

Sheth T. J. Education Society'
Sheth N.K.T.T College of Commerce
and Sheth J.T.T College of Arts, (Autonomous).Thane (W)

T.Y.B.Sc. (Computer Application) 2026-27

	Semester V	Credits		Semester VI	Credits
Major (Mandatory)			Major (Mandatory)		
BCA501	Advanced Web Programming	2	BCS601	Security in Networking	2
BCAP502	Advanced Web Programming Practical	2	BCSP602	Security in Networking Practical	2
BCS503	Software Project Management	2	BCM603	Mobile Application Development	2
BCDP504	Data Visualization using Tableau and Software Project Management Practical	2	BCMP604	Mobile Application Development Practical	2
BCI505	Indian Knowledge Systems in Information Technology- I	2	BCD605	DevOps	2
Major (Elective)			Major (Elective)		2
BCJ506	Java Programming	2	BCL606	Machine Learning	2
BCJP507	Java Programming Practical	2	BCLP607	Machine Learning Practical	2
BCE508	Exploratory Data Analysis		BCS608	Search Engine Optimization (SEO)	2
BCEP509	Exploratory Data Analysis Practical		BCSP609	Search Engine Optimization (SEO) Practical	
Minor			Minor		
BCE510	Embedded & IoT Systems	2	BCC610	Cloud Computing	2
BCEP511	Embedded & IoT Systems Practical	2	BCCP611	Cloud Computing Practical	2
VSC			SEC	-----	
BCM512	MERN	2			
FP			OJT		
BCFP513	Project Dissertation	2	BCP612	Project Implementation	4
	Total	22			22

Dr. Yogeshwari Patil
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Prof. Heena Chande
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Dr. Dilip Patil
Principal

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Proramme Name: B.Sc. (Computer Application)		Semester: VI
Course Category: Major Mandatory		
Name of the Dept: Science and Technology		
Course Title: Security in Networking		
Course Code: BCS601		Course Level: 5.5
Type: Theory		
Course Credit: 02		
Hours Allotted: 30 Hours		
Marks Allotted: 50 Marks		
Course Objectives: 1. Understand the fundamentals of computer networks and network devices. 2. Develop foundational skills in network security to protect data integrity, confidentiality, and availability in real-world network environments.		
Course Outcomes: After completion of the course learners will be able to CO1. analyze and configure network components and protocols to enable efficient and secure communication across different types of networks. CO2. apply network security principles and tools to detect, prevent, and mitigate cyber threats.		
Description of the course:		This course introduces the fundamentals of computer networks, including network types, devices, protocols, and addressing schemes. It emphasizes network security principles, covering authentication, encryption, firewalls, and intrusion detection/prevention systems, enabling students to design, analyze, and secure modern network environments.

Syllabus: NEP 2020 w.e.f 2026-27

Unit No.	Content	Hours
I	Introduction: Computer Network, Evolution of Computer Networks Different types of Computer Network, Devices used for Networking: Network Interface Card (NIC), Modem, Hub, Switch L1 and L2 switches, Comparison between switch and hub, Bridge, Router, Gateway. Network Models: Protocol layering, TCP/IP protocol suite, The OSI model. Network Layer: IPv4 Addresses, IPv4 Protocol, ARP, IPv6 Routing: RIP, OSPF	15
II	Information Security Overview: The Importance of Information Protection, Authentication, Authorization, Encryption: Symmetric-Key Cryptography, Public Key Cryptography, Public Key Infrastructure. Firewalls: Overview, Core Firewall Functions, Additional Firewall Capabilities Intrusion Detection and Prevention Systems: IDS Concepts, IDS Types and Detection Models, IDS Features	15
	Total Hours	30

References:

Sr.No.	Title	Author/s	Publisher	Edition	Year
1	TCP/IP Protocol Suite	Behrouz A. Forouzan	Tata McGraw Hill 2010	----	----
2	Computer Networks	Andrew Tanenbaum	Pearson	Fifth	2013
3	The Complete Reference: Information Security	Mark Rhodes-Ousley	McGraw- Hill	Second	2013
4	Essential Cybersecurity Science	Josiah Dykstra	O'Reilly	Fifth	2017
5	Principles of Computer Security: CompTIA Security+ and Beyond	Wm.Arthur Conklin, Greg White	McGraw Hill	Second	2010

