HSNC UNIVERSITY,MUMBAI

School of Applied Sciences

Syllabus of BSc Data Science and Business Analytics

Board of Faculty of Science & Technology

Board of Studies in the Subject of Data Science & Business Analytics

Dr. Maqsood Ahmed Khan (Chairperson)
MBA(HR), M.Sc. (Statistics), Ph.D. (O.R.), DHE, DCE, ADCCSSA,
Ex-Registrar, University of Mumbai
Ex-Director, Sydenham Inst. of Mgmt. Studies,
Ex-Professor & Director, N.L. Dalmia Inst. of Mgmt. Studies & Research
Ex- CEO, HCOI, Ministry of Minority Affairs, Govt. of India.

Mrs. Shailaja. J. Rane, (Co-Chairperson)
Academic Head, Dept. of Data Science and Business Analytics, School of Applied Science, HSNC University, Mumbai

Teachers from the University School and College

Ms. Beenarani Karutharan,
Assistant Professor Dept. of Computer Science,
K.C. College, Churchgate, Mumbai 400020
Email ID : beenarani.karutharan@kccollege.edu.in
Mob. No. 9967014385

Mrs. Mrunal M Hardikar ,
Assistant Professor, Department of Mathematics,
K.C. College, Churchgate, Mumbai 400020
Email ID : mrunal.hardikar@kccollege.edu.in Mob. No. 9653227252

Ms. Anjali Sutar, Assistant Professor,
Dept. of Data Science & Business Analytics, School of Applied Science,
HSNC University, Mumbai
Email ID : anjali.sutar@kccollege.edu.in
Mob. No. 9930165338

Ms. Shruti Agarwal, Assistant Professor,
Dept. of Data Science & Business Analytics, School of Applied Science,
HSNC University, Mumbai
Email ID : shruti.agarwal@hsncu.edu.in
Mob. No.7208202258

Ms. Shweta Maitri, Assistant Professor,
Dept. of Data Science & Business Analytics, School of Applied Science,
HSNC University, Mumbai
Email ID : sweta.maitri@hsncu.edu.in
Mob. No. 8879011252

External Experts Professor / Teachers

Rosemary Gosling,
Director of External Studies for the London School of Economics and Political Science (LSE),
rosemary.gosling@gmail.com

Dr. Santosh Bothe, Founder and Director AiSense(Start up funded by BIRAC, Govt. of India), Principal, Saraswati College, Shegaon, Affiliated to SGBU Amravati University

Prof. Parag Mahulikar is Ex- Dean and Senior Professor of Marketing at IES Management College and Research Centre, Bandra, India and Management Consultant

Dr. Alok Deepak Dabade, Assistant Professor, Department of Statistics, University of Mumbai.

Dr. Sujata Suvarnapathki, Assistant Professor, Department of Statistics, Ramnarayan Ruia Autonomous College, Matunga, Mumbai.

Mr. Subhash Kumar, Assistant Professor, MCA, MPHIL IT department, St.Xavier's college, Mumbai.

External Industry Experts

Mr. Vinayak Deshpande, Managing Director, Sankhya Analytical Research Pvt. Ltd.

Mr. Nishad Kapadia, MCA, Technical trainer,Data and Solution Architect Project Manager, TeraData, Mumbai.

Miss. Praveena Premanand Menon, MSc in Big Data Analytics

Mr. Awesh Bhornya ,Infinity Learning (Founder)

Alumni:

Harsh Mahapadi
Mob. No.9702294127

Rushabh Maru
Mob. No.9930869944

Structure of Curriculum (BSc Data Science and Business Analytics)

Semester – VII

Course Title	No of Credits	No of Hours	Summative Marks	Formative Marks	Total Marks
Gen AI with Prompt Engineering	3	45	60	15	100
Practical on Gen AI with Prompt Engineering	1	30		25	
Coding Theory and Cryptography (Major)	3	45	60	15	100
Practical on Coding Theory and Cryptography	1	30		25	
Operations Research (Major)	3	45	60	15	100
Practical on Operations Research	1	30		25	
Statistical Inference & Design of Experiment (DSE)	3	45	60	15	100
Practical on Statistical Inference	1	30		25	
Cyber security (DSE)	3	45	60	15	100
Practical on Cyber security	1	30		25	
Research Methodology	4	60	60	40	100

Course Code:

Title of paper: Generative Artificial Intelligence with Prompt Engineering

Course Outcomes (COs)
After successful completion of the course, students will be able to:

CO1: Explain core concepts, evolution, and architectures of Generative Artificial Intelligence models.

CO2: Design and refine effective prompts for text, image, and multimodal content generation.

CO3: Apply Generative AI tools to support data science tasks, analytics, research, and academic workflows.

CO4: Evaluate AI-generated outputs with respect to accuracy, bias, limitations, and reliability.

CO5: Demonstrate ethical, legal, and responsible use of Generative AI systems in academic and professional contexts.

Program Specific Outcomes (PSOs)

PSO 1: Demonstrate foundational understanding of Artificial Intelligence and Generative AI, including its evolution, working principles, and comparison with predictive and discriminative models.

PSO 2: Explain and differentiate core generative model architectures such as Transformers, Diffusion Models, GANs, and VAEs, and interpret their role in text, image, audio, and video generation.

PSO 3: Apply prompt engineering techniques—including zero-shot, few-shot, and chain-of-thought prompting—to effectively generate, refine, and evaluate AI-assisted content for diverse applications.

PSO 4: Utilize Generative AI tools for practical tasks such as content creation, data analysis support, AI-assisted coding, documentation, and research assistance in academic and professional contexts.

PSO 5: Critically evaluate AI-generated outputs by identifying limitations such as hallucinations, bias, and inconsistency, and apply strategies to improve accuracy and reliability.

PSO 6: Demonstrate awareness of ethical, legal, and societal considerations in Generative AI, including fairness, transparency, copyright, data privacy, and responsible usage in academia and industry.

