05
ISE III (10 Marks)	00	05	05
ESE Assessment (60 Marks)	20	20	20
Total Marks 100	35	35	30

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SEMESTER- VI												
				Hours per week				Continuous Evaluation in terms of Marks				
Sr.No	Category	Course Code	Course Title	L	T	P	Credits	ISEI	ISEII	ISE III	ESE	Total
1	PCC	ITPCC3010	Cryptography and Network Security	3	0	0	3	15	15	10	60	100
2	PCC	ITPCC3011	Machine Learning	3	0	0	3	15	15	10	60	100
3	PCC	ITPCC3012	Software Engineering	3	0	0	3	15	15	10	60	100
4	PCC	ITPCC3013	Lab Cryptography and Network Security	0	0	2	1			25	25	50
5	PCC	ITPCC3014	Lab Machine Learning	0	0	2	1			25	25	50
6	PEC	ITPEC3021 ITPEC3023 ITPEC3025	Professional Elective IV and V	2	0	0	2	10	10	-	30	50
7	PEC	ITPEC3022 ITPEC3024 ITPEC3026	Labs Professional Elective IV and V	0	0	2	1			25	-	25
8	MDM	ITMDM5006 ITMDM6006	Python Programming Introduction to Machine Learning	3	0	0	3	15	15	10	60	100
9	VSEC-3	ITVSE2001	Advanced Java Programming	1	0	0	1	15	0	10	0	25
10	VSEC-3	ITVSE2002	Lab Advanced Java Programming	0	0	2	1	-	-	25	25	50
Total Credits with MDM				17	0	10	22	195	80	75	375	675
11		ITHNC7001	Applied Accelerated Artificial Intelligence	3	0	0	3				100	100
Total Credits with MDM + Honors				20	0	10	25	195	80	75	475	775

List of Professional Electives (Theory+Lab)

Professional Elective IV and V
ITPEC3021Advanced DBMS ITPEC3022Lab Advanced DBMS
ITPEC3023Deep Learning ITPEC3024 Lab Deep Learning
ITPEC3025Datawarehousing and Data Mining ITPEC3026Lab Datawarehousing and Data Mining

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ITPCC3010 : Cryptography and Network Security		
Teaching Scheme	Examination Scheme	
Lectures: 03 hrs/ week	ISE I	15 Marks
Tutorial: 0	ISE II	15 Marks
	ISE-III	10 Marks
Credits:03	End Semester Examination	60 Marks

Course Description: This course aims at introducing the concepts of data security starting with the goals of data security, mechanisms for implementing data security and associated problems of identity establishment, access controls. The course also provides introduction to cryptographic techniques for authentication, confidentiality, integrity and associated mechanisms. The course also introduces the concepts of cryptographic algorithms and security protocols to provide security over the Internet.

Course Outcome: After completing the course, students will be able to	
CO1	Demonstrate the basic mathematical foundations of cryptography
CO2	Summarize classical and modern symmetric key and public key algorithms
CO3	Demonstrate Encryption and Decryption using symmetric key and public key algorithm
CO4	Describe network security protocols, firewalls, and intrusion detection systems
CO5	Evaluate various real-world threats, attacks, and secure network design principles

Detailed Syllabus:

Unit 1	Introduction and Symmetric Key Ciphers Security attacks, Security Services and Security Mechanisms. Symmetric Ciphers: Symmetric Cipher Model, Classical encryption techniques like Substitution and Transposition. Block cipher Principle: The Data Encryption Standard, Linear and Differential Cryptanalysis, triple DES, Linear and Differential Cryptanalysis
Unit 2	Number Theory and Public Key Encryption Fermat's and Euler's Theorem, The Chinese Remainder Theorem, Euclidean Algorithm, Extended Euclidean Algorithm. Public Key Cryptosystem: Encryption Principles, the RSA Algorithm, Key Management, Diffie- Hellman Key Exchange
Unit 3	Authentication and Network Security Applications: Authentication Requirements, Authentication Functions, Digital Signatures, IP security architecture, Authentication header
Unit 4	IP Security and Web Security, Web Security: Web security requirements, Secure Socket Layer (SSL): Functionality, Transport layer security TLS, · Firewalls: types and configurations, Intrusion Detection and Prevention Systems (IDS/IPS), Email and Web security protocols
Unit 5	System Security: Intruders, Intrusion Detection, Password Management, Viruses, Virus countermeasures. Firewalls: Firewall Design Principles, Trusted Systems, Cloud Security and Mobile Security : Challenges , attacks and counter measures

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Text and Reference Books

1. William Stallings, "Cryptography and Network Security" Pearson Education, Fourth Edition
2. Behrouz A. Forouzan & Debdeep Mukhopadhyay, Cryptography and Network Security" Mc Graw Hill Publication , 2nd Edition
3. Robberta Bragg, Mark Phodes-Ousley &Keith Strassberge "The Complete Reference Book of Network Security", Tata McGraw-Hill Publication
4. Neal Krawetz, "Introduction to Network Security", Cengage Learning Pub

Web Resources:

1. https://nptel.ac.in/courses/106106221 : Foundations of Cryptography, IIIT Bangalore Prof. Ashish Choudhury
2. https://nptel.ac.in/courses/106105162 : Cryptography And Network Security, IIT Kharagpur, Prof. Sourav Mukhopadhyay

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1		2										1	1		
CO2	2		1		1							1	1	1	
CO3					1	3						2		1	2
CO4		2	1					1				3			2
CO5												2			2

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

3– High 2 – Medium 1 – Low

Assessment:

ISE I / ISE II /ISE III:

In Semester Evaluation can be based on:

Class Test

Power point presentation

Question & answer / Numerical solution

Surprise test

Any other activity suggested by course coordinator

ESE: End Semester Examination as per guidelines

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember				
K2	Understand	5			10
K3	Apply	5	5		10
K4	Analyze		5		5
K5	Evaluate				5
K6	Create				
Total Marks 100		10	10		30

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Assessment table:

Assessment Tool	K1	K2	K3
	CO1	CO2,CO3	CO4,CO5
ISE I (10 Marks)	5	5	
ISE II(10 Marks)	5	5	
ESE Assessment (30 Marks)	10	10	10
Total Marks 50	20	20	10

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ITPCC3011 : Machine Learning		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 0	**ISE II**	**15 Marks**
Credits:03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course Description:

Course Outcome: After completing the course, students will be able to	
CO1	Understand fundamental concepts of Machine Learning and its applications.
CO2	Apply supervised learning algorithms to classification and regression problems.
CO3	Implement unsupervised learning methods including clustering and dimensionality reduction.
CO4	Evaluate model performance using appropriate metrics and techniques.
CO5	Design and develop ML models for real-world problems using Python libraries.

Detailed Syllabus:

Unit 1	**Introduction to Machine Learning:** Basics of Machine Learning, Applications, Types: Supervised, Unsupervised, Reinforcement Learning, Steps in a Machine Learning project, Data preprocessing: handling missing values, normalization, standardization, Feature selection and engineering
Unit 2	**Supervised Learning – Regression:** Linear Regression: simple and multiple, Logistic regression, Polynomial Regression, Evaluation metrics: MSE, MAE, R^2, Regularization: Ridge and Lasso, Implementation using Python (e.g., Scikit-learn)
Unit 3	**Supervised Learning – Classification:** Decision Trees, k-Nearest Neighbors, Support Vector Machines, Naive Bayes classifier, Evaluation metrics: Confusion matrix, Precision, Recall, F1 Score, ROC-AUC, Cross-validation, Underfitting and Overfitting, Gradient descent
Unit 4	**Unsupervised Learning:** Clustering: k-Means, Hierarchical clustering, Dimensionality Reduction, Applications in customer segmentation, anomaly detection, Visualization techniques
Unit 5	**Ensemble Learning and Model Deployment:** Bagging: Random Forest, Boosting: AdaBoost, Gradient Boosting, Basics of model interpretability, Introduction to model deployment and tools (e.g., Flask, Streamlit overview), Case studies and mini project guidance

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Text Books & Reference Books

1. Tom M. Mitchell, "Machine Learning", McGraw Hill
2. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", O'Reilly
3. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press
4. Machine Learning with PyTorch and Scikit-Learn, Sebastian Raschka, Yuxi (Hayden) Liu, Vahid Mirjalili, Packt Publishing Ltd.

Web Resources:

- https://www.udacity.com/course/intro-to-machine-learning--ud120
- https://nptel.ac.in/courses/106106139
- https://nptel.ac.in/courses/106106247
- https://www.shorturl.at/shortener.php

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcomes	Program Outcomes														
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PS O3
CO1	1	2	2	0	0	0	0	0	0	3	0	2	1	3	1
CO2	2	2	3	0	0	0	0	0	0	0	0	1	2	3	1
CO3	3	2	1	0	0	3	0	2	0	0	0	3	0	2	3
CO4	1	3	3	0	0	0	1	0	0	1	0	2	2	0	2
CO5	2	1	2	0	0	0	0	0	0	0	0	2	1	1	1

3– High 2 – Medium 1 - Low

Assessment:

ISE I / ISE II /ISE III:

In Semester Evaluation can be based on:

1. Class Test
2. Powerpoint presentation
3. Question & answer / Numerical solution
4. Surprise test
5. Any other activity suggested by course coordinator

ESE: End Semester Examination as per guidelines

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	03	03	02	10
K2	Understand	06	06	04	25
K3	Apply	06	06	04	25
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

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Assessment table:

Assessment Tool	K1	K2	K3
	CO1	CO2,CO3	CO4,CO5
ISE I (15 Marks)	03	06	06
ISE II (15 Marks)	03	06	06
ISE III (10 Marks)	02	04	04
ESE Assessment (60 Marks)	10	25	25
Total Marks 100	18	41	41

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ITPCC3012: Software Engineering		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
	ISE II	**15 Marks**
Credits: 03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course Description: Students should learn the concept and importance of Software Engineering. They should be able to construct software that is reasonably easy to understand, modify, maintain and reliable. They should learn strengths and weaknesses of various Software Engineering Techniques and Software testing fundamental principles used in engineering applications using an automated testing tool.