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Programme Name: B.Sc. (Computer Application)		Semester: VI
Course Category: Major Mandatory		
Name of the Dept: Science and Technology		
Course Title: Security in Networking Practical		
Course Code: BCSP602		Course Level: 5.5
Course Type: Practical		
Course Credit: 02		
Total Hours: 60 Hours		
Total Marks: 50 Marks		
Course Objectives: 1. To develop practical networking skills by understanding LAN cabling, IP addressing, subnetting, network topology design, router configuration, and routing protocols. 2. To apply network security techniques including AAA authentication, ACLs, IPv6 security, and firewall configurations to protect network resources and ensure secure communication.		
Course Outcomes: After completion of the course learners will be able to OC1: design, configure, and troubleshoot network infrastructures using LAN cabling, IP addressing, routing protocols, and network devices effectively. OC2: implement and verify network security measures such as AAA authentication, access control lists (ACLs), IPv6 security policies, and zone-based firewalls to secure networks against threats.		
Course Description:	This course provides hands-on training in designing, configuring, and securing computer networks. Students learn LAN cabling, IP addressing, routing protocols, and practical security techniques including AAA authentication, ACLs, IPv6 security, and firewall configuration to protect network resources.	

Syllabus: NEP 2020 w.e.f 2026-27

Sr No.	Content (List of Practicals)	Hours
1	Colour code for crimping LAN (Cat 5/6/7) cable a. Study of Different color codes b. Study of different connecting devices and their differences c. Crimping LAN Cable	
2	IPv4 Addressing and Subnetting Given an IP address and network mask, determine other information about the IP address such as: • Network address • Network broadcast address • Total number of host bits • Number of hosts	
3	Designing and configuring a network topology a. Configure IP static routing	
4	Configure IP routing using RIP.	
5	Configure Routers a. OSPF MD5 authentication. b. NTP. c. to log messages to the syslog server.	
6	Configure AAA Authentication a. Configure a local user account on Router and configure authenticate on the console and vty lines using local AAA b. Verify local AAA authentication from the Router console and the PC-A client	
7	Configuring Extended ACLs a. Configure, Apply and Verify an Extended Numbered ACL	
8	Configure IP ACLs to Mitigate Attacks a. Verify connectivity among devices before firewall configuration. b. Use ACLs to ensure remote access to the routers is available only from management station PC-C. c. Configure ACLs on to mitigate attacks.	
9	Configure IPV6 ACLs to Mitigate Attacks.	
10	Configuring a Zone-Based Policy Firewall	
	Total Hours	60

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Programme Name: B.Sc. (Computer Application)		Semester: VI
Course Category: Major Mandatory		
Name of the Dept: Science and Technology		
Course Title: Mobile Application Development		
Course Code: BCM603		Course Level: 5.5
Type: Theory		
Course Credit: 2		
Hours Allotted: 30 Hours		
Marks Allotted: 50 Marks		
Course Objectives: - To introduce students to the fundamentals of mobile computing and Android application development using Android Studio. - To enable students to design Android user interfaces, implement application components, and manage data using databases such as SQLite and Firebase.		
Course Outcomes: After completion of the course learners will be able to CO1: develop Android applications using UI components, layouts, views, and core Android components. CO2: implement database connectivity and advanced Android features and deploy applications on the Google Play Store.		
Description of the course:		This course introduces students to the fundamentals of mobile application development using the Android platform. It covers the concepts of mobile computing, Android architecture, user interface design, application components, database connectivity, and advanced mobile features. Students will learn to design and develop Android applications using Android Studio, implement database connectivity using SQLite and Firebase, and deploy applications to the Google Play Store.

Unit No.	Content	Hours
I	Introduction to Mobile Computing: Types of Mobile Applications (Native, Hybrid, Web Apps), Overview of Android Operating System, Android Architecture, Features of Android, Introduction to Android Studio Design UI in Android: GUI components: Text View, Edit Text, Button, types of buttons like image button, toggle button, Checkbox, Radiobutton, Radiobutton Group Progress bar, Scrollbars, List, Custom Toast Alert message etc. Layouts and types of Layouts: Constraint layout, Linear Layout, Frame Layout, Relative Layout etc. Views and its types: List view, Grid view, Image view, scroll view Basics of splash screen, adding styles to splashscreen	15
II	Android Components and Database Connectivity Major components in Android: Intent, Activity, Services, Broadcast Receiver Life cycle of Android components: Activity, Broadcast Receiver, Services SQLite/Firebase database: Necessity of SQLite/Firebase, creation and connection of the database, extracting data from the databases Advanced Features and Deployment Advanced Concepts: Fragments, Location based services, SMS telephony, Audio capture, Camera, Bluetooth Application Deployment: Process for creating and deploying Android applications on Google Play store, become a publisher	15
	Total Hours	30