Unit	Content	No. of Hours
1	Unit 1: Foundations of Generative AI and Models **i.** Overview of Artificial Intelligence and Evolution towards Generative AI **ii.** Generative AI vs Predictive and Discriminative Models **iii.** Working principles of Generative AI systems **iv.** Core architectures: Transformer models, Diffusion models, GANs, VAEs **v.** Training data, tokens, embeddings, parameters, and hyperparameters **vi.** Multimodal Generative AI: text, image, audio, and video generation **vii.** Overview of popular Generative AI tools (ChatGPT, Gemini, Copilot, Claude) **viii.** Generative AI in Business Intelligence Role of Generative AI in analytics and decision support Overview of AI-enabled BI tools with focus on Power BI Copilot	15

	Natural language interaction with data using Generative AI	
2	Unit 2: Prompt Engineering Techniques and Applications i. Introduction to Prompt Engineering and its importance ii. Prompt structure: instructions, context, constraints, and examples iii. Prompting techniques: zero-shot, few-shot, chain-of-thought prompting iv. Prompt refinement strategies for accuracy and consistency v. Content generation: summarization, rewriting, ideation, and explanation vi. Prompting for images, presentations, resumes, reports, and analytics tasks vii. Use of reference documents and templates in prompting viii. Prompting for analytics and business intelligence tasks a) Prompting Power BI Copilot for: • Auto-generation of reports and dashboards • Creating DAX measures and visuals using natural language • Data summarization and insight generation b) Prompt refinement for accurate analytical outputs	15
3	Unit 3: Advanced Applications, Ethics and Responsible AI i. Generative AI in Data Science workflows and research assistance ii. AI-assisted coding, debugging, and documentation iii. Evaluation of AI-generated outputs: hallucinations, bias, and limitations iv. Ethical issues in Generative AI: bias, fairness, and transparency v. Copyright, intellectual property, and data privacy concerns vi. Responsible use of Generative AI in academics and industry vii. Case studies and real-world applications of Generative AI viii. AI in Power BI and Data Analytics a) Copilot in Power BI: features and capabilities b) AI visuals in Power BI: • Key Influencers • Decomposition Tree • Smart Narratives	15

Self-Learning topics (Unit wise)

Unit	Topics
1	i. Working of Large Language Models (LLMs) and transformer architecture (conceptual understanding) ii. Comparison of Generative AI with traditional Machine Learning and predictive models
2	i. Zero-shot and Few-shot prompting techniques with simple examples ii. Prompt refinement strategies for improving accuracy and relevance of AI outputs
3	i. Identification of bias and hallucinations in AI-generated content ii. Ethical, legal, and responsible use of Generative AI in academic and professional settings

Online Resources

https://onlinecourses.swayam2.ac.in/ntr26_ed111/preview Fundamentals of AI on SWAYAM portal
https://onlinecourses.swayam2.ac.in/imb26_mg37/preview Generative AI and Large Language Models on SWAYAM portal
https://onlinecourses.swayam2.ac.in/imb26_mg131/preview Prompt engineering on SWAYAM portal
https://www.youtube.com/watch?v=UrC6jZJdVXk&list=PL9ooVrP1hQOE5dmqWrYQqQTX-FFyfYdLf Generative AI course on Youtube

References:

1. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press.
2. Foster, D. (2023). Generative Deep Learning (2nd ed.). O'Reilly Media.
3. Jurafsky, D., & Martin, J. H. (2023). Speech and Language Processing. Pearson.
4. Bishop, C. M. (2006). Pattern Recognition and Machine Learning. Springer.
5. Russell, S., & Norvig, P. (2021). Artificial Intelligence: A Modern Approach (4th ed.). Pearson.
6. Murphy, K. P. (2022). Probabilistic Machine Learning. MIT Press.
7. Aggarwal, C. C. (2018). Neural Networks and Deep Learning. Springer.
8. Brown, T. et al. (2020). Language Models are Few-Shot Learners. MIT Press.
9. McKinsey & Company. (2023). The State of AI and Generative AI.
10. Mollick, E. (2024). Co-Intelligence: Living and Working with AI. Penguin.

Course Code:

Title of paper: Coding Theory and Cryptography

Course Outcomes (COs)
After successful completion of the course, students will be able to:

CO1: Explain fundamental concepts of coding theory and cryptography used in secure and reliable communication.

CO2: Analyze error-detecting and error-correcting codes and their performance.

CO3: Apply classical and public key cryptographic techniques to real-world data security problems.

CO4: Implement basic coding and cryptographic algorithms using suitable computational tools. –

CO5: Demonstrate awareness of security applications, limitations, and ethical considerations in cryptography.

Program Specific Outcomes (PSOs)

PSO 1: Explain the role of coding theory and cryptography in achieving secure and reliable digital communication, supported by appropriate mathematical foundations.

PSO 2: Apply number theory and algebraic concepts such as modular arithmetic, prime numbers, Euler's theorem, and the Chinese Remainder Theorem in coding and cryptographic algorithms.

PSO 3: Design and analyze error-detecting and error-correcting codes, including linear block codes, Hamming codes, cyclic codes, and CRC, for data transmission and storage applications.

PSO 4: Implement and evaluate classical and symmetric cryptographic techniques, including substitution and transposition ciphers, DES, AES, hash functions, and message authentication mechanisms.

PSO 5: Explain and apply public key cryptographic systems such as RSA and Diffie–Hellman for secure key exchange, encryption, authentication, and digital signatures.

PSO 6: Assess real-world applications of cryptography in secure communication, blockchain technologies, and data science, considering security goals and cryptanalytic perspectives.

Unit	Content	No. of Hours
1	Unit 1: Foundations of Coding Theory and Mathematical Background i. Need for coding theory in secure and reliable digital communication ii. Mathematical preliminaries for coding and cryptography: a. Modular arithmetic and congruences b. Euclidean algorithm and Extended Euclidean algorithm c. Prime numbers and divisibility d. Euler's totient function and Fermat's Little Theorem e. Chinese Remainder Theorem iii. Information theory basics: entropy and redundancy iv. Linear block codes: generator and parity check matrices v. Hamming codes: construction, encoding, decoding, and error correction vi. Cyclic codes and CRC codes vii. Applications of error-detecting and error-correcting codes in data transmission and storage	15

2	Unit 2: Classical and Symmetric Cryptography i. Introduction to cryptography and security goals ii. Classical ciphers: substitution and transposition ciphers iii. Symmetric key cryptography: stream ciphers and block ciphers iv. Data Encryption Standard (DES) and Advanced Encryption Standard (AES) v. Hash functions and message authentication codes vi. Introduction to cryptanalysis concepts	15
3	Unit 3: Public Key Cryptography and Applications i. Number theory background: modular arithmetic and prime numbers ii. RSA public key cryptosystem: key generation, encryption, and decryption iii. Diffie–Hellman key exchange algorithm iv. Digital signatures and authentication v. Public Key Infrastructure (PKI) and certificates vi. Applications of cryptography in blockchain, secure communication, and data science	15

Self-Learning topics (Unit wise)