Course Outcomes: After completing the course, students will able to:	
CO1	Describe process of identification of real problem.
CO2	Interpret requirements, design concepts, implementation, maintain and risks.
CO3	Prepare project planning schedule.
CO4	Implement small size software application according to software standards.
CO5	Choose appropriate software testing techniques for software application.

Detailed Syllabus:

Unit 1	**Introduction and Software Process Models:** Software Engineering, Importance of SoftwareEngineering,StandardforSoftwareProcess,WaterfallModel,PrototypingModel,IterativeEnhancement Model, Spiral Model, RAD model, 4th Generation models, Formal Methods, AgileDevelopment.
Unit 2	**Requirement Engineering and Software Project Management:** Software Requirements, Types of Requirements, Requirement Engineering, Requirements Specification document, Characteristics of Requirements, Requirement verification and validation, Role of Management in Software Development, Project Estimation Techniques, Staffing, Scheduling, Earned Value Analysis, Software Risks, Software Configuration Management, Project metrics.
Unit 3	**Software Design and Coding** :Data andBehavioralModeling,Design Concepts, Modularity,Architectural design,Coupling and Cohesion, Top-down and bottom-up design, Object-oriented Analysis, Function-oriented and Object-Oriented Design approach, Software Design Document, Coding styles anddocumentation.
Unit 4	Testing and Software Quality: Testing principles, testing strategies,Black-boxand White-boxTesting Techniques,Levels oftesting-unit,integration,system, Regression,TestPlan,TestCases,Softwaredebugging,SoftwareMaintenance,SoftwareQualityAssurance(SQA),SQAtasks,Formal Technical Reviews, Software Quality Factors, ISO 9126, SEICMM,CMMI, Software Reliability.Open Source Software Testing Tools: Selenium, TestComplete.
Unit 5	**Computer Aided Software Engineering:** Computer Aided Software Engineering (CASE) and its Scope, CASE support in Software LifeCycle,ArchitectureofCASEEnvironment,UpperCASEandLowerCASE,ExposuretoCASEtools. Software Process Improvement, Component Based Software Engineering, Web Engineering, Reverse Engineering, Software Engineering challenges of Big Data.

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Text and Reference Books

1. Software Engineering: A Practitioners Approach by Roger Pressman, McGraw-Hill Publications
2. SoftwareEngineering(3rded.),ByK.KAggarwal&YogeshSingh,NewAgeInternationalPublishers,2007
3. Software Engineering – Concepts and Practices by UgrasenSuman, Cengage Learning
4. An integrated approach to Software Engineering by PankajJalote, Springer/Narosa
5. Software Engineering by Jibitesh Mishra and Ashok Mohanty, PearsonPublications
6. Fundamentals of Software Engineering by Rajib Mall Prentice Hall India
7. Software Engineering by Ian Sommerville Pearson Education (9th edition)
8. Software Engineering Fundamentals by Ali Behfrooz and FredeickJ.Hudson, Oxford University Press

Web Resources

1. https://nptel.ac.in/courses/106/105/106105182/
2. https://onlinecourses.nptel.ac.in/noc19_cs69/preview
3. https://www.mooc-list.com/course/software-engineering-introduction-edx
4. http://vlabs.iitkgp.ac.in/se/
5. http://nptel.iitm.ac.in

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes

Course outcomes	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	2	3	1	2	1	1	1	2	1	3	2	1
CO2	3	3	3	3	3	2	2	2	1	2	1	1
CO3	3	2	2	1	3	1	2	2	1	3	1	1
CO4	3	2	3	2	3	1	2	2	1	2	1	1
CO5	3	2	2	1	3	1	2	2	1	2	2	1

3 – High 2 – Medium 1 - Low

Assessment:

ISE I / ISE II /ISE III:

In Semester Evaluation can be based on:

1. Class Test
2. Power point presentation
3. Question & answer / Numerical solution
4. Surprise test

Any other activity suggested by course coordinator

ESE: End Semester Examination as per guidelines

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ITPCC3013: Lab Cryptography and Network Security		
Teaching Scheme	Examination Scheme	
Practical: 2Hrs/Week	ISE I(Term Work)	25 Marks
Credits:01	End Semester Evaluation	25 Marks

Course Outcome: After completing the course, students will be able to	
CO1	Solve problems using mathematical fundamentals for cryptography
CO2	Implement symmetric key and public key cryptographic algorithm
CO3	Identify attacks and implement defense mechanisms
CO4	Study modern tools for web and system security

List of the Experiments:
The student shall perform minimum ten experiments of the following using C/C++/Python/Java