References:

1. Android Programming: The Big Nerd Ranch Guide. (2022). Big Nerd Ranch.
2. Head First Android Development by Griffiths, D., & Griffiths, D. (2021). O'Reilly Media.
3. Android Programming for Beginners by John Horton. (2023). Packt Publishing.
4. Professional Android by Reto Meier. Wiley Publications.

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Programme Name: B.Sc. (Computer Application)		Semester: VI
Course Category/Vertical: Major Mandatory		
Name of the Dept: Science and Technology		
Course Title: Mobile Application Development Practical		
Course Code: BCMP604		Course Level: 5.5
Type: Practical		
Course Credit: 02 credits		
Hours Allotted: 60 Hours		
Marks Allotted: 50 Marks		
Course Objectives: - To introduce students to the fundamentals of mobile computing and Android application development using Android Studio. - To enable students to design Android user interfaces, implement application components, and manage data using databases such as SQLite and Firebase.		
Course Outcomes: After completion of the course learners will be able to CO1: develop Android applications using UI components, layouts, views, and core Android components. CO2: implement database connectivity and advanced Android features and deploy applications on the Google Play Store.		
Description the course:		This course introduces students to the fundamentals of mobile application development using the Android platform. It covers the concepts of mobile computing, Android architecture, user interface design, application components, database connectivity, and advanced mobile features. Students will learn to design and develop Android applications using Android Studio, implement database connectivity using SQLite and Firebase, and deploy applications to the Google Play Store.

Unit No.	Content (List of Practicals)	Hours
	1. Installation and First Android Application A) Install Android IDE and create Android virtual device B) Develop a program to display "Hello World" on screen C) Explore the directory structure in Android IDE 2. Design UI using Basic Components Create an Android application demonstrating basic GUI components such as TextView, EditText, Button, and ImageButton. 3. Implement Selection Controls Develop an application using CheckBox, RadioButton, and RadioGroup to display user selections. 4. Implement Toggle Button and Progress Bar Create an application demonstrating ToggleButton functionality and ProgressBar to indicate loading progress. 5. Implement Toast and Alert Messages Create an application that displays Custom Toast messages and Alert Dialog boxes based on user interaction. 6. Design Layouts in Android Create an Android application demonstrating different layouts such as Linear Layout, Relative Layout, Constraint Layout, and Frame Layout. 7. Implement Views Create an application to display data using ListView, GridView, ImageView, and ScrollView. 8. Splash Screen Design Develop an Android application with a splash screen and apply styles to the splash screen. 9. Android Components and Intent Create an application demonstrating Activity lifecycle and navigation between activities using Intent. 10. Database Connectivity Create an application that stores and retrieves data using SQLite or Firebase database.	
	Total Hours	60

References:

1. Android Programming: The Big Nerd Ranch Guide. (2022). Big Nerd Ranch.
2. Head First Android Development by Griffiths, D., & Griffiths, D. (2021). O'Reilly Media.
3. Android Programming for Beginners by John Horton. (2023). Packt Publishing.
4. Professional Android by Reto Meier. Wiley Publications.

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Programme Name: B.Sc. (Computer Application)		Semester: VI
Course Category / Vertical: Major Mandatory		
Name of the Dept: Science and Technology		
Course Title: DevOps		
Course Code: BCD605		Course Level: 5.5
Type: Theory		
Course Credit: 2 credits		
Hours Allotted: 30 Hours		
Marks Allotted: 50 Marks		
Course Objectives: 1. To understand the concepts and principles of DevOps and its role in improving collaboration between development and operations teams. 2. To study continuous delivery, release automation, and DevOps toolchains used to automate software development and deployment processes.		
Course Outcomes: After completion of the course learners will be able to CO1. explain DevOps practices and continuous delivery models used in modern software development. CO2. apply DevOps tools and techniques to improve software deployment and operational efficiency.		
Description of the course:		The course covers DevOps adoption strategies, business case development, and optimization of the software delivery pipeline. It also explores innovation through DevOps platforms, microservices architecture, and API-driven ecosystems in modern enterprises.