Unit	Topics
1	BCH codes and Reed–Solomon codes; Applications of coding theory in QR codes
2	Modern symmetric encryption standards; Cryptographic hash functions in practice
3	Blockchain basics and cryptographic foundations; Post-quantum cryptography overview

Online Resources

https://onlinecourses.nptel.ac.in/noc26_cs57/preview Cryptography and Network Security on SWAYAM portal
A Basic Course In Number Theory - Course https://share.google/ZwqMnhOkKRShZlUDD On SWAYAM Portal
https://onlinecourses.nptel.ac.in/noc26_cs18/preview Foundations of cryptography on SWAYAM portal

References:

1. N. Koblitz, A Course in Number Theory and Cryptography, Springer.
2. A. Menezes, P. C. van Oorschot, and S. A. Vanstone, Handbook of Applied Cryptography, CRC Press.
3. D. R. Stinson, Cryptography: Theory and Practice, CRC Press.
4. J. Katz and Y. Lindell, Introduction to Modern Cryptography, CRC Press.
5. W. Cary Huffman and Vera Pless, Fundamentals of Error-Correcting Codes, Cambridge University Press.
6. S. Lin and D. J. Costello, Error Control Coding, Pearson.
7. Douglas R. Stinson and Maura Paterson, Cryptography: Theory and Practice, CRC Press.
8. Behrouz A. Forouzan, Cryptography and Network Security, McGraw-Hill.
9. Christof Paar and Jan Pelzl, Understanding Cryptography, Springer.
10. Heiko Knopp, Applied Cryptography and Data Security, Springer.

Course Code:

Title of the paper: Operations Research (Major)

Course Outcomes (COs)
After successful completion of the course, students will be able to:

CO1: Apply optimisation techniques to solve assignment and transportation problems.

CO2: Analyse and manage projects using CPM and PERT methodologies.

CO3: Understand strategic decision-making using game theory concepts and models.

CO4: Solve and interpret matrix games relevant to business and economics.

Program Specific Outcomes (PSOs)

PSO 1: Formulate and solve assignment problems using the Hungarian method, including maximization, minimization, balanced and unbalanced cases, prohibited assignments, and interpretation of unique or multiple optimal solutions.

PSO 2: Model and analyze transportation problems under various constraints by applying appropriate initial feasible solution methods and optimization techniques to achieve cost-effective and optimal resource allocation.

PSO 3: Apply network optimization techniques such as CPM and PERT for project planning, scheduling, monitoring, and control, including identification of critical paths, slack analysis, and project duration estimation.

PSO 4: Construct and interpret project network diagrams using AON and AOA methods, adhering to standard rules of network representation and identifying common structural errors in project networks.

PSO 5: Analyze strategic decision-making problems using game theory concepts, including players, strategies, payoffs, and equilibrium principles in competitive and non-cooperative environments.

PSO 6: Solve two-person and n-person zero-sum matrix games using maximin–minimax principles and dominance strategies, and interpret real-world implications of classical games in business and economics.

Unit	Content	No. of Hours
1	Transportation and Assignment Models Assignment Problem: Hungarian Method for maximisation and minimisation problems; balanced and unbalanced assignment problems; prohibited assignment problems; unique and multiple optimal solutions. (Maximum size: 5 × 5 matrix; up to a maximum of two iterations after row and column minimisation.) Transportation Problems: Maximization and minimisation transportation problems; balanced and unbalanced problems; prohibited transportation problems; unique and multiple optimal solutions. Initial Feasible Solutions (IFS): North West Corner Rule (NWCR), Least Cost Method (LCM), Vogel's Approximation Method (VAM). Optimal Solution: Modified Distribution (MODI) Method – determination of u, v and Δ values. (Maximum size: 5 × 5 transportation matrix; up to a maximum of two iterations after IFS.)	15

2	Project Network Analysis using PERT and CPM Introduction to CPM and PERT techniques: Concept, objectives, and significance. Applications of CPM and PERT in project planning, scheduling, monitoring, and control. Basic steps in CPM and PERT: Identification of activities, sequencing, time estimation, network construction, and scheduling. Framework of CPM and PERT: Elements of project networks, activities, events, precedence relationships, and underlying assumptions. Network diagram representation: Activity-on-Node (AON) and Activity-on-Arrow (AOA) methods. Rules for drawing network diagrams: Common errors in drawing networks: Looping, dangling activities, redundancy, and incorrect precedence relationships Critical path in network analysis: Determination of critical path, critical activities, project duration, and slack/float analysis. Advantages and disadvantages of CPM and PERT.	15
3	Foundations of Game Theory Introduction to Game Theory: Concept, importance, and applications in business and decision-making. Basic concepts: Players, strategies, payoffs, value of the game. Non-cooperative games: Discrete and continuous static games involving two-person and n-person games. Famous games: Prisoner's Dilemma, Ultimatum Game, and Tragedy of the Commons. Zero-sum matrix games: Two-person zero-sum games; maximin and minimax principles; convex and concave games; dominant and dominated strategies. Solution of matrix games of size: 2 × 2, 2 × n, m × 2, and m × n.	15

Self-Learning topics (Unit wise)

Unit	Topics
1	1) Study real-life applications of transportation and assignment models in logistics, supply chain management, and workforce allocation. 2) Explore variations of the Hungarian Method and MODI method using small datasets. 3) Use spreadsheet tools or open-source software to solve transportation and assignment problems.
2	1) Draw network diagrams for simple real-life projects (event planning, construction phases, software development). 2) Explore differences between CPM and PERT through additional reading. 3) Practice identifying critical paths and slack for given project networks.
3	1) Analyze famous strategic games and identify players, strategies, and payoffs. 2) Explore real-world business scenarios involving competitive decision-making. 3) Study additional examples of zero-sum and non-zero-sum games.

Online Resources

'Operations Research' by PROF.KUSUMDEEP, Department of Mathematics, IIT Roorkee available on the NPTEL portal, https://nptel.ac.in/courses/111/107/111107128/#

Course Code:
Title of Paper: Operations Research (Major)

1. Operations Research Techniques for Management, Kapoor V.K Sultan Chand & Sons,7th.
2. Operations Research, Kantiswarup, Gupta P.K. &Manmohan, Sultan Chand & Sons,9th.
3. Operations Research, Sharma S.D, Kedarnath, Ramnath& Company,8th.
4. Quantitative Techniques in Management, Vora N.D. Tata McGraw Hill co,3rd 5. Operations Research, P.k .Gupta,D.s. Hira,Sultan Chand & Sons

Course Code:

Title of the paper: Statistical Inference & Design of Experiments (DSE)

Course Outcomes (COs)
After successful completion of the course, students will be able to:

CO1: Explain and apply fundamental concepts of statistical estimation including unbiasedness, consistency, efficiency and sufficiency for parametric inference problems.

