ESTD : 1946

THE NATIONAL INSTITUTE OF ENGINEERING

(An Autonomous Institute under Visvesvaraya Technology University, Belagavi)

Scheme of Teaching &
Blown-up Syllabus for Semester-VI
(2022 admitted batch)
Academic Year 2024-25

DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Department Vision

"The Department will provide quality and value based education to produce innovative world-class computing engineers and will enhance quality research for the betterment of society"

Department Mission

- To impart high quality training, education and competence in information science domain through best-in class faculty and facilities

- To produce globally acceptable information science graduates who can contribute professionally to the industry and research activities by offering courses on emerging technologies.

- To provide platforms to work effectively and innovatively in multi-disciplinary domain.

Programme Educational Objectives

PEO 1: Professionally successful in the field of Information and emerging technologies.
PEO 2: Successful in pursuing higher studies at globally recognized institutions.

Programme Specific Objectives

PSO 1: Apply the knowledge of information Systems in the field of Engineering to provide Solution through programming skills
PSO 2: Collaborate and communicate effectively with professionals in the field of computing, involve in continuous learning and address societal issues

Programme Outcomes

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

The National Institute of Engineering

Scheme of Teaching & Examination (2022 Scheme)

Department: Information Science & Engineering

B.E. 2022 & 2023 Admitted Batch

Semester : VI

Sl. No	Type of Course	Course Code	Course Title	Teaching Department (TD)	Question Paper setting Board (PSB)	Teaching Hrs/Week				Examination				Credits
						L	T	P	S	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	IPCC	BIS601	Full Stack Development	IS&E	IS&E	3	0	2		3	100	100	100	4
2	PCC	BIS602	Machine Learning	IS&E	IS&E	4	0	0		3	100	100	100	4
3	PEC	BIS613x	Professional Elective Course - Group II	IS&E	IS&E	3	0	0		3	100	100	100	3
4	OEC	BIS654x	Open Elective Course - Group I	IS&E	IS&E	3	0	0		3	100	100	100	3
5	PCC	BIS605	Software Architecture and Design Patterns	IS&E	IS&E	3	0	0		3	100	100	100	3
6	PCC	BIS606	Cryptography and Network Security	IS&E	IS&E	3	0	0		3	100	100	100	3
7	PCCL	BISL607	Machine Learning Lab	IS&E	IS&E	0	0	2		3	50	50	100	1
8	AEC/SDC	BXX657X	Ability Enhancement Course / Skill Development Course V	IS&E	IS&E	If the course is a Theory: 1	0	0		1	50	50	100	**1**
						OR								
						If the course is a Laboratory: 0	0	2		2				
9	MC	BNSK658	National Service Scheme (NSS)	NSS Coordinator		0	0	2		_	100	_	100	**0**
		BPEK658	Physical Education (PE) (Sports & Athletics)	PED										
		BYOK658	Yoga	Yoga Teacher										
10	MC	BIKK259	Indian Knowledge Systems	Humanities		1	0	0	0	0	50	-	50	0
Total											**550**	**400**	**950**	**22**

Professional Elective Course - Group II			
BIS613A	Blockchain Technology		
BIS613B	Internet of Things		
BIS613C	Compiler Design		
Open Elective Course - Group I			
BIS654A	Introduction to Data Structures	BIS654D	Introduction to AI
BIS654B	Fundamentals of Operating Systems		
BIS654C	Mobile Application Development		
Ability Enhancement Course / Skill Enhancement Course-V			
BISL657A	Progressive App Development	BIS/L657D	DevOps
BISL657B	Tosca – Automated Software Testing		
BISL657C	Cyber Laws		

Course Code: BIS601
Credits: 4
CIE: 50 Marks
SEE Hours: 3

Course: Full Stack Development
L:T:P 3:0:2
SEE: 50 Marks
Max. Marks: 100

Prerequisites if any	Nil
Learning objectives	1. Explain the use of learning full stack web development. 2. Make use of rapid application development in the design of responsive web pages 3. Illustrate Models, Views and Templates with their connectivity in Django for full stack web development 4. Demonstrate the use of state management and admin interfaces automation in Django 5. Design and implement Django apps containing dynamic pages with SQL databases

Course Outcomes:
On successful completion of the course, the student will be able to:

COs	Course Outcomes	Bloom's level
CO1	Understand the working of MVT based full stack web development with Django	L2
CO2	Designing of Models and Forms for rapid development of web pages	L3
CO3	Analyze the role of Template Inheritance and Generic views for developing full stack web applications	L3
CO4	Apply the Django framework libraries to render non-HTML contents like CSV and PDF	L3
CO5	Perform jQuery based AJAX integration to Django Apps to build responsive full stack web applications	L3