Syllabus : NEP 2020 w.e.f 2026-27

Unit No.	Content	Hours
I	DevOps: An Overview: Origins, Roots, Practices, Culture. DevOps in the Ascendancy: Accelerating Agile Practices in Today's Software Factory, Embracing DevOps in the Application Economy, DevOps as a Critical Requirement, Banking on DevOps Practices, DevOps: A Key Component of Business Agility, DevOps: A Practice for Champions. IT Impasse: A World of 'Wicked' Business Problems, The Emergence of Agile Development, Modern Application Architectures, Ending the Technical Impasse.DevOps Foundations: What Characterizes DevOps Culture?, Lean Thinking to Reduce Waste, DevOps Metrics. Build: Case Study: IceMobile, From Little API Acorns Big Things Grow, API Management: Stakeholders and Requirements, APIs Are Products, Managing the API Lifecycle, API Management: Essential Integrations, Taking a Strategic Approach, Building an API Future, Faster. Test: Case Study: AutoTrader.com, Testing Times, Agile Testing Trifecta..	15
II	Deploy: Case Study: Citrix, Obstacles to Continuous Delivery, Continuous Delivery Maturity, Accelerating Maturity: Three Ways, Essential Tool chain Integrations, Release Automation: Capability Checklist, Recommendations and Action Plan. Manage: CaseStudy: ANZBank, MoreChange, MoreComplexity, New IT Operations Imperatives, Toward Agile Operations Adopting DevOps: Developing the Playbook. Developing a Business Case for a DevOps Transformation: Developing the Business Case, Completing. The Business Model Canvas, Customer Segments, Value Propositions, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships, Cost Structures. DevOps Plays for Optimizing the Delivery Pipeline: DevOps as an Optimization Exercise, Core Themes, The DevOps Plays, Specializing Core Plays.Practical DevOps: DevOps and Enterprise Architecture, DevOps and Information Security, DevOps and IT Service Management, DevOps and Lean Startup.DevOps Plays for Driving Innovation: Optimize to Innovate, The UberSyndrome, Innovation and the Role of Technology, Core Themes, Play: Build a DevOps Platform, Play: Deliver Microservices Architectures, Play: Develop an API Economy, Play: Organizing for Innovatio	15
	Total Hours	30

References:

Sr. No	Title	Author/s	Publisher	Edition	Year
1.	DevOps for Digital Leaders	Aruna Ravichandran Kieran Taylor Peter Waterhouse	A press		2016
2.	The DevOps Adoption Playbook	Sanjeev Sharma	Wiley, IBM Press		2017

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Programme Name: B.Sc. (Computer Application)		Semester : V
Course Category: Major Elective		
Name of the Dept: Science & Technology		
Course Title: Machine Learning		
Course Code: BCL606		Course Level: 5.5
Type: Theory		
Course Credit: 02		
Hours Allotted: 30 Hours		
Total Marks: 50 Marks		
Course Objectives: • To understand the fundamental concepts of Machine Learning • To study and apply various Machine Learning algorithms • To evaluate and improve Machine Learning models		
Course Outcomes: After completion of the course learners will be able to CO1: understand fundamental Machine Learning concepts and implement various algorithms. CO2: evaluate and improve Machine Learning models using performance metrics, dimensionality reduction techniques.		
Description of the course:		This course introduces the core concepts and techniques of Machine Learning, focusing on supervised and unsupervised learning methods. It covers key algorithms such as KNN, Decision Trees, Naïve Bayes, SVM, regression, and clustering techniques like K-means and hierarchical clustering. The course also includes model evaluation metrics, dimensionality reduction using PCA, and association rule mining for pattern discovery in data.