CO2: Implement classical methods of estimation, such as Method of Moments and Maximum Likelihood Estimation, and evaluate the performance of estimators using analytical and simulation-based approaches.

CO3: Apply Bayesian inference techniques to estimate parameters, update beliefs using data, and compare Bayesian and frequentist approaches in practical data science contexts.

CO4: Design and analyse data-driven experiments, including A/B testing and factorial designs, to support decision-making under uncertainty.

CO5: Use statistical software and programming tools (e.g., Python) to perform estimation, Bayesian analysis and experimental design, and interpret results effectively.

Program Specific Outcomes (PSOs)

PSO 1: Apply fundamental concepts of statistical estimation to data science problems, including point and interval estimation, and interpret the properties of estimators for effective data-driven decision making.

PSO2: Implement and evaluate estimation methods such as the Method of Moments and Maximum Likelihood Estimation (MLE) for modelling real-world data, with an understanding of their assumptions, limitations, and relevance to machine learning applications.

PSO3: Analyze optimal estimation techniques using concepts of sufficiency, efficiency, Fisher information, and minimum variance estimators, emphasizing practical interpretation and comparative assessment of estimators.

PSO4: Develop and interpret Bayesian inference models by integrating prior information with observed data, and distinguish Bayesian and frequentist approaches for uncertainty quantification and probabilistic reasoning.

PSO5: Apply statistical inference techniques to modern applications such as A/B testing and introductory causal inference, supporting evidence-based decision making in data science and analytics contexts.

PSO6: Design, analyze, and interpret experiments using classical and factorial experimental designs, and extend experimental design principles to machine learning validation, cross-validation, and online experimentation.

Unit	Content	No. of Hours
1	Estimation for Data Science Applications 1.1 Concepts of Estimation • Role of estimation in data-driven decision making • Point estimation and interval estimation • Properties of estimators: (Unbiasedness, Consistency, Sufficiency & Efficiency) (Emphasis on interpretation rather than proofs) 1.2 Methods of Estimation • Method of Moments (MoM) ➢ Concept and procedure ➢ Applications to common data models ➢ Practical limitations in real datasets	15

	➢ Use of MoM for estimating parameters in simple forecasting models • Method of Maximum Likelihood Estimation (MLE) ➢ Likelihood and log-likelihood functions ➢ Numerical maximisation (conceptual) ➢ Properties of MLE (invariance, asymptotic normality – applied view) ➢ Why MLE is widely used in machine learning models ➢ MLE-based parameter estimation for forecasting models 1.3 Optimal Estimation and Information • Fisher–Neyman criterion (statement and applications) • Factorization theorem (sufficiency without proof) • Complete statistics (conceptual) • Minimum Variance Unbiased Estimator (MVUE) • Rao–Blackwell and Lehmann–Scheffé theorems (applications) • Cramér–Rao inequality and efficiency of estimators • Minimum Variance Bound (MVB) estimators • Efficiency of estimators in forecasting performance (Derivations discouraged; application and interpretation encouraged)	
2	Bayesian Inference & Modern Applications: 2.1 Bayesian Framework • Bayes' Theorem • Components of Bayesian inference: ➢ Prior distribution ➢ Likelihood function ➢ Posterior distribution • Interpretation of posterior probabilities 2.1 Bayesian vs Frequentist Inference • Conceptual comparison • Philosophical differences • Situations where Bayesian methods are preferred • Strengths and limitations of both approaches 2.2 Simple Bayesian Estimation • Bayesian estimation of: (Mean & Proportion) • Conjugate priors (conceptual treatment only) • Posterior mean and credible intervals (No heavy mathematics — software-based understanding) 2.4 Modern Applications of Inference • A/B Testing ➢ Classical vs Bayesian A/B testing ➢ Decision-making using posterior probabilities • Introduction to Causal Inference ➢ Correlation vs causation ➢ Basic idea of treatment and control ➢ Role of randomisation	15
3	3.1 Principles of Experimental Design • Core Concepts: Randomisation, Replication, Blocking. • Role of experimental design in high-dimensional data and model building. • Factorial thinking and Data Science applications. 3.2 Completely Randomized Design (CRD) • Model formulation and analysis. • Interpretation and post-hoc tests. • Use of CRD for baseline comparison in screening experiments	15

	3.3 Randomised Block Design (RBD) and Latin Square • Blocking to reduce nuisance variation. • Latin Square Design for two blocking factors. 3.4 Factorial Designs • Two-factor full factorial designs. • Interaction effects and graphical interpretation. 3.5 Higher-Order Factorial Designs • Concept of 3-factor (2^3) factorial designs • Main effects and interaction hierarchy principle • Interpretation of three-way interaction (conceptual) • Use cases in Data Science & A/B testing 3.6 Experimental Designs in Machine Learning • Cross-validation as experimental framework. • A/B testing and online experiment design. • Design of experiments for feature selection and hyperparameter screening • Factorial experiments for reducing dimensionality in predictive and forecasting model.	

Self-Learning topics (Unit wise)

Unit	Topics
1	• Method of Moments (MoM) ➢ Concept and procedure ➢ Applications to common data models ➢ Practical limitations in real datasets • Fisher–Neyman criterion (statement and applications)
2	2.1 Bayesian Framework • Bayes' Theorem • Components of Bayesian inference: ➢ Prior distribution ➢ Likelihood function ➢ Posterior distribution • Interpretation of posterior probabilities 2.4 Introduction to Causal Inference • Correlation vs causation • Basic idea of treatment and control • Role of randomisation
3	3.1 Completely Randomized Design (CRD) • Model formulation and analysis. • Interpretation and post-hoc tests. 3.4 Factorial Designs • Two-factor full factorial designs. • Interaction effects and graphical interpretation.

Online Resources

1. https://www.classcentral.com/university/iit-kharagpur
2. https://www.youtube.com/watch?v=9wCnvr7Xw4E

Course Code:
Title of Paper : Statistical Inference & Design of Experiments

1. Bayesian Data Analysis — Andrew Gelman, John B. Carlin, Hal S. Stern, David B. Dunson, Aki Vehtari & Donald B. Rubin
2. Introduction to Mathematical Statistics — Robert V. Hogg, Joseph McKean & Allen T. Craig
3. Statistical Inference — George Casella & Roger L. Berger
4. Design and Analysis of Experiments — Douglas C. Montgomery

Course Code:

Title of the paper: Cyber security (DSE)

Course Code:

Title of the paper: Cyber security (DSE)

Course Outcomes (COs)

After successful completion of this course, students will be able to:

C01: Understand the Foundations of Cyber Security.