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	3	1		1	3							1		3	
CO2	3	2	3	2	3						1	2		3	
CO3	3	3	2		3						1			3	
CO4	3	2	2		3						1	2		3	
CO5	3	2	3		3						1	1		3	

3 – Strong 2 – Medium 1 – Low

Course Structure

	Module – 1	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
1.1	MVC based Web Designing: Web framework	2		
1.2	MVC Design Pattern, Django Evolution	2		2
1.3	Views, Mapping URL to Views	1		
1.4	Working of Django URL Confs and Loose Coupling	2		2
1.5	Errors in Django, Wild Card patterns in URLS	1		
	Module – 2			
2.1	Django Templates and Models: Template System Basics,	1		
2.2	Using Django Template System	1		
2.3	Basic Template Tags and Filters, MVT Development Pattern	1		
2.4	Template Loading, Template Inheritance	1		
2.5	MVT Development Pattern	1		
2.6	Configuring Databases, Defining and Implementing Models	1		
2.7	Basic Data Access, Adding Model String Representations,	1		2
2.8	Inserting/Updating data, Selecting and deleting objects, Schema Evolution	1		2
	Module – 3	1		
3.1	Django Admin Interfaces and Model Forms, Activating Admin Interfaces, Using Admin Interfaces	1		
3.2	Customizing Admin Interfaces, Reasons to use Admin Interfaces	2		
3.3	Form Processing, Creating Feedback forms	2		2
3.4	Form submissions, custom validation, creating Model Forms	2		2
3.5	URLConf Ticks, Including Other URLConfs	1		
	Module – 4			
4.1	Generic Views and Django State Persistence: Using Generic Views, Generic Views of Objects	2		
4.2	Extending Generic Views of objects, Extending Generic Views	2		
4.3	MIME Types, Generating Non-HTML contents like CSV and PDF	2		2
4.4	Syndication Feed Framework, Sitemap framework	1		
4.5	Cookies, Sessions, Users and Authentication	1		2
	Module – 5			
5.1	jQuery and AJAX Integration in Django: Ajax Solution, Java Script, XHTML HTTP Request and Response	2		2
5.2	HTML, CSS, JSON, iFrames	2		
5.3	Settings of Java Script in Django	1		
5.4	jQuery and Basic AJAX	2		2
5.5	jQuery AJAX Facilities, Using jQuery UI Autocomplete in Django	2		
	Total No. of Lecture Hours	40		
	Total No. of Tutorial Hours		00	
	Total No. of Practical Hours			20

Practical Component:

1. Installation of Python, Django and Visual Studio code editors, Creation of virtual environment, Django project and App should be demonstrated
2. Develop a Django app that displays current date and time in server and modify the Django app that displays date and time four hours ahead and four hours before as an offset of current date and time in server.
3. Develop a layout.html with a suitable header (containing navigation menu) and footer with copyright and developer information. Inherit this layout.html and create 3 additional pages: contact us, About Us and Home page of any website.
4. Develop a Django app that performs student registration to a course. It should also display list of students registered for any selected course. Create students and course as models with enrolment as ManyToMany field.
5. For student and course models created in Lab experiment for Module2, register admin interfaces, perform migrations and illustrate data entry through admin forms.
6. Develop a Model form for student that contains his topic chosen for project, languages used and duration with a model called project.
7. For students enrolment developed in Module 2, create a generic class view which displays list of students and detailview that displays student details for any selected student in the list.
8. Develop example Django app that performs CSV and PDF generation for any models created in previous laboratory component.
9. Develop a registration page for student enrolment as done in Module 2 but without page refresh using AJAX.
10. Develop a search application in Django using AJAX that displays courses enrolled by a student being searched.

Textbooks:

1. Adrian Holovaty, Jacob Kaplan Moss, The Definitive Guide to Django: Web Development Done Right, Second Edition, Springer-Verlag Berlin and Heidelberg GmbH & Co. KG Publishers, 2009.
2. Jonathan Hayward, Django Java Script Integration: AJAX and jQuery, First Edition, Pack Publishing, 2011.