Syllabus: NEP 2020 w.e.f 2026-27

Unit No.	Content	Hours
I	Introduction to Machine Learning: Machine Learning(ML), Need for Machine Learning, ML from Knowledge-driven to Data Driven, Applications of Machine Learning, Problems suitable for Machine Learning, Advantages, Disadvantages and Challenges of Machine Learning, Challenges of ML. General architecture of ML systems, Underlying Concepts in Machine Learning: Inductive Learning, Generalization, Bias and Variance, Overfitting and Underfitting, Parametric and Non Parametric algorithms . Types of Machine Learning: Supervised and Unsupervised Learning, Workflow, Semi supervised Learning, Reinforced Learning, Introduction to Classification Algorithms: Concept of Classification, Binary classification, Multi-Class Classification, Multi Label Classification K-Nearest Neighbor Method: need and Working of KNN, Computing Distance, Pros and Cons of KNN. Decision Tree based Algorithm: Terminologies and assumptions, Working of Decision Trees, ID3 Algorithm, Attribute selection Methods(Entropy, Gini Impurity, Information Gain)	15
II	Performance Evaluation: Classification Metrics-Accuracy, Sensitivity, Precision, F1 Score, ROC/AUC Curve, Cross Validation Dimensionality Reduction: Criteria for Reduction, Feature Reduction and Selection, Principal Component Analysis(PCA) Probabilistic Learning: Introduction to Bayes Learning, Interpretation of Bayes Rule, Benefits and shortfalls of Bayesian Learning, Naïve Bayes Classifier, Characteristics of Naïve Bayes Support Vector Machines: Working of SVM, SVM Concepts :Support Vectors, Hard Margin, soft Margin, Kernels, Advantages and Disadvantages of SVM Regression Methods: Linear Regression Models, Logistic Regression Unsupervised Learning: Concept of unsupervised Learning, Importance and Challenges of unsupervised Learning, Clustering and its applications Hierarchical Clustering: Introduction, Types of Hierarchical Clustering, Issues with Hierarchical Clustering Partition algorithm: K-means Clustering, steps of K-means Clustering, Issues, Strength and Weakness of K-means clustering. Association rule Mining: Basic Concepts, Market Basket Analysis, and Apriori algorithm.	15
	Total Hours	30

References:

Sr. No	Title	Author	Publisher	Edition	Year
1.	Machine Learning: Concepts, Techniques and Applications	T V Geetha S, Sendhil Kumar	CRC Press, Taylor and Francis	First	2023
2.	Machine Learning for Decision Sciences with Case Studies in Python	S. Sumathi, Suresh V. Rajappa	CRC Press, Taylor and Francis	First	2022
3.	Introduction to Machine Learning with Python	Andreas C. Müller, Sarah Guido	O'Reilly Media, Inc.	First	2016
4.	Machine Learning	S Sridhar	Oxford University Press	First	2021
5.	Machine Learning	Ruchi Doshi, Kamal Kant Hiran	BPB	First	2021

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Programme Name: B.Sc. (Computer Application)		Semester: VI
Course Category: Major Elective		
Name of the Dept: Science & Technology		
Course Title: Machine Learning Practical		
Course Code: BCLP607		Course Level: 5.5
Type: Practical		
Course Credit: 2		
Hours Allotted: 60 Hours		
Total Marks: 50 Marks		
Course Objectives: 1. To implement and analyze Machine Learning algorithms. 2. To apply clustering and dimensionality reduction techniques. 3. To evaluate the performance of Machine Learning models.		
Course Outcomes: After completion of the course learners will be able to CO1: implement and apply Machine Learning algorithms. CO2: apply clustering and dimensionality reduction techniques. CO3: evaluate Machine Learning models using performance metrics.		
Description of the course:		This course focuses on implementing Machine Learning algorithms such as KNN, Decision Trees, Naïve Bayes, SVM, regression, clustering methods, and evaluating models using performance metrics and PCA.

Syllabus : NEP 2020 w.e.f 2026-27

Sr. No.	Content (List of Practicals)	Hours
1.	Implementing a K-Nearest Neighbor (KNN) algorithm (e.g. to classify handwritten digits).	
2	Building a decision tree model using the ID3 algorithm (e.g. to predict whether a customer will churn or not).	
3.	Developing a Support Vector Machine (SVM) model (e.g. to classify email messages as spam or not spam).	
4.	Building a Naïve Bayes classifier (e.g. to classify movie reviews as positive or negative sentiment).	
5.	Implementing linear regression (e.g. to predict housing prices based on features such as size and location).	
6.	Using logistic regression (e.g. to predict whether a credit card transaction is fraudulent or not).	
7.	Evaluating a classification model using metrics such as accuracy, precision, recall, and F1 score.	
8.	Applying hierarchical clustering (e.g. to group customer segments based on their purchasing behavior).	
9.	Implementing the K-means clustering algorithm (e.g. to identify distinct clusters in a customer demographic dataset).	
10.	Utilizing Principal Component Analysis (PCA) for dimensionality reduction to improve the efficiency and interpretability of a model.	
	Total Hours	60