C02: Apply techniques to limit the visibility of personal information and enhance online privacy.

C03: Design and deliver awareness campaigns to promote safe online behavior and skepticism.

C04: Analyse Cyber Threats and Attacks.

C05: Demonstrate safe practices for sharing links, files, and multimedia to prevent spreading malware.

C06: Design and practice effective incident response procedures to minimize damage and recover from attacks.

Program Specific Outcomes (PSOs)

PSO1: Apply fundamental cyber security concepts to protect personal and organizational data across cyberspace, social media platforms, and digital communication systems.

PSO2: Implement secure practices for web browsing, email usage, password management, Wi-Fi access, and Windows operating systems to reduce cyber security risks.

PSO3: Demonstrate the ability to secure smartphones, mobile applications, online banking, UPI, e-wallets, and point-of-sale systems against common cyber threats.

PSO4: Identify, analyze, and prevent social engineering attacks by understanding cyber criminal techniques and applying appropriate countermeasures.

PSO5: Apply knowledge of cyber laws, IT Act provisions, and cyber security initiatives in India to ensure legal compliance and responsible digital behavior.

PSO6: Use information security tools and techniques for safe data handling, recovery from information loss, and secure destruction of sensitive information.

Unit	Content	No. of Hours
1	Social Media Security 1.1 Introduction to Cyber Space: History of Internet, Cyber Crime, Information Security, Computer Ethics and Security Policies 1.2 Choosing the Best Browser according to the requirement and email security: Guidelines to choose web browsers, Securing web browser, Antivirus, Email security 1.3 Guidelines for secure password and wi-fi security 1.4 Guidelines for setting up a Secure password 1.5 Two-steps authentication 1.6 Password Manager 1.7 Wi-Fi Security 1.8 Guidelines for social media and basic Windows security 1.9 Guidelines for social media security 1.10Tips and best practices for safer Social Networking 1.11Basic Security for Windows	15

	1.12User Account Password	
2	Security Guidelines 2.1 Smartphone security guidelines: Introduction to mobile phones, Smartphone Security, Android Security, IOS Security 2.2 Cyber Security Initiatives in India: Counter Cyber Security Initiatives in India, Cyber Security Exercise, Cyber Security Incident Handling, Cyber Security Assurance 2.3 Online Banking, Credit Card and UPI Security: Online Banking Security, Mobile Banking Security, Security of Debit and Credit Card, UPI Security, Micro ATM, e-wallet and POS Security, Security of Micro ATMs. 2.4 e-wallet Security Guidelines 2.5 Security Guidelines for Point of Sales(POS)	15
3	Social Engineering and IT Security 3.1 Social Engineering: Social Engineering, Types of Social Engineering, How Cyber Criminal Works, How to prevent for being a victim of Cyber Crime. 3.2 Cyber Security Threat Landscape and Techniques: Cyber Security Threat Landscape, Emerging Cyber Security Threats, Cyber Security Techniques. 3.3 IT Security Act and Misc. Topics: IT Act, Hackers-Attacker Countermeasures, Web Application Security, Digital Infrastructure Security, Defensive Programming 3.4 Information Destroying and Recovery Tools 3.5 Recovering from Information Loss 3.6 Destroying Sensitive Information 3.7 CCleaner for Windows	15

Self-Learning topics (Unit wise)

Unit	Topics
2	2.3 Online Banking, Credit Card and UPI Security: Online Banking Security, Mobile Banking Security, Security of Debit and Credit Card, UPI Security, Micro ATM, e-wallet and POS Security, Security of Micro ATMs. 2.4 e-wallet Security Guidelines 2.5 Security Guidelines for Point of Sales(POS)
3	3.1 Social Engineering: Social Engineering, Types of Social Engineering, How Cyber Criminal Works, How to prevent for being a victim of Cyber Crime.

Online Resources

Course Code:

Title of the paper: Research Methodology

CO1 Explain the fundamental concepts, objectives, and types of research, and distinguish between research methods and research methodology.

CO2 Identify and clearly define research problems, and outline the research process using appropriate scientific approaches.

CO3 Design an appropriate research plan and research design, including exploratory, descriptive, and experimental designs.

CO4 Select suitable sampling techniques and sample sizes based on research objectives, population characteristics, and precision requirements.

CO5 Apply measurement and scaling techniques to develop reliable and valid research instruments.

CO6 Evaluate and select appropriate data collection methods for primary research, including observation, interviews, questionnaires, and schedules.

Program Specific Outcomes (PSOs)

PSO1 Demonstrate a clear understanding of the fundamental concepts, objectives, and types of research relevant to academic, professional, and applied studies.

PSO2 Identify, formulate, and clearly define research problems using appropriate scientific and systematic approaches.

PSO3 Design and develop appropriate research designs and research plans, including exploratory, descriptive, and experimental designs.

PSO4 Select and apply suitable sampling techniques and sample size determination methods to ensure representative and reliable data collection.

PSO5 Develop and evaluate measurement and scaling instruments by applying principles of reliability and validity in research studies.

PSO6 Choose and apply appropriate data collection methods to gather accurate primary data and support evidence-based analysis and conclusions.

1	1.1 Research Methodology: An Introduction,Meaning of Research, Objectives of Research, Motivation in Research, Types of Research 1.2 Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method 1.3 Importance of Knowing How Research is Done,Research Process,Criteria of Good Research,Problems Encountered by Researchers in India,Defining the Research Problem 1.4 What is a Research Problem,Selecting the Problem,Necessity of Defining the Problem,Technique Involved in Defining a Problem An Illustration	15