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Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
1	Write a program for implementation of Euclid's and Extended Euclid's Algorithm	S1	CO1	02
2	Write a program for finding frequency of letters of a given file. Take three different text/ doc files as an input analyze frequency of letters (a-z or A-Z) from each file and analyze the result.	S2	CO1	02
3	Mono-alphabetic Substitution cipher : Demonstrate Caesar Cipher with the help of a program Sender's Side(Encryption) B. Receiver's Side(Decryption) The algorithm for encryption Enc takes as inputs the message m and the secret key k and outputs the ciphertext c. The algorithm for decryption Dec inputs the ciphertext c and the key k and outputs the message m. Analyze input and output using Frequency of letters	S2	CO2	03
4	Transposition cipher Demonstrate Columnar Transposition Cipher with the help of a program Sender's Side(Encryption) B. Receiver's Side(Decryption) The algorithm for encryption (E) takes as inputs the message (M) and the secret key (K) and outputs the ciphertext (C). The algorithm for decryption (D) inputs the ciphertext (C) and the key (K) and outputs the message (M). Analyze input and output using Frequency of letters	S2	CO2	03
5	Implement Key generation , Encryption and Decryption using RSA Algorithm	S2	CO2	04
6	Write a program for implementation of DH Algorithm also find the solution for man – in- the middle attack	S3	CO3	04
7	Write a program for the demonstration of Digital Signature	S3	CO3	04
8	Write a program for implementation of Radix -64	S2	CO1	03
9	Study of Firewall Configuration	S3	CO4	04
10	Case study: System Security tools	S3	CO4	04

Assessment:
ISE I (Term Work) :In-Semester Evaluation will be based on practical assignments completed and timely submission

End Semester Evaluation:The ESE will be based on oral / practical performance of the students

Assessment Table:

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Assessment Tool	S1	S2	S3
	CO1	CO2, CO3	CO4
ISE I (Term Work)	00	10	15
End Semester Evaluation (Practical Examination & Viva Voce)	00	10	15

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	05	05
S2	Manipulation	10	10
S3	Precision	10	10
S4	Articulation	00	00
S5	Naturalization	00	00
Total Marks		25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1												1		
CO2	1	1											2		1
CO3		1	2		3									2	
CO4		1	3		3		1	1	1	1	1	1		2	

3 – High 2 – Medium 1 – Low

ITPCC3014: Lab Machine Learning		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I (Term Work)**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

Course Outcomes	
CO1	Implement machine learning life cycle
CO2	Implement supervised and unsupervised machine learning algorithms
CO3	Analyze the applicability of algorithms to solve problems

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CO4	Design ensemble learning models

List of the Experiments:

The student shall perform a minimum ten experiments of the following.

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all)				
1	Implement simple linear regression model on a standard data set and plot the least square regression fit. Comment on the result. [One may use inbuilt data sets like Boston, Auto etc]	S2	CO1,CO2	02
2	Implement multiple regression model on a standard data set and plot the least square regression fit. Comment on the result. [One may use inbuilt data sets like Car seats, Boston etc].	S2	CO1,CO2	02
3	Fit a classification model using Logistic regression on a standard data set. [One may use in built data sets like Smarket, Weekly, Auto, Boston etc].	S2	CO1,CO2	02
4	Fit a classification model using K-Nearest Neighbour (KNN) Algorithm on a given data set. [One may use inbuilt data sets like Caravan, Smarket, Weekly, Auto and Boston etc].	S2	CO1,CO2	02
5	Fit a classification model using K-means Algorithm on a given data set. [One may use inbuilt data sets like Caravan, Smarket, Weekly, Auto, Boston etc.].	S2	CO1,CO2	02
Level: Moderate (All)				
6	Implement any one hierarchical clustering algorithm using a standard data set.	S2, S3	CO1,CO2,CO3	03
7	Implement feature selection approach for any one standard data set.	S2, S3	CO1,CO2,CO3	03
8	Implement Random Forest Algorithm using a standard data set.	S2, S3	CO1,CO2,CO3	03
9	Implement decision tree classification algorithm using a standard data set.	S2, S3	CO1,CO2,CO3	03
Level: Complex				
10	Implement PCA algorithm using a standard data set.	S2	CO4	03

Assessment Table:

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Assessment Tool	**S1**	**S2**	**S3**
	CO1	CO2, CO3	CO4
ISE I (Term Work)	00	15	10
End Semester Evaluation (Practical Examination & Viva Voce)	05	10	10

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**End Semester Examination**
S1	Imitation	00	05
S2	Manipulation	15	10
S3	Precision	10	10
S4	Articulation	00	00
S5	Naturalization	00	00
	Total Marks	25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes:

Course outcome	**Program Outcomes**												**PSO's**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	1	1	2						1	1	1	1	1	1	1
CO 2	1	1	2		2							1	2	1	1
CO 3	1	1	2	3	2	1						1	1	1	1

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CO 4	1	1	2									1	2	1	

3 – High 2 – Medium 1 – Low

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ITPEC3021 : Advanced Database Management System		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs/ week	**ISE I**	**10 Marks**
Tutorial: 0	**ISE II**	**10 Marks**
Credits:02	**ISE III**	**-**
	End Semester Examination	**30 Marks**

Course Description: Advanced Database Management System. In short, a ADBMS is a database program. Technically speaking, it is a software system that uses a standard method of cataloging, retrieving, and running queries on data. ADBMS contain comprehensive contents on various concepts related to database systems, database design and management, broadly it discuss about parallel and distributed database systems. The students will get a detailed introduction about database administration and management. This course includes study if structured and unstructured database like MangoDB, SQL and XML of data management.