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Programme Name: B.Sc. (Computer Application)		Semester: VI
Course Category: Major Elective		
Name of the Dept: Science & Technology		
Course Title: Search Engine Optimization [SEO]		
Course Code: BCS608		Course Level: 5.5
Course Type: Theory		
Course Credit: 02		
Hours Allotted: 30 Hours		
Marks Allotted: 50 Marks		
Course Objectives: • To Understand the core principles of search engines, including their functionality. • To develop SEO-friendly web techniques to design and build optimized websites and Analyze website performance.		
Course Outcomes: After completion of the course learners will be able to CO1: describe how search engines work and explain the factors that influence webpage ranking, Use technical tools for keyword research CO2: develop websites that are optimized for search engines, considering accessibility, content structuring, and URL hierarchy, Diagnose SEO issues.		
Description of the course:		Introduction to Search Engines and their Fundamentals, Keyword Research and SEO-Friendly Web Design, SEO Optimization and Analytics

Syllabus: NEP 2020 w.e.f 2026-27

Unit No.	Content	Hours
I	Introduction to Search Engines and their Fundamentals : Putting Search Engines in Context and Meeting Them Identifying Search Engine Users, Understanding the Search Engines: They're a Community, Finding the Common Threads among the Engines, Getting to Know the Major Engines, Understanding Metasearch Engines Search Fundamentals:Deconstructing Search, The Language of Search, Crawling, The Index, The Search Engine Results Page, Ranking Factors Keyword Research and SEO-Friendly Web Design Keyword Strategy: Researching Client Niche Keywords, Checking Out Seasonal Keyword Trends, The Words and Phrases That Define Business, Internal Resources for Keyword Research, External Resources for Keyword Research, Keyword Valuation, Acting on Keyword Plan, Periodic Keyword Reviews	15
II	Developing SEO Friendly Website Making Site Accessible to Search Engines, Creating Optimal Information Architecture, Root Domains, Subdomains, and Microsites, Optimization of Domain Names/URLs, Keyword Targeting, Content Optimization and Duplicate Issues, Controlling Content with Cookies and Session IDs, Content Delivery and Search Spider Control, Best Practices for Multilingual/Multicounty Targeting, Google's EEAT and YMYL, Domain Changes, Content Moves, and Redesigns SEO Optimization and Analytics Optimizing the Foundations: Meeting the Servers, Health and Fast Servers, Excluding Pages and Sites from the Search Engines, creating 404 Error Pages, Dirty IPs , Serving Your Site to Different Devices, Selecting Domain Name, Discovering the Types of Redirects, Reconciling www and non-www URLs, 301 Redirects, Inviting Spiders to Your Site, 302 Hijacks, Handling Secure Server Problems SEO Analytics and Measurement Why Measurement Is Essential in SEO, Analytics Tools for Measuring Search Traffic, Connecting SEO and Conversions, Diagnostic Search Metrics, Free SEO Specific Analytics Tools from Google and Bing, Auditing Websites for SEO Improvements, AI in Search Engine	15
	Total Hours	30

References:

1. Eric Enge, Stephen Spencer, Jessie Stricchiola, “The Art of SEO”, 4th Edition, O’Reilly Media Inc, September 2023
2. Bruce Clay, Kristopher B. Jones, “Search Engine Optimization All-in-One For Dummies”, 4th Edition, For Dummies, February 2022 (9 Books in One)

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Programme Name: B.Sc. (Computer Application)		Semester: VI
Course Category: Major Elective		
Name of the Dept: Science & Technology		
Course Title: Search Engine Optimization Practical		
Course Code: BCSP609		Course Level: 5.5
Type: Practical		
Course Credit: 02		
Hours Allotted: 60 Hours		
Marks Allotted: 50 Marks		
Course Objectives: 1. To understand the core principles of search engines, including their functionality 2. To develop SEO-friendly web techniques to design and build optimized websites and Analyze website performance using SEO analytics tools and recommend strategies for improvement based on data insights.		
Course Outcomes: After completion of the course learners will be able to CO1: describe how search engines work and explain the factors that influence webpage ranking, Use technical tools for keyword research CO2: develop websites that are optimized for search engines, considering accessibility, content structuring, and URL hierarchy, Diagnose SEO issues.		
Description of the course:		Introduction to Search Engines and their Fundamentals, Keyword Research and SEO-Friendly Web Design, SEO Optimization and Analytics