Reference Books:

1. Aidas Bendroraitis, Jake Kronika, Django 3 Web Development Cookbook, Fourth Edition, Packt Publishing, 2020
2. William Vincent, Django for Beginners: Build websites with Python and Django, First Edition, Amazon Digital Services, 2018
3. Antonio Mele, Django3 by Example, 3rd Edition, Pack Publishers, 2020
4. Arun Ravindran, Django Design Patterns and Best Practices, 2nd Edition, Pack Publishers, 2020.
5. Julia Elman, Mark Lavin, Light weight Django, David A. Bell, 1st Edition, Oreily Publications, 2014

Online Resources:

1. MVT architecture with Django: https://freevideolectures.com/course/3700/django-tutorials
2. Using Python in Django: https://www.youtube.com/watch?v=2BqoLiMT3Ao
3. Model Forms with Django: https://www.youtube.com/watch?v=gMM1rtTwKxE
4. Real time Interactions in Django: https://www.youtube.com/watch?v=3gHmfoeZ45k
5. AJAX with Django for beginners: https://www.youtube.com/watch?v=3VaKNyjlxAU

Course Code: BIS602
Credits: 3
CIE: 50 Marks
SEE Hours: 3

Course: Machine Learning
L:T:P 4:0:0
SEE: 50 Marks
Max. Marks: 100

Prerequisites if any	Linear Algebra, Calculus, probability, and statistics, Python or Matlab
Learning objectives	1. Explain the basics of machine learning and its classifications. 2. Illustrate the working of algorithms on classifications. 3. Discuss the working of Support Vector Machines and Decision tree. 4. Illustrate data pre-processing techniques and describe Data Compression using Dimensionality Reductiontechniques. 5. Outline best practices for model evaluation.

Course Outcomes:

On successful completion of the course, the student will be able to:

COs	Course Outcomes	Bloom's level
CO1	1. Explain the basics of machine learning and its classifications.	L3
CO2	2. Illustrate the working of algorithms on classifications and data pre-processing techniques.	L2
CO3	3. Discuss the working of Support Vector Machines & Decision tree. Data Compression using Dimensionality Reduction techniques.	L3
CO4	4. Outline best practices for model evaluation.	L3

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	3		2		3									3	3
CO2	3		2	3	3									3	3
CO3	3		2	3	3									3	3

3 – Strong 2 – Medium 1 – Low

Course Structure

	Module–1	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
1.1	Introduction to Machine Learning, The three different types of machine learning, Making predictions about the future with supervised learning, Classification for predicting class labels, Regression for predicting continuous outcomes.	2	0	0
1.2	Solving interactive problems with reinforcement Learning, Discovering hidden structures with unsupervised learning, Finding subgroups with clustering Dimensionality reduction for data compression,	2	0	0
1.3	An introduction to the basic terminology and notations, A roadmap for building machine learning systems Preprocessing–getting data into shape, Training and selecting a predictive model Evaluating models and predicting unseen data instances.	2	0	0
1.4	Artificial neurons – a brief glimpse into the early history of machine learning Implementing a perception learning algorithm in Python Training a perception model on the Iris dataset. Adaptive linear neurons and the convergence of learning Minimizing cost functions with gradient descent.	2	0	0
	Module–2			
2.1	A Tour of Machine Learning Classifiers Using Scikit-learn-Choosing a classification algorithm, Training a perception via Scikit learn, Learning the weights of the logistic cost function.	2	0	0
2.2	Training a logistic regression model with Scikit-learn, Modeling class probabilities via logistic regression- Logistic regression intuition and conditional probabilities.	2	0	0
2.3	Tackling overfitting via regularization, Maximum margin classification with support vector machines. Maximum margin intuition.	2	0	0
2.4	Dealing with the non linearly separable case using slack variables, Alternative implementation sin Scikit-learn, Solving non linear problems using a kernel SVM, Using the kernel trick to find separating hyper planes in higher dimensional space.	2	0	0
	Module3			
3.1	Decision tree learning, Maximizing information gain–getting the most bang for the buck, Building a decision tree, Combining weak to strong learners via random forests, K-nearest neighbors–a lazy learning algorithm	2	0	0
3.2	Building Good Training Sets – Data Preprocessing, Dealing with missing Data, Eliminating samples or features with missing values, Imputing missing values Understanding the scikit-learn estimator API.	2	0	0
3.3	Handling categorical data Mapping ordinal features, Encoding class labels, Performing one-hot encoding on nominal features, Partitioning a dataset in training and test sets.	2	0	0
3.4	Bringing features onto the same scale, Selecting meaningful features-Sparse solutions with L1 regularization, Sequential feature selection algorithms.	2	0	0
	Module–4			