Course Outcome:

CO1 Understand the basic concepts and architecture associated with ADBMS

CO2 Interpret and explain the impact of emerging database standards

CO3 Make use of object oriented and Advanced XML queries on Database

CO4 Apply Parallel and distributed database techniques in given situation

Detailed Syllabus:

Unit 1 **Object and Object Relational Databases** : Concepts for Object Databases: Object Identity ,Object structure ,Type Constructors ,Encapsulation of Operations ,Methods ,Persistence, Type and Class Hierarchies Inheritance , Complex Objects ,Object Database Standards, Languages and Design: ODMG Model, ODL , OQL Object Relational and Extended – Relational Systems : Object Relational features in SQL/Oracle – Case Studies XML – Structure of XML, Document Schema, Querying and Transformation, API in XML, XML applications

Unit 2 **Parallel Databases** :Database System Architectures: Centralized and Client- Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism

Unit 3 **Distributed Data Base**: Distributed database concepts, distributed DBMS architecture, distributed database design, top-down and bottom design,fragmentation, fragment allocation, distributed query processing, transactionmanagement in distributed database, distributed concurrency control, reliabilityissues in distributed DBMS.

Text Books & Reference Books

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition
2. Pramod J. Sadalage and Martin Fowler, ―NoSQL Distilled‖, Addison Wesley, ISBN10:0321826620, ISBN-13: 978-0321826626
3. Paulraj Ponniah, "Data Warehousing Fundamentals, Wiley Publications
4. C J Date, ―An Introduction to Database Systems‖, Addison-Wesley
5. Kristina Chodorow, Michael Dirolf, ―MangoDB: The Definitive Guide‖ ,O'ReillyPublications, ISBN: 978-1-449-34468-9

Web Resources

https://mongodb.com/mannueal/tutorial/install-mongodb-on-windows/

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Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1		2	2										1		
CO2	2	3	2	1									3	2	
CO3	1	2	3	1									2	3	2
CO4	1	3	3	2	1								1		2
CO5	2	2	3	3	1								2	3	3

3– High 2 – Medium 1 - Low

Assessment:

ISE I-Maximum Marks-15

ISE II- Class Test of Maximum Marks-15

ISE III-Teacher's Assessment of Maximum Marks-10

ISE I and ISE III -May be based on one of the / or combination of few of following

1) Class Test/ Surprise test/ MCQ Test
2) Assignment
3) Quizzes
4) Any other activity suggested by course coordinator

ESE-End Semester Examination of Maximum Marks-60

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**ISE II**	**ISE III**	**End Semester Examination**
K1	Remember	05	05	00	10
K2	Understand	10	10	05	25
K3	Apply	00	00	05	25
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1,K2**	**K3**
	CO1,CO2	CO3,CO4,CO5
ISE I (15 Marks)	05	10
ISE II(15 Marks)	05	10
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	35	25
Total Marks 100		

Special Instructions if any: Nil

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ITPEC3023: Deep Learning		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs/ week	**ISE I**	**10 Marks**
Tutorial: 0	**ISE II**	**10 Marks**
Credits:02	**End Semester Examination**	**30 Marks**

Course Description: Students will explore the theoretical foundations and practical applications of deep learning techniques, including feedforward neural networks, convolutional neural networks (CNNs), recurrent neural networks (RNNs), and generative models. The course covers essential topics such as backpropagation, optimization algorithms, regularization, transfer learning, and sequence modeling. Students will gain hands-on experience through programming assignments and projects using industry-standard frameworks like TensorFlow and PyTorch.

Course Outcome: After completing the course, students will be able to	
CO1	Explain the fundamental concepts of neural networks and the mathematical foundations of deep learning models.
CO2	Apply deep learning architectures such as CNNs and RNNs to solve real-world problems in domains like image and text processing.
CO3	Evaluate the performance of different deep learning models using appropriate metrics
CO4	Design deep learning solutions using frameworks such as TensorFlow or PyTorch
CO5	Demonstrate the ability to work on deep learning projects involving data preprocessing, model training, validation, and deployment.

Detailed Syllabus:

Unit 1	**Foundations of Deep Learning:** Introduction to AI, ML, and Deep Learning, Neural Networks: Perceptron, Multi-Layer Perceptron (MLP), Activation Functions: Sigmoid, Tanh, ReLU, Leaky ReLU, etc., Loss Functions: MSE, Cross-Entropy, Gradient Descent and Backpropagation, Optimization Algorithms: SGD, Momentum, RMSProp, Adam, Overfitting, Underfitting, and Regularization (L1, L2, Dropout)
Unit 2	**Deep Neural Architectures:** Convolutional Neural Networks (CNNs), Convolution, Pooling, Padding, Stride, Architectures: LeNet, AlexNet, VGG, ResNet, Transfer Learning and Fine-Tuning, Data Augmentation and Preprocessing for Images, Applications: Image Classification, Object Detection
Unit 3	**Sequence Models and NLP:** Recurrent Neural Networks (RNNs), Issues: Vanishing/Exploding Gradient, Long Short-Term Memory (LSTM) and Gated Recurrent Units (GRU), Sequence-to-Sequence Models, Introduction to Transformers and Attention Mechanism, Advanced Topics and Applications