2	2.1 Research Design, Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Developing a Research Plan 2.2 Sampling Design, Census and Sample Survey, Implications of a Sample Design, Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of Sample Designs 2.3 How to Select a Random Sample, Random Sample from an Infinite Universe, Complex Random Sampling Designs, Sample Size and its Determination, Determination of Sample Size through the Approach Based on Precision Rate and Confidence Level 1	15
3	3.1 Measurement and Scaling Techniques, Measurement in Research, Measurement Scales, Sources of Error in Measurement, Tests of Sound Measurement, Technique of Developing Measurement Tools, 3.2 Scaling, Meaning of Scaling, Scale Classification Bases,Important Scaling Techniques, Scale Construction Techniques 3.3 Methods of Data Collection, Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Difference between Questionnaires and Schedules, Some Other Methods of Data Collection 3.4 Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method 3.5 Guidelines for Constructing Questionnaire/Schedule, Guidelines for Successful Interviewing, Difference between Survey and Experiment 3.6 Processing Operations, Some Problems in Processing, Elements/Types of Analysis, Statistics in Research, Measures of Relationship, Simple Regression Analysis	15
4	4.1 Interpretation and Report Writing, Meaning of Interpretation, Why Interpretation, Technique of Interpretation, Precaution in Interpretation 4.2 Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report 4.3 Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports 4.4 The Computer: Its Role in Research, Introduction, The Computer and Computer Technology, The Computer System, Important Characteristics, The Binary Number System, Computer Applications, Computers and Researcher	15

Self-Learning topics (Unit wise)

Unit	Topics
1	.1 Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method .2 What is a Research Problem,Selecting the Problem,Necessity of Defining the Problem,Technique Involved in Defining a Problem An Illustration
2	.1 How to Select a Random Sample, Random Sample from an Infinite Universe, Complex Random Sampling Designs, Sample Size and its Determination, Determination of Sample Size through the Approach Based on Precision Rate and Confidence Level 1
3	4 Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method 3.5 Guidelines for Constructing Questionnaire/Schedule, Guidelines for Successful Interviewing, Difference between Survey and Experiment
4	1 Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report 4.2 Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports

Online Resources

Kothari, C.R. & Garg Gaurav, Research Methodology : Methods and Techniques, New Age International Pvt Ltd Publishers
Not Available
'Research Methodology ' available on the NPTEL-NOC IITM portal https://www.youtube.com/@nptel-nociitm9240/search?query=research%20methodology and https://www.youtube.com/watch?v=b4GnUdkEAWo

Course Code:
Title of Paper : Research Methodology

1. Creswell, J. W. (2014). Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications.
2. Kumar, R. (2019). Research methodology: A step-by-step guide for beginners. Sage publications.
3. Sekaran, U., & Bougie, R. (2016). Research methods for business: A skill-building approach. John Wiley & Sons.

4. Polit, D. F., & Beck, C. T. (2017). Nursing research: Generating and assessing evidence for nursing practice. Wolters Kluwer.
5. Kothari, C.R. & Garg Gaurav, Research Methodology : Methods and Techniques, New Age International Pvt Ltd Publishers
6. Andy P. Field, ADVENTURE IN STATISTICS: The Reality Enigma, SAGE Publications Ltd; Second edition
7. Andy P. Field, Discovering Statistics Using IBM SPSS Statistics, SAGE Publications Ltd; Fifth edition
8. S.P.Robbins(1998), Organizational Behaviour: Concepts, Contraversies and applications, Seventh Edition,Prentice Hall of India
9. Wikipedia forvK20 formula on Kunder-RichardsonFormula 20
10. Naresh K. Malhotra(2021), Marketing Research: An Applied Orientation, Pearson, 7th edition.
11. Cochrane Handbook for Systematic Reviews of Interventions, Cochrane Book Series Edited by Julian PT Higgins and Sally Gree, Wiley~ Blackwell
12. Michael Borenstein, Larry V. Hedges, Julian P. T. Higgins, Hannah R. Rothstein, Introduction to Meta Analysis, Wiley
13. John E. Hunter and Frank L. Schmidt, Methods of Meta- Analysis (Correcting Error and Bias in Research Findings), Wiley, Second Edition
14. Mike W.L.Cheung, Meta Analysis: A structural equation modeling Approach,Wiley

Structure of Curriculum (BSc Data Science and Business Analytics)

Semester – VIII

Course Title- Sem VIII	No of Credits	No of Hours	Summative Marks	Formative Marks	Total Marks
Applied Statistical Models	3	45	60	15	100
Practical based on Applied Statistical Models	1	30		25	
Cloud Computing	3	45	60	15	100
Practical based on Cloud Computing	1	30		25	
AI for Financial banking (DSE)	3	45	60	15	100
Practical based on AI for Financial banking (DSE)	1	30		25	
Fintech (DSE)	3	45	60	15	100
Practical based on Fintech (DSE)	1	30		25	
Individual Research Project	8			200	200

Course Code:
Title of Paper: Applied Statistical Models

Course Outcomes (COs)

CO1: Understand the theoretical foundations of linear statistical models and their underlying assumptions.
CO2: Apply matrix algebra techniques in the formulation and analysis of linear models.
CO3: Analyze variance using one-way and two-way ANOVA models and interpret results statistically.
CO4: Develop and apply generalized linear models for binary, count, and non-normal response data.
CO5: Estimate model parameters using ordinary least squares, generalized least squares, and maximum likelihood methods.
CO6: Identify and address issues such as endogeneity, measurement errors, and multicollinearity in regression models.
CO7: Analyze time-dependent data using autoregressive and distributed lag models.
CO8: Interpret statistical model outputs for data-driven decision making in real-world applications.

Program Specific Outcomes (PSOs)

PSO1: Apply advanced statistical modeling techniques to solve complex data science problems.
PSO2: Integrate statistical theory with computational tools for effective data analysis.
PSO3: Design, implement, and evaluate regression and classification models for structured data.
PSO4: Analyze large and complex datasets using appropriate statistical and probabilistic methods.
PSO5: Select suitable statistical models based on data characteristics and problem requirements.
PSO6: Interpret and communicate statistical results effectively to technical and non-technical stakeholders.
PSO7: Apply statistical modeling techniques in interdisciplinary domains such as economics, business, health, and social sciences.
PSO8: Demonstrate ethical and professional responsibility in data analysis and statistical reporting.

Unit	Content	No. of Hours
1	Linear models: Linear parametric function and its estimability, Gauss Markoff theorem, Interval estimates and test of hypothesis, fundamental theorems on conditional error ss, Test of β=d, generalized least squares Analysis of variance, fixed effect models: (i) One –way classification model. (ii) Checking assumptions of ANOVA Model. (iii) Simultaneous Confidence Intervals: Scheffe's, Bonferroni and Turkey's interval. Two – way classification model with and without interaction effect, one observation per cell. Tukey's test for non-additivity.	15
2	Generalized Linear models: GLM for Binary data: Linear probability model, Logistic regression model and Probit regression model. GLM for Count data: Poissons regression, Negative Binomial regression. Model with constant coefficient of variation: Gamma Regression, Variance function, Canonical link, Multiplicative model- Log link and Linear model- Identity link.	15
3	Linear and Stochastic Regression Models:	15

	Linear regression model and assumptions; stochastic regression model; ordinary least squares estimation; properties of OLS estimators; endogeneity in regression models; instrumental variable estimation and Two-Stage Least Squares method. Errors in variables models; consequences of measurement errors; autoregressive linear regression models; lagged variables in regression; distributed lag models; estimation of lag coefficients using OLS method.	