4.1	Compressing Data via Dimensionality Reduction, Unsupervised dimensionality reduction via Principal Component Analysis, Total and explained variance, Feature transformation, Principal component analysis in scikit-learn,	2	0	0
4.2	Supervised data compression via linear discriminant analysis, Computing the scatter matrices, Selecting linear discriminants for the new feature Subspace, Projecting samples on to the new feature space, LDA via scikit-learn	2	0	0
4.3	Using kernel principal component analysis for nonlinear mappings, Kernel functions and the kernel trick, Implementing a kernel principal component analysis in Python- Example1– separating half-moon shapes, Example2 –separating concentric circles.	2	0	0
4.4	Projecting new data points Kernel principal component analysis in scikit-learn.	2	0	0
	Module–5		0	0
5.1	Learning Best Practices for Model Evaluation and Hyper parameter Tuning- Streamlining workflows with pipelines, Loading the Breast Cancer Wisconsin dataset, Combining transformers and estimators in a pipeline.	2	0	0
5.2	Using k-fold cross-validation to assess model performance- The holdout method, K-fold cross-validation.	2	0	0
5.3	Debugging algorithms with learning and validation curves- Diagnosing bias and variance problems with learning curves, Addressing over fitting and under fitting with validation curves.	2	0	0
5.4	Looking at different performance evaluation metrics, Reading a confusion matrix, Optimizing the precision and recall of a classification model, Plotting a receiver operating characteristic, The scoring metrics for multi class classification.	2	0	0
	Total No. of Lecture Hours	40	0	
	Total No. of Tutorial Hours		0	0
	Total No. of Practical Hours			0

Textbooks:

1. Sebastian Raschka, "Python Machine Learning", Machine learning and deep learning with python, Sciki- learn and TensorFlow2, 3rd edition-includes TensorFlow2,GANs and Reinforcement Learning, 2019.
2. Aurelien Geron, Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems, O'Reilly Publications, 2nd edition, 2019.

Reference Books:

1. Ethem Alpaydm , Introduction to Machine Learning (Adaptive Computation and machine learning), The MIT Press Cambridge, Massachusetts London, ISBN: 0-262- 01211-1, 2004.
2. Simon Rogers, Mark Girolami, A first course in machine learning, Chapman, & Hall/CRCmachine learning& pattern recognition, 2011.
3. John D. Kelleher, Brian Mac Namee, Aoife D'Arcy, FUNDAMENTALS OF MACHINE LEARNING FOR PREDICTIVE DATA ANALYTICS Algorithms, Worked Examples, and Case Studies, The MIT Press, Cambridge, Massachusetts, London, England.

Course Code: BIS613A
Credits: 3
CIE: 50 Marks
SEE Hours: 3

Course: Blockchain Technology
L:T:P 3:0:0
SEE: 50 Marks
Max. Marks: 100

Prerequisites if any	Nil
Learning objectives	1. Understand blockchain technology. 2. Understand the various cryptocurrency ecosystem.

Course Outcomes:
On successful completion of the course, the student will be able to:

COs	Course Outcomes	Bloom's level
CO1	Describe the underlying architecture and basics of cryptographic concepts for blockchain technology	L2
CO2	Understand the Bitcoin blockchain	L2
CO3	Distinguish the working of Ethereum against the Bitcoin blockchain	L2
CO4	Understand the altcoins and regulations of blockchain	L2

Mapping with POs and PSOs:

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

3 – Strong 2 – Medium 1 – Low

Course Structure

	Module – 1	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
1.1	**Introduction to Fundamentals and Cryptography**: Basics: Distributed Database, Two Generals' Problem	2		
1.2	Byzantine Generals Problem and Fault Tolerance	2		
1.3	Cryptographic Hash Functions, Hash Pointers and Data structures	1		
1.4	Digital Signatures	2		
1.5	Public keys as Identities, Application Specific Integrated Circuits (ASIC)	1		
	Module – 2			
2.1	**Bitcoin Blockchain-1**: History of Bitcoin, Transactions	1		
2.2	Blocks, Mining and the Blockchain	1		
2.3	Bitcoin Transactions, Constructing a Transaction	1		
2.4	Bitcoin Mining, Mining Transaction in Blocks	1		
2.5	Spending the Transaction, Bitcoin Addresses, Wallets	1		
2.6	Transactions: Transaction Lifecycle, Transaction Structure	1		
2.7	Transaction Outputs and Inputs, Transaction Chaining and Orphan Transactions	1		
2.8	Transaction Scripts and Script Language, Standard Transactions-Pay to Public Key Hash (P2PKH)	1		
	Module – 3	1		
3.1	**Bitcoin Blockchain-2**: Structure of a Block, Block Header	1		
3.2	Block Identifiers - Block Header Hash and Block Height	1		
3.3	The Genesis Block, Linking Blocks in the Blockchain	1		
3.4	De-centralized Consensus, Independent Verification of Transactions	1		
3.5	Mining Nodes, Aggregating Transactions into Blocks	1		
3.6	Constructing the Block Header, Mining the Block- Proof of Work	2		
3.7	Successfully Mining the Block, Validating a New Block, Blockchain Forks	1		
	Module – 4			
4.1	**Ethereum Blockchain**: Introduction, Comparison with Bitcoin Blockchain	1		
4.2	Ether currency Units, Choosing a Ethereum Wallet, A Simple Contract: A Test Ether Faucet	1		
4.3	Ethereum's Cryptographic Hash Function, Ethereum Addresses	1		
4.4	Transactions: The Structure of a Transaction	1		
4.5	The Transaction Nonce, Transaction Gas, Transaction Recipient, Transaction Value and Data	1		
4.6	Proof-of-Stake, Introduction to DApps	2		