Text Books & Reference Books

1. Deep Learning, Ian Goodfellow, Yoshua Bengio, and Aaron Courville, MIT Press,
2. Neural Networks and Deep Learning, Michael Nielsen, Determination Press
3. Deep Learning with Python, François Chollet, Manning Publications
4. Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer

Web Resources

1. https://onlinecourses.nptel.ac.in/noc20_cs62/preview
2. https://onlinecourses.nptel.ac.in/noc21_cs76/preview

Mapping of Course outcome with Program Outcomes and Program Spe

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Course outcome	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	3						2	2	1	2	3
CO2	2	2	2	3	3						2	2	1	2	3
CO3	2	2	2	3	3						2	2	1	2	3
CO4	2	2	2	3	3						2	2	1	2	3
CO5	2	2	2	3	3						2	2	1	2	3

3– High 2 – Medium 1 - Low

Assessment:
ISE I / ISE II /ISE III:
In Semester Evaluation can be based on:

1. Class Test
2. Powerpoint presentation
3. Question & answer / Numerical solution
4. Surprise test
5. Any other activity suggested by course coordinator

ESE: End Semester Examination as per guidelines

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	End Semester Examination
K1	Remember	3	2	05
K2	Understand	5	5	15
K3	Apply	2	3	05
K4	Analyze	-	-	-
K5	Evaluate	-	-	-
K6	Create	-	-	-
Total Marks 50		10	10	30

Assessment table:

Assessment Tool	K1	K2	K3
	CO1	CO2,CO3	CO4,CO5
ISE I (10 Marks)	3	5	2
ISE II (10 Marks)	3	3	4
ISE III (00 Marks)	-	-	-
ESE Assessment (30 Marks)	10	10	10
Total Marks 50	16	18	16

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ITPEC3025 : Data Warehousing and Data Mining		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs/ week	**ISE I**	**10 Marks**
Tutorial: 0	**ISE II**	**10 Marks**
Credits:02	**End Semester Examination**	**30 Marks**

Course Description:

Course Outcome: After completing the course, students will be able to	
CO1	This course will introduce the concepts, techniques, design and applications of data warehousing and data mining.
CO2	The course is expected to enable students to understand and implement classical algorithms in data mining and data warehousing.
CO3	Students will learn how to analyze the data, identify the problems, and choose the relevant algorithms to apply.
CO4	Students will be able to assess the strengths and weaknesses of the algorithms and analyze their behavior on real datasets

Detailed Syllabus:

Unit 1	**Data warehouse and OLAP Technology for data mining:** Data warehouse, multidimensional data model, data warehouse architecture, data warehouse storage, data warehouse implementation.
Unit 2	**Data mining:** Data mining functions, classification and major issues. Data Preprocessing Data cleaning, data integration and transformation, data reduction, discrimination & concept hierarchy generation.
Unit 3	**Data mining primitives**: Further development of Data Cube and OLAP technology, Concept, Data mining query language. Concept description: data generalization, Analytical characterization, mining class comparison, Association Mining, Apriori Algorithm, Frequent Pattern Growth Algorithm, Data Mining Functions,Introduction to Classification and prediction, Issues regarding classification and prediction, conditional probabilities-m estimate approach,

Text Books & Reference Books

1. Data Mining Concepts and Technique's, Han and M.Kamber, 1st edition, Elsevier Pub. Indian Reprint, 2004.
2. Data Ware Housing, Data Mining and OLAP, Berson, 2nd Edition, Tata McGraw-Hill, 2004.
3. The Data Ware House Life Cycle Tool Kit, R. Kimball , 1st Edition, Wiley Press, John Wiley and Sons (ASIA) Pvt. Ltd,2001.
4. Data Mining Techniques, Arun K. Pujari, 2nd Edition, University Press (Orient Longman), 2003.

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Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

CO	PO / PSO														
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PSO 2	PSO 3
ITU526.1	3	2	0	0	3	0	0	0	0	0	0	0	0	2	1
ITU526.2	2	2	0	0	3	0	0	0	0	0	0	0	1	2	1
ITU526.3	2	2	0	2	3	0	0	0	0	0	0	0	0	2	2
ITU526.4	2	2	2	2	3	0	0	0	0	0	0	0	2	2	3
ITU526.5	2	2	3	2	3	0	0	0	0	0	3	0	1	2	3

3– High 2 – Medium 1 - Low

Assessment:
ISE I: Class Test-I of Maximum Marks-15
ISE II: Class Test-II of Maximum Marks-15
ISE III: Teacher's Assessment of Maximum Marks-10
Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Power point presentation
2) Question & answer / Numerical solution
3) Surprise test
4) Any other activity suggested by course coordinator

ESE: End Semester Examination of Maximum Marks-60

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	End Semester Examination
K1	Remember	00	00	05
K2	Understand	05	05	15
K3	Apply	05	05	10
K4	Analyze	00	00	00
K5	Evaluate	00	00	00
K6	Create	00	00	00
Total Marks 50		10	10	30