Unit No.	Content (List of Practicals)	Hours
I	1. Introduction of SEO and Google search algorithm a. Search, read and understand following terms: Alt tags, Anchor text, Black Hat SEO, White Hat SEO, Keyword Keyword Density, Title, Headline Tags, Inbound links, Outbound links, Indexing, Link building, Link Juice, Long tail, No-follow, Search query, SEM, ranking, backlink, SERP b. Study the given algorithms of google and prepare a detailed analysis report: Panda, Penguin ,Hummingbird ,Pigeon , Mobilegeddon , Possum , Fred , Bidirectional Encoder representation from transformers 2 Blog Creation and content writing, posting and Google analytics a. Prepare a report with screenshots of all steps (signing up, the configuration of the blog, content writing/posting, adding and configuring the google analytics addon) b. Add and configure the google analytics add-on to your blog. Monster insights official site For WordPress:https://wordpress.org/plugins/google-analytics-forwordpress/ For blogger: Link 3 To experiment and learn Keyword search analysis by Google trends. a. Find out what is top-10 most searched terms of today(daily search trends / real-time search trends/country wise searches) b. Find out the difference between ‘term’ and ‘topic’ for any keyword by comparing its results. c. Take any four terms and compare their analysis. (test all filters provided by google trends) 4 Develop robots.txt file for your blog. a. Know what is robot.txt file and its content for any blog/website. b. Make your own robot.txt file and prepare a report. 5 Creation and submission of sitemap for your blog.	

	6 Analyzing website performance and performing on-page optimization techniques. a. GTmetrix b. Pagespeed insights 7 To perform the keyword research and analysis for your blog or website a. keyword listing and show competition per keyword with its CPC using Google AdWords. b. Show the steps to do the same using https://keywordtool.io/ 8 To study and practice off-page optimization techniques.	
	Total Hours	60

References:

1. Eric Enge, Stephen Spencer, Jessie Stricchiola, “The Art of SEO”, 4th Edition, O’Reilly Media Inc, September 2023
2. Bruce Clay, Kristopher B. Jones, “Search Engine Optimization All-in-One For Dummies”, 4th Edition, For Dummies, February 2022 (9 Books in One)

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Programme Name: B.Sc. (Computer Application)		Semester: VI
Course Category: Minor		
Name of the Dept: Science and Technology		
Course Title: Cloud Computing		
Course Code: BCC610		Course Level: 5.5
Type: Theory		
Course Credit: 2 credits		
Hours Allotted: 30 Hours		
Marks Allotted: 50 Marks		
Course Objectives: 1. To understand and use cloud services, virtualization, task scheduling algorithms, and the MapReduce programming model for cloud computing applications. 2. To develop and manage private cloud systems while understanding the legal and societal impact of cloud computing technologies.		
Course Outcomes: After completion of the course learners will be able to CO1 - analyze cloud computing architectures, vulnerabilities, and applications, and design workflows. CO2 - apply virtualization concepts, cloud resource management, scheduling algorithms, cloud storage systems, and security measures to develop secure cloud applications while understanding their legal and societal impact.		
Description of the course:	Cloud Computing syllabus introduces the basic concepts and technologies used to deliver computing services over the internet. It covers topics such as cloud architecture, service models (IaaS, PaaS, SaaS), deployment models (public, private, hybrid), virtualization, cloud storage, and security. The syllabus also explains benefits, challenges, and applications of cloud computing in modern IT systems.	