	Module – 5			
5.1	**Altcoins and the Cryptocurrency Ecosystem**: Cryptocurrency Regulation: Stakeholders, Roots of Bitcoin	2		
5.2	Legal Aspects-Crypto currency Exchange	2		
5.3	Altcoins: History and Motivation	1		
5.4	Few Altcoins in Detail- Namecoin, Litecoin	2		
5.5	Dogecoin, Relationship Between Bitcoin And Altcoins-Comparing Altcoins	2		
	Total No. of Lecture Hours	39		
	Total No. of Tutorial Hours		00	
	Total No. of Practical Hours			00

Textbooks:

1. Andreas M. Antonopoulos, "Mastering Bitcoin", O'Reilly Media, Inc, 2017.
2. Andreas M. Antonopoulos, Galvin Wood, "Mastering Ethreum", O'Reilly Media, Inc, 2018
3. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies", A Comprehensive Introduction, Princeton University Press, 2016.

Reference Books:

1. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
2. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014. 3. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

Online Resources:

1. https://www.my-mooc.com/en/categorie/blockchain-andcryptocurrency
2. https://www.lopp.net/pdf/princeton_bitcoin_book.pdf
   https://crypto.stanford.edu/cs251_fall16/syllabus.html
3. https://www.mooc4dev.org/blockchain1

Course Code: BIS654B
Credits: 3
CIE: 50 Marks
SEE Hours: 3

Course: Fundamentals of Operating Systems
L: T:P 3:0:0
SEE: 50 Marks
Max. Marks: 100

Prerequisites if any	Nil
Learning objectives	1. Understand the services provided by and the operating system 2. Discuss suitable techniques for management of different resources by the operating system

Course Outcomes:
On successful completion of the course, the student will be able to:

Cos	Course Outcomes	Bloom's Level
CO1	Explain the structure and functionality of the operating system.	L2
CO2	Analyse the basics of the operating systems, mechanisms of OS to handle processes, threads, and Inter process communication.	L3
CO3	Illustrate different conditions for deadlock and their possible solutions.	L2
CO4	Analyze the memory management and its allocation policies.	L3
CO5	Discuss the storage management policies with respect to different storage management technologies.	L2

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	3	2	3	1			1					2		3	
CO2	3	2	3	1			1					2		3	
CO3	3	2	3	1			1					2		3	
CO4	3	2	3	1			1					2		3	
CO5	3	2	3	1			1					2		3	

3 – Strong 2 – Medium 1 – Low

Course Structure

	Module – 1	No. of Lecture Hours	No. of Tutorial Hours	Self-Learning Hours
1.1	Introduction to operating systems, System structures: What operating systems do; Computer System organization; Operating System structure; Operating System operations;	2	-	-
1.2	Process management; Memory management; Storage management; Protection and Security; Operating System Services;	2	-	-
1.3	User – Operating System interface; System calls; Types of system calls;	2	-	-
1.4	Operating System structure; Virtual machines; Operating System generation; System boot.	2	-	-
	Module – 2			
2.1	Process Management: Process concept; Process scheduling; Operations on processes.	2	-	-
2.2	Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues	2	-	-
2.3	Process Scheduling: Basic concepts; Scheduling Criteria;	1	-	-
2.4	Scheduling Algorithms;	2	-	-
2.5	Thread scheduling; Multiple-processor scheduling.	1	-	-
	Module – 3			
3.1	Process Synchronization: Synchronization: The critical section problem; Semaphores;	2	-	-
3.2	Peterson's solution; Synchronization hardware	2	-	-
3.3	Classical problems of synchronization;	1	-	-
3.4	Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention;	1	-	-
3.5	Deadlock avoidance; Deadlock detection and recovery from deadlock.	2	-	-
	Module – 4			
4.1	Memory Management: Memory management strategies: Background; Swapping.	2	-	-
4.2	Contiguous memory allocation; Paging; Structure of page table; Segmentation.	2	-	-
4.3	Virtual Memory Management: Background; Demand paging; Copy-on-write;	2	-	-
4.4	Page replacement; Allocation of frames; Thrashing.	2	-	-
	Module – 5			
5.1	File system: File concept; Access methods;	2		-
5.2	File-System Operations; Directory implementation; Allocation methods;	2		-