Self-Learning topics (Unit wise)

Unit	Topics
1	(i) One –way classification model. (ii) Checking assumptions of ANOVA Model. (iii) Simultaneous Confidence Intervals: Scheffe's, Bonferroni and Turkey's interval.
1	Probit regression model. GLM for Count data: Poissons regression, Negative Binomial regression.
3	stochastic regression model; ordinary least squares estimation; properties of OLS estimators;

Online Resources

1. 'Statistics for Business Economics' by Dr. Patel from University School of Sciences available on the Swayam portal http://ugcmoocs.inflibnet.ac.in/ugcmoocs/view_module_ug.php/227
2. 'Business Statistics' by Dr Mukesh Kumar Barua from IIT Roorkee available on the Swayam portal https://nptel.ac.in/courses/110/107/110107114/ for unit I and unit II.
3."Econometrics"by Prof. S. R. Badi, IIT Madras Available on the SWAYAM / NPTEL Portal https://nptel.ac.in/courses/110/105/110105039/
4. "Applied Econometrics" by Prof. T. R. Subramaniam, IIT Madras Available on the SWAYAM / NPTEL Portal https://nptel.ac.in/courses/110/106/110106044/

Course Code:

Title of Paper: Cloud Computing

Course Outcomes (COs)

CO1 Explain fundamental networking concepts, network classifications, and operating system types used in distributed environments.

CO2 Describe cloud architecture principles, including virtualization, hypervisors, virtual machines, and parallel computing concepts.

CO3 Apply containerization and orchestration tools such as Docker and Kubernetes to deploy and manage applications in distributed systems.

CO4 Differentiate between cloud service models and deployment models, and explain cloud security concepts including identity and access management.

CO5 Analyze business requirements to plan cloud migration, deploy cloud-based tools, and manage cloud resources efficiently.

CO6 Compare major cloud service providers (AWS, Azure, GCP) in terms of services, cost, scalability, and suitability for organizational needs.

Program Specific Outcomes (PSOs)

PSO1 Develop a strong foundation in networking and distributed system concepts required for modern cloud-based applications.

PSO2 Apply cloud computing technologies such as virtualization, containerization, and DevOps practices to build scalable systems.

PSO3 Design and manage secure cloud environments by understanding service models, deployment strategies, and identity management mechanisms.

PSO4 Evaluate and select appropriate cloud platforms and services based on technical, financial, and business considerations.

PSO5 Support organizational goals by enabling efficient cloud migration, deployment, and resource management strategies.

PSO6 Demonstrate readiness for cloud and DevOps roles by integrating networking, security, and business perspectives in distributed system solutions.

Unit	Content	No. of Hours
1	Networking Concepts & Distributed Systems 1.1 Introduction to networking 1.2 Classification of networks 1.3 Cloud Architecture 1.4 Cloud DevOps 1.5 Virtualization	15

	1.6 Types of Operating systems 1.7 Hypervisors & Virtual Machines 1.8 Parallel Computing 1.9 Docker and Kubernets	
2	Cloud Computing and Security 2.1 Cloud Service Models 2.2 Cloud Deployment Models 2.3Identity and Access Management	15
3	Business demands and needs 3.1 Migrating to Cloud 3.2 Deployment of cloud based tools 3.3 Ease of cloud resource management 3.4 Financial projections w.r.t cloud 3.5 Cloud Techonology (Azure, AWS) 3.6 Comparison between CSPs (AWS, Azure, GCP Etc.)	15

Self-Learning topics (Unit wise)

Sub Unit	Topics
1	1.2 Classification of networks 1.7 Hypervisors & Virtual Machines
3	3.5 Comparison between CSPs (AWS, Azure, GCP Etc.)

Online Resources

Cloud computing by Prof. Soumya Kanti Ghosh from IIT Kharagpur available on the Swayam portal https://nptel.ac.in/courses/106105167
Cloud Computing and Distributed Systems by Dr.Rajiv Misra from IIT Patna https://nptel.ac.in/courses/106104182

Course Code:

Title of paper: AI for Financial banking

Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO1: Explain the evolution of digital banking systems and the role of cloud computing, blockchain, and AI in improving efficiency, security, and reliability of financial and banking operations.

CO2: Apply concepts of probability, financial statistics, and descriptive analytics to analyze financial datasets and support data-driven decision-making in finance.

CO3: Use unsupervised learning techniques, including autoencoders and clustering methods, to identify patterns, relationships, and structures in financial and investment data.

CO4: Evaluate investment performance and portfolio risk using Sharpe ratio, CAPM, and Bayesian market sentiment analysis techniques.

CO5: Design, implement, and assess AI-driven trading strategies using deep learning models and backtesting frameworks for financial markets.

CO6: Develop and evaluate AI-based risk management and fraud analytics systems while ensuring ethical practices, transparency, and regulatory compliance.

Program Specific Outcomes (PSOs)

PSO1: Apply artificial intelligence, machine learning, and statistical techniques to design and implement solutions for digital banking, financial analytics, algorithmic trading, risk management, and fraud detection.

PSO2: Analyze financial and market data using quantitative, clustering, and deep learning methods to support investment decision-making and portfolio optimization.

PSO3: Develop and evaluate AI-based trading systems and market sentiment models using Bayesian reasoning, time-series analysis, and backtesting frameworks.

PSO4: Design AI-driven risk assessment and fraud analytics systems that ensure model robustness, accuracy, and compliance with financial regulations.

PSO5: Demonstrate proficiency in using modern financial analytics tools, programming environments, and cloud-based platforms for implementing AI solutions in finance.

PSO6: Apply ethical principles, data security practices, and responsible AI standards while developing transparent, reliable, and sustainable financial technology solutions.