Syllabus : NEP 2020 w.e.f 2026-27

Unit No.	Content	Hours
I	Introduction to Cloud Computing – Introduction, Historical developments, Building Cloud Computing Environments. Principles of Parallel and Distributed Computing – Eras of Computing, Parallel v/s distributed computing, Elements of Parallel Computing, Elements of distributed computing, Technologies for distributed computing. Virtualization – Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples. Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud usage monitor, Resource replication, Ready-made environment.	15
II	Cloud Computing Architecture: Introduction, Fundamental concepts and models, Roles and boundaries, Cloud Characteristics, Cloud Delivery models, Cloud Deployment models, Economics of the cloud, Open challenges. Fundamental Cloud Security: Basics, Threat agents, Cloud security threats, additional considerations. Industrial Platforms and New Developments: Amazon Web Services, Google App Engine, Microsoft Azure. Distributed software engineering, Distributed systems issues, Client-server computing, Architectural patterns for distributed systems, Software as a service	15
	Total Hours	30

References:

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Mastering Cloud Computing Foundations and Applications Programming	Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi	Elsevier	-	2013
2.	Cloud Computing Concepts, Technology & Architecture	Thomas Erl, Zaigham Mahmood , and Ricardo Puttini	Prentice Hall	-	2013
3.	Distributed and Cloud Computing, From Parallel Processing to the Internet of Things	Kai Hwang, Jack Dongarra, Geoffrey Fox	MK Publishers	--	2012

**Sheth T. J. Education Society's
Sheth N.K.T.T College of Commerce and
Sheth J.T.T College of Arts, (Autonomous). Thane (W)**

Programme Name: B.Sc. (Computer Application)		Semester: VI
Course Category: Minor		
Name of the Dept: Science and Technology		
Course Title: Cloud Computing Practical		
Course Code: BCCP611		Course Level: 5.5
Type: Practical		
Course Credit: 2 credits		
Hours Allotted: 60 Hours		
Marks Allotted: 50 Marks		
Course Objectives: 1. To understand the basic concepts and services of cloud computing. 2. To gain hands-on experience in developing and deploying cloud-based applications and web services.		
Course Outcomes: After completion of the course learners will be able to CO1: to develop and deploy basic cloud-based applications and web services. CO2: to use cloud platforms and virtualization tools for storage and computing services.		
Description of the course:	Cloud Computing practical provides hands-on experience in creating and managing cloud environments. Students learn virtualization, cloud platforms, clustering, and deployment of applications on cloud services. These practical's help in understanding how cloud infrastructure, virtual machines, and distributed systems work in real-world applications.	

Syllabus : NEP 2020 w.e.f 2026-27

Sr. No.	Content(List of Practicals)	
1	Implement Windows / Linux Cluster.	
2	Developing application for windows Azure.	
3	Implementing private cloud with Xen Server.	
4	Implementing operating system on Xen Server.	
5	Implement Hadoop .	
6	Develop application using GAE.	
7	Implement VMWARE ESXI server.	
8	Native virtualization using Hyper V.	
9	Implementing operating system on Hyper V.	
10	Using Open Nebula to manage heterogeneous distributed data center infrastructure.	
	Total Hours	60

Scheme of Examination

Course with Credit	External Examination	Internal Examination	Total
Credit 4	60 marks	40 marks	100 marks
Credit 2	30 marks	20 marks	50 marks

Internal Examination Structure(Theory)

Internal examination	40 marks	20 marks
Project Presentation/Case Study /Quiz/Group Discussion	10 marks	5 marks
Assignment /Active class Participation/Attendance	10 marks	5 marks
Class test	20 marks	10 marks
Total	40 marks	20 marks

Structure for Class Test(For 10 Marks)

For 10 Marks	
Q1. Multiple Choice Questions	5 Marks
Q2. Answer in one or two sentences	5 Marks

Structure for Class Test(For 20 Marks)

For 20 Marks	
Q1. Multiple Choice Questions	10 Marks
Q2. Answer in one or two sentences	10 Marks

External Examination (For 60 Marks)

Q. No.	External	Marks: 60
Q.1	Answer the following questions (Any 3) A B C D E F	15 Marks
Q. 2	Answer the following questions (Any 3) A B C D E F	15 Marks
Q. 3	Answer the following questions (Any 3) A B C D E F	15 Marks
Q. 4	Answer the following questions (Any 3) A B C D E F	15 Marks

External Examination (For 30 Marks)

Q. No.	External	Marks: 30
Q.1	Answer the following questions (Any 3) A B C D E F	15 Marks
Q. 2	Answer the following questions (Any 3) A B C D E F	15 Marks

Scheme of Practical Examination (Under NEP)

Under Graduate:

Practical External Exam: 50 marks

A Certified copy journal is essential to appear for the practical examination.

1	Practical Question 1	20
2	Practical Question 1	20
3	Journal	5
4	Viva Voce	5

OR

1	Practical Question 1	40
3	Journal	5
4	Viva Voce	5