5.3	Free space management-Bit Vector; Linked List; Grouping; Counting	1		-
5.4	Disk structure; Disk attachment;	2		-
5.5	Disk scheduling-FCFS Scheduling; SCAN Scheduling; C-SCAN Scheduling;	1		-
	Total No. of Lecture Hours	40		
	Total No. of Tutorial Hours		-	-

Textbooks:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 10th edition, Wiley-India, 2018

Reference Books:

1. McHoes and I. M. Flynn, Understanding Operating Systems, 8th ed. Boston, MA: Cengage Learning, 2018.
2. D. M. Dhamdhere, Operating Systems: A Concept-Based Approach, 3rd ed. New York, NY: McGraw-Hill, 2017.
3. P. C. P. Bhatt, An Introduction to Operating Systems: Concepts and Practice, 4th ed. New Delhi, India: PHI Learning, 2014.
4. W. Stallings, *Operating Systems: Internals and Design Principles*, 9th ed. Hoboken, NJ: Pearson, 2018.

Online Resources:

1. Introduction to Operating Systems by NPTEL
   https://www.youtube.com/watch?v=783KABtuE4&list=PLIemF3uozcAKTgsCIj82voMK3TMR0YE_f
2. Operating Systems IIT Delhi
   https://www.youtube.com/watch?v=3-ITLMMeeXY&list=PL3pGy4HtqwD0n7bQfHjPnsWzkeRn6mkO
3. Introduction to Operating Systems
   https://youtu.be/vBURTt97EkA
4. For Operating System ebooks
   https://codex.cs.yale.edu/avi/os-book/

Course Code: BIS605 **Course:** Software Architecture and Design Patterns
Credits: 3 **L:T:P** 3:0:0
CIE: 50 Marks **SEE:** 50 Marks
SEE Hours: 2 **Max. Marks:** 100

Prerequisites if any	Basic programming knowledge, OOP, Software Engineering basics and Data Structures and Algorithms.
Learning objectives	1. Students will gain a deep understanding of object-oriented principles, enabling them to identify and model the state and behaviour of real-world objects effectively. 2. Students will acquire the skills to construct and interpret various UML models and apply systems analysis and design methodologies to solve complex problems through practical case studies.

Course Outcomes:
On successful completion of the course, the student will be able to:

COs	Course Outcomes	Bloom's level
CO1	Understand the basic concepts to identify state & behaviour of real-world objects.	Understand
CO2	Apply Object-Oriented Analysis and Design concepts to solve complex problems.	Apply
CO3	Construct various UML models using the appropriate notation for specific problem context.	Apply
CO4	Design models to show the importance of systems analysis and design in solving complex problems using case studies.	Apply
CO5	Study of Pattern-Oriented approach for real-world problems.	Understand

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	3														
CO2	3														
CO3		3													
CO4			3												
CO5				3											

3 – Strong 2 – Medium 1 – Low

Course Structure

	Module – 1	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
1.1	Introduction: what is a design pattern? Describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems.	2		
1.2	how to select a design pattern,how to use a design pattern.	2		
1.3	What is object-oriented development? key concepts of object oriented design other related concepts	2		
1.4	Benefits and drawbacks of the paradigm	2		
	Module – 2			
2.1	Analysis of a System: overview of the analysis phase, stage 1: gathering the requirements functional requirements specification.	2		
2.2	Defining conceptual classes and relationships, using the knowledge of the domain.	3		
2.3	Design and Implementation.	3		
	Module – 3			
3.1	Design Pattern Catalog: Structural patterns.	2		
3.2	Adapter and bridge patterns	2		
3.3	Composite and decorator patterns	2		
3.4	Facade, flyweight and proxy patterns.	2		
	Module – 4			
4.1	Interactive systems and the MVC architecture: Introduction, The MVC architectural pattern, analysing a simple drawing program.	2		
4.2	Designing the system, designing of the subsystems.	2		
4.3	Getting into implementation, implementing undo operation.	2		
4.4	Drawing incomplete items, adding a new feature, pattern-based solutions.	2		
	Module – 5			
5.1	Designing with Distributed Objects: Client server system, java remote method invocation.	2		
5.2	Implementing an object-oriented system on the web (discussions and further reading).	3		
5.3	A note on input and output, selection statements, loops arrays.	3		
	Total No. of Lecture Hours	40		
	Total No. of Tutorial Hours		0	
	Total No. of Practical Hours			0

Textbooks:

1. Object-oriented analysis, design and implementation, brahma Dothan, Sarnath Ramnath, universities press,2013
2. Design patterns, Erich gamma, Richard Helen, Ralph Johman,John Vlissides, PEARSON Publication,2013.