Assessment table:

Assessment Tool	K1	K2	K3
	CO1	CO2,CO3	CO4
ISE I (10 Marks)	02	03	05
ISE II (10 Marks)	00	05	05
ESE Assessment (30 Marks)	05	15	10
Total Marks 50	07	23	20

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Course Outcomes:

After completion of this course students will be able to:

ITPEC3022 : Lab Advanced Database Management System		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE (Term Work)**	**25 Marks**
Credits:01	**End Semester Evaluation**	

	Course Outcomes
CO1	Identify and resolve physical database design and implementation issues
CO2	Design, develop and implement a mid-scale relational database for an application domain using a commercial-grade DBMS
CO3	Demonstrate capacity to perform a self directed piece of practical work that requires the application of data warehousing techniques
CO4	Design and implement a complete problem solution using current database technology

List of the Experiments:

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all)				
1	**Group A:** Introduction to Databases (Study assignment)Study and design a database with suitable example using following databasesystems: Relational: SQL / PostgreSQL / MySQL Key-value: Riak / Redis (different database systems based on points like efficiency, scalability, characteristicsand performance.)	S1,S2	CO1, CO2	2
2	**Group B:** Design any database with at least 3 entities and relationships between them. Apply DCL and DDL commands. Draw suitable ER/EER diagram for the system.	S2,S3	CO1, CO2	2
3	Design and implement a database and apply at least 10 different DML queries for the following task. For a given input string display only those records which match thegiven pattern or a phrase in the search string. Make use of wild characters and LIKE operator for the same. Make use of Boolean and arithmetic operators wherever necessary	S3	CO1, CO2, CO4	2
4	Implement nested sub queries. Perform a test for set membership (in, not in), setcomparison (<some, >=some, <all etc.) and set cardinality (unique, not unique	S4	CO1, CO2	2
5	Write and execute suitable database triggers .Consider row level and statement levelTriggers.	S3	CO1, CO2	2
Level: Moderate (any six)				
6	**Group C:** Study of Open Source NOSQL Database: MongoDB (Installation, Basic CRUDoperations, Execution)	S1	CO1, CO2, CO4	2
7	Design and Develop MongoDB Queries using CRUD operations. (Use CRUDoperations, SAVE method, logical operators)	S2	CO1, CO2, CO4	2
8	Implement aggregation and indexing with suitable example using	S2		

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	MongoDB.		CO2, CO4	
9	Design and Implement any 5 query using MongoDB	S3	CO1, CO2, CO4	2
10	Create simple objects and array objects using JSON	S2	CO1, CO2, CO4	2
11	Encode and Decode JSON Objects using Java/Perl/PHP/Python/Ruby	S2,S3	CO1, CO2, CO4	2
12	Implement Fact Tables	S3	CO1, CO2, CO3	2
13	Implement star schema	S3	CO1, CO2, CO3	2
Level: Complex (any one)				
14	**Group D:** Write a program to implement MogoDB database connectivity with PHP/ python/Java Implement Database navigation operations (add, delete, edit etc.) using ODBC/JDBC	S3,S4	CO1, CO2, CO3, CO4	3
15	Implement MYSQL/Oracle database connectivity with PHP/ python/Java Implement Database navigation operations (add, delete, edit,) using ODBC/JDBC	S3,S4	CO1, CO2, CO3, CO4	3

Assessment:

ISE I It shall be based on one of the / or combination of few of: Attendance, punctuality, sincerity throughout semester, performance of during practical sessions, timely completion of allotted lab work, relevant test etc. Maximum marks shall be 25

End Semester Evaluation It shall be based on practical examination and viva-voce. Maximum marks shall be 25

Assessment Table:

Assessment Tool	S3	S3	S1	S6
	CO1	CO2	CO3	CO4
Term work(25Marks)	06	07	06	06
Practical Examination & Viva Voce(25 Marks)	06	07	06	06

Assessment Pattern: Use the relevant table for assessment pattern.

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Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	06	06
S2	Manipulation	07	07
S3	Precision	06	06
S4	Articulation	06	06
S5	Naturalization	00	00
Total Marks		25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3	2	1									1		
CO2		2	3	2	1								2	3	3
CO3	1	2	2											2	
CO4		2	3	3	1								1	3	3

3 – High 2 – Medium 1 - Low

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ITPEC3024: Lab Deep Learning		
Teaching Scheme	**Examination Scheme**	
Practical: 2 Hrs/Week	**ISE I (Term Work)**	**25 Marks**
Credits:01	**End Semester Evaluation**	

Course Outcome: After completing the course, students will be able to	
CO1	Implement fundamental neural network architectures such as Perceptrons, Multi-layer Perceptrons (MLPs), and Convolutional Neural Networks (CNNs).
CO2	Apply appropriate training techniques (e.g., backpropagation, optimizers) and activation functions to improve the performance of deep learning models.
CO3	Evaluate the performance of deep learning models on image, text, and sequential datasets using suitable metrics and visualization tools.
CO4	Develop deep learning solutions using modern frameworks such as TensorFlow or PyTorch for real-world applications like image classification, text analysis, and object detection.

List of the Experiments:

The student shall perform minimum ten experiments of the following using Python/ Matlab:

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Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all)				
1	Implement Perceptron Algorithm, Binary classification on linearly separable data	S2	1	2
2	Build a simple feedforward neural network from scratch. Use activation functions (ReLU, Sigmoid, Tanh)	S2	1	2
3	Implement Backpropagation Algorithm	S2	1	2
4	Implement SGD, Momentum, RMSprop, Adam	S2	2	2
5	Implement Image Classification using CNN (e.g., MNIST / CIFAR-10). Use Conv2D, MaxPooling, Flatten layers	S2	2	2
Level: Medium				
6	Write program for Data Augmentation & Regularization Techniques, Dropout, Batch Normalization, Image Data Generator	S2	2	2
7	Implement Transfer Learning. Use pre-trained models like VGG16, ResNet for classification	S2	2	2
8	Program for Sequence Models: RNN for Sequence Prediction Predict next element in a sequence	S2	3	2
9	Program for LSTM/GRU for Text Generation. Train model to generate text character-by-character or word-by-word	S2	3	2
10	Sentiment Analysis using Embeddings (e.g., IMDB Dataset)	S3	4	2
Level: Complex				
11	Autoencoders for Dimensionality Reduction	S3	4	2
12	Program for GANs (Generative Adversarial Networks), Generate synthetic images (Basic GAN architecture)	S3	4	3

Assessment:

ISE I (Term Work): In-Semester Evaluation will be based on practical assignments completed and timely submission

End Semester Evaluation: The ESE will be based on oral / practical performance of the students

Assessment Table:

Assessment Tool	S1	S2	S3
	CO1	CO2, CO3	CO4
ISE I (Term Work)	05	13	07
End Semester Evaluation (Practical Examination & Viva Voce)	00	10	15

Assessment Pattern:

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Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	05	05
S2	Manipulation	10	10
S3	Precision	10	10
S4	Articulation	00	00
S5	Naturalization	00	00
	Total Marks	25	25

Course outcome	Program Outcomes												PSO's		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	2	2	2	3						1	2	1	2	3
CO2	1	2	2	2	3						1	2	1	2	3
CO3	1	2	2	2	3						1	2	1	2	3
CO4	1	2	2	2	3						1	2	1	2	3

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes:
3 – High 2 – Medium 1 – Low

ITPEC3026: Lab Data Warehousing and Data Mining		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I (Term Work)**	**25 Marks**
Credits:01	**End Semester Evaluation**	

Course Outcome: After completing the course, students will be able to	
CO1	Solve problems using mathematical fundamentals for data mining and data preprocessing
CO2	Implement clustering algorithm using data set

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CO3	Implement classification algorithm for standard data set
CO4	Study modern tools for data mining

List of the Experiments:

The student shall perform minimum eight experiments of the following

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all)				
1	Implementation of Binning Methods for DATA SMOOTHING.	S1	CO1	02
2	Implementation of MIN/MAX normalization and Z-SCORE normalization.	S1	CO1	02
3	Write a program for finding MEAN and MEDIAN of the given Data Set. DATA SET-(4,8,9,15,21,21,24,25,26,28,29,34)	S1	CO1	03
4	Generate/Prepare HISTOGRAMS for given data using WEKA software. DATASET-(1,1,5,5,5,5,5,8,8,10,10,10,12,14,14,14,15, 15, 15, 15, 15, 15,18, 18, 18, 18, 18, 18,18, 18,20, 20, 20, 20, 20, 20, 20,25, 25, 25, 25, 25,28,28,30,30,30)	S2	CO1	03
5	Implement the STAR Schema of a Data Warehouse for Sales (Consider one Example).	S2	CO1	03
Level: Medium				
6	Implementation of K-MEANS algorithm for Clustering.	S3	CO2	03
7	Write a program for predicting a class Label using Naïve Bayesian Classification for a given data set.	S3	CO3	03
8	Prepare Correlation analysis using CHI-SQUARE method in WEKA software Using given data set.	S2	CO4	03
Level: Complex				
09	Implementation of Apriori algorithm for Association mining.	S2	CO4	03

Assessment:

ISE I (Term Work) : In-Semester Evaluation of 25 marks each will be based on practical assignments completed and timely submission

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End Semester Evaluation: The ESE will be based on oral / practical performance of the students

Assessment Table:

Assessment Tool	**S1**	**S2**	**S3**
	CO1	CO2, CO3	CO4
ISE I (Term Work)	00	10	15
End Semester Evaluation (Practical Examination & Viva Voce)	00	10	15

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**End Semester Examination**
S1	Imitation	05	05
S2	Manipulation	10	10
S3	Precision	10	10
S4	Articulation	00	00
S5	Naturalization	00	00
	Total Marks	25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes:

Course outcome	**Program Outcomes**												**PSO's**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1												1		
CO2	1	1											2		1

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CO3		1	2		3									2	
CO4		1	3		3		1	1	1	1	1	1		2	

3 – High 2 – Medium 1 – Low

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