Reference Books:

1. Frank Bachmann, Regine Meunier, Hans Rohnert “Pattern Oriented Software Architecture” –Volume 1, 1996.

2. William J Brown et al., "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998

Online Resources:

- **Coursera: Software Design and Architecture Specialization by the University of Alberta**
  - This specialization includes multiple courses that cover design patterns, architecture, and software design principles.
  - https://www.coursera.org/specializations/software-design-architecture
- **YouTube: Design Patterns in Object-Oriented Programming by Christopher Okhravi**
  - This YouTube series explains various design patterns in an easy-to-understand manner with practical examples.
  - https://www.youtube.com/playlist?list=PLrW43fNmjaQVYF4xcMZEHZX9m6B9JRBsh
- **MIT Open Courseware: Software Design and Development**
  - This course covers software design principles, including design patterns and software architecture.
  - https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-005-software-construction-fall-2008/

Course Code: BIS606 **Course:** Cryptography and Network Security
Credits: 3 **L:T:P** 3:0:0
CIE: 50 Marks **SEE:** 50 Marks
SEE Hours: 2 **Max. Marks:** 100

Prerequisites if any	Modular Arithmetic, Matrices, Linear Congruence, Algebraic structures, GF (2n) Fields.
Learning objectives	1. Understand the principles, goals, and techniques of both symmetric-key and asymmetric-key cryptography. 2. Develop the skills to implement message integrity, authentication methods, and digital signatures for secure communication.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Describe traditional and modern symmetric-key cryptosystems.	Understanding
CO2	Apply RSA, El-Gamal, and elliptic curve cryptography.	Apply
CO3	Explain hash functions, message integrity, and use digital signatures.	Understanding
CO4	Describe entity authentication and key management concepts.	Understanding

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	2	2	3	-	3	-	-	-	-	-	-	-		2	2
CO2	3	3	3	2	3	-	-	-	-	-	-	2		2	3
CO3	3	3	3	2	3	-	-	-	-	-	-	-		2	-
CO4	2	2	2	-	3	-	-	-	-	-	-	-		-	

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: Introduction to Symmetric-Key Cryptosystems				
1.1	Introduction to Symmetric-Key Encipherment: Security Goals, Cryptographic Attacks, Services and mechanism, Techniques	04	-	-
1.2	Traditional Symmetric-Key Ciphers: Introduction, Substitution Ciphers, Transposition Ciphers.	04	-	-
Module – 2: Modern Symmetric-Key Ciphers				
2.1	Introduction to Modern Symmetric-Key Ciphers: Modern Block Ciphers, Modern Stream Ciphers	02	-	-
2.2	Data Encryption Standard (DES): Introduction, DES Structure (overview only), Security of DES	03	-	-
2.3	Advanced Encryption Standard (AES): Introduction, Transformations, Key expansion, The AESCiphers	03	-	-
Module – 3: Asymmetric-Key Cryptosystems				
3.1	Asymmetric-Key Cryptography: RSA Cryptosystems	03	-	-
3.2	El-Gamal Cryptosystem	03	-	-
3.3	Elliptic curve cryptosystems (overview only).	02	-	-
Module – 4:Hashing and Digital Signatures				
4.1	Message Integrity and Message Authentication: Message Integrity, Random Oracle Model, Message Authentication	04	-	-
4.2	Digital Signature: Comparison, Process, Services, Attacks of Digital Signature, Digital Signature Schemes	04	-	-
Module – 5: Entity Authentication and Key Management				
5.1	Entity Authentication: Introduction, Passwords, Challenge-Response, Biometrics	04	-	-
5.2	Key Management: Symmetric-Key Distribution, Kerberos, Symmetric-key Agreement.	04	-	-
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours		**00**	**-**
	Total No. of Practical Hours			**00**

Textbook:

1. Cryptography and Network Security, Behrouz Forouzan, SIE, 2nd Edition, McGraw-Hill

Reference Book:

1. Cryptography and Network Security, Principles and Practice; Fifth Edition. By William Stallings, Prentice Hall.
2. Handbook of Applied Cryptography, A. Menezes, P. and S. Vanstone, CRC Press.

Online Resources:

1. NPTEL Course Link: https://onlinecourses.nptel.ac.in/noc22_cs90/preview
2. MIT OpenCourseWare Link: https://ocw.mit.edu/courses/6-857-network-and-computer-security-spring-2014/pages/lecture-notes-and-readings/

Course Code: BISL607
Credits: 1
CIE: 50 Marks
SEE Hours: 3

Course: Machine Learning Lab
L:T:P 0:0:2
SEE: 50 Marks
Max. Marks: 100

Prerequisites if any	Python programming, Linear algebra, Calculus, probability, and statistics
Learning objectives	1. Develop proficiency in implementing machine learning algorithms using Python and relevant libraries, fostering hands-on experience in model construction and evaluation. 2. Cultivate practical data analysis skills through real-world dataset exploration, encompassing tasks like preprocessing, feature engineering, and model optimization for robust performance.

Course Outcomes:
On successful completion of the course, the student will be able to:

COs	Course Outcomes	Bloom's level
CO1	Make use of Data sets in implementing the machine learning algorithms	L3
CO2	Implement the machine learning concepts and algorithms in any suitable language of choice	L3

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	3		3	3	3									3	3
CO2	3		3	3	3									3	3

3 – Strong 2 – Medium 1 – Low

List of experiments

1. Implement an Adaptive Linear Neuron in Python
2. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a.CSV file.
3. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
4. Write a program to demonstrate the working of the decision tree based ID3algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same dataset for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Textbooks:

1. Sebastian Raschka, “Python Machine Learning”, Machine learning and deep learning with python, Sciki- learn and TensorFlow2, 3rd edition-includes TensorFlow2,GANs and Reinforcement Learning, 2019
2. Aurelien Geron, Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, O’Reilly Publications, 2nd edition,2019

Reference Books:

1. Ethem Alpaydm , Introduction to Machine Learning (Adaptive Computation and machine learning), The MIT Press Cambridge, Massachusetts London, ISBN: 0-262- 01211-1, 2004
2. Simon Rogers, Mark Girolami, A first course in machine learning, Chapman, & Hall/CRC machine learning& pattern recognition, 2011
3. John D. Kelleher, Brian Mac Namee, Aoife D’Arcy, FUNDAMENTALS OF MACHINE LEARNING FOR PREDICTIVE DATA ANALYTICS Algorithms, Worked Examples, and Case Studies, The MIT Press, Cambridge, Massachusetts, London, England.

Course Code: BIS657C
Credits: 1
CIE: 50 Marks
SEE Hours: -
Course: Cyber Laws
L:T:P 1:0:0
SEE: -
Max. Marks: 50

Prerequisites if any	NIL
Learning objectives	1. Understand overview of cyber offenses 2. Aware and know the laws covering cyber offenses

Course Outcomes:
On successful completion of the course, the student will be able to:

COs	Course Outcomes	Bloom's level
CO1	Explain various types of cyber related offenses	L2
CO2	Analyze various laws in information technology act related to offenses	L4

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	3	2	1					2						1	
CO2	3	2	1			3		2						2	2

3 – Strong 2 – Medium 1 – Low

Course Structure

	Module – 1	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
1.1	Forms of Cyber crimes	1		
1.2	Crimes affecting individuals –invasion of privacy, Voyurism,Theft of identity, Cyber stalking	1		
1.3	Crimes affecting economy –Hacking, Malicious programs, sabotage, fraud	1		
	Module – 2			
2.1	Counterfeiting and cheating, theft , cloning ,copyright violation, piracy, espionage, tax evasion, squatting, internet market frauds	2		
2.2	Information Technology Act 2000, preliminary concepts ,Digital Signature	2		
2.3	Electronic governance	1		
	Module – 3			
3.1	Dispatch of Electronic Records ,Penalties and adjudication	2		
3.2	Cyber regulations appellate Tribunal	1		
	Module – 4			
4.1	Offenses	2		
	Module – 5			
5.1	Network Service provider related laws	2		
	Total No. of Lecture Hours	15		
	Total No. of Tutorial Hours		0	
	Total No. of Practical Hours			0

Textbooks:

1. Laws on Cyber Crimes along with IT act and Relevant Rules by Promod Kr. Singh, Book Enclave publication, First edition, 2015.

Reference Books:

1. Cyber Security by Nina Godbole, Wiley publication, 2011

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs127/preview Cyber security and privacy