Unit	Content	No. of Hours
1	Digital Transformation & AI Foundations in Banking 1.1 Digital Banking and Financial Innovation • Evolution from traditional to digital banking • Online payments, mobile wallets, UPI, and digital transfers	15

	• Introduction to blockchain and digital currencies • Cloud computing and enterprise software in banking • AI in banking: chatbots, credit scoring, loan approval, and process automation 1.2 Financial Data and Statistical Foundations • Nature of financial data: prices, returns, volumes • Mean, variance, and standard deviation • Correlation, covariance, and portfolio diversification • Risk and uncertainty in financial decision making 1.3 Introduction to AI & Machine Learning in Finance • Overview of AI, ML, and Deep Learning • Supervised vs unsupervised learning in financial applications • Role of data quality, preprocessing, and feature engineering • Real-world examples of AI in banking operations and investment analytics	
2	Investment Analytics, Market Analysis & Unsupervised Learning 2.1 Investment Performance & Portfolio Analytics • Financial returns and risk measurement • Sharpe Ratio: concept, calculation, and interpretation • Ranking investment opportunities and portfolio evaluation • Annualization and time period adjustments • Case study: Evaluating historical investment performance 2.2 Unsupervised Learning for Finance • Introduction to clustering and dimensionality reduction • K-Means clustering and visualization of financial datasets • Autoencoders for anomaly detection and feature extraction • Applications: stock grouping, portfolio diversification, fraud detection 2.3 Market Sentiment and Probabilistic Thinking • Understanding market sentiment and behavioral finance • Introduction to Bayesian reasoning (priors and posteriors)	15

	• Basic trend analysis, momentum indicators, and pattern recognition • Sentiment-driven trading insights (conceptual)	
3	AI-Driven Trading, Risk & Fraud Analytics 3.1 AI-Assisted Trading and Strategy Evaluation • Trading strategy concepts: rule-based vs AI-assisted • Backtesting fundamentals for strategy validation • Entry, exit, and profitability analysis • Short-term volatility modeling and scenario evaluation 3.2 Risk Management with AI • Role of risk management in banking and trading • Key risk metrics: VaR, volatility, and stress testing (conceptual) • Stop-loss, take-profit, and AI-assisted risk control mechanisms • Event-based and vectorized backtesting 3.3 Fraud Detection & Ethical AI in Finance • Financial fraud overview and impact • AI-based fraud detection pipelines • Fraud model lifecycle: monitoring, calibration, and stability • Visual analytics and alert systems • Ethical AI, transparency, bias mitigation, and compliance	15

Self-Learning topics (Unit wise)

Unit	Topics
1	• Blockchain technologies in finance and banking • AI-driven efficiency, productivity, and reliability in banking operations • Business efficiencies, industrial productivity, competitive advantage, and carbon-neutral enterprises
2	• Sharpe ratios applied to financial growth analysis

Online Resources

Generative AI in Finance (Coursera) A practical beginner-level course covering how generative AI models apply to forecasting, risk assessment, fraud detection, and automation in finance. https://www.coursera.org/learn/generative-ai-in-finance
Introduction to Generative AI in Finance (Coursera) Part of the AI-powered finance specialization; introduces fundamental AI applications in financial services including automation, predictive analysis, and regulation. https://www.coursera.org/learn/introduction-to-generative-ai-in-finance
AI in Financial Services: Foundations and Future Trends (Coursera) A broader specialization on AI technologies, machine learning, and digital innovation in financial services — good for deeper conceptual foundations and trends. https://www.coursera.org/specializations/ai-financial-services-foundations-future-trends
AI in Finance (FINSIA Online Course) Industry-focused online course exploring how AI, NLP, and ML are transforming financial systems and banking processes. https://finsia.com/learn/education-courses/ai-in-finance

Course Code:

Title: Financial technology **(Total Hours : 45 Lectures)**

Course Outcomes (COs)

CO1 Explain the basic concepts of FinTech, its evolution, ecosystem, segmentation, and impact on traditional banking and financial systems.

CO2 Identify and classify different categories and emerging sectors of FinTech, including digital payments, lending, banking, and asset management.

CO3 Describe the core technologies used in FinTech, such as artificial intelligence, machine learning, blockchain, cryptocurrencies, and data analytics.

CO4 Analyze the working of FinTech applications including payment gateways, crypto wallets, algorithmic trading systems, and digital financial platforms.

CO5 Evaluate FinTech business models and valuation methods at various organizational stages using technology and analytics-driven perspectives.

CO6 Examine regulatory frameworks and real-world FinTech case studies to assess compliance, innovation, and strategic adoption of FinTech trends.

Program Specific Outcomes (PSOs)

PSO1 Develop a strong foundation in FinTech concepts, ecosystem structure, and industry practices within modern financial services.

PSO2 Apply knowledge of emerging financial technologies to analyze digital financial products and services.

PSO3 Assess the impact of FinTech-driven digital transformation across banking, payments, lending, insurance, and asset management sectors.

PSO4 Analyze FinTech business models and valuation approaches to support strategic and investment decision making.

PSO5 Interpret FinTech regulations and policy developments, including those related to blockchain and cryptocurrencies, in a global context.

PSO6 Critically evaluate FinTech case studies to identify innovation opportunities and improvements in existing financial products and services.

Unit	Content	No. of Lectures
1	Introduction to Fintech Basic of Fintech Categories & Types of Fintech Fintech v/s Traditional Banking & Finance	15

	Technology Used in Fintech Rise of Fintech Emerging Sectors in Fintech Impact of Fintech Fintech Ecosystems Fintech Segmentation	
2	Working of Fintech AI and Machine Learning Blockchain Technology Introduction to Crypto Currency, Cryto Wallets Payment Gateways Algorithm Trading Data Analytics application in Fintech Valuation of a fintech organization at different stages	15
3	Sectors in Fintech Digital Lending Digital Banking Digital Identity Digital Wallet Asset Management Alternative Insurance Underwriting Alternative Credit Score Regulations in Fintech & Case Studies Regulations FinTech Regulations Global FinTech-enabling Regulations Database Evolving Regulations Regulatory and policy developments in the use and governance of blockchain and cryptocurrencies Case Studies	15

	M-Pesa Goldman Sachs' Digital Journey The NEAT Account : Fintech Innovation in Hongkong Paytm : Building a Payment Network Binance Fidelity Investments Analysis : How Existing products can benefit from Fintech Trends	

Self-Learning topics (Unit wise)

Sub Unit	Topics
1	Rise of Fintech Emerging Sectors in Fintech
2	Data Analytics application in Fintech Valuation of a fintech organization at different stages
3	Case Studies M-Pesa Goldman Sachs' Digital Journey

Online Resources

Introduction to Blockchain Technology and Applications by Prof. Sandeep Shukla from IIT Kanpur available on the Swayam portal https://nptel.ac.in/courses/106104220
Fintech: Foundations & Applications of Financial Technology Specialization available on coursera https://www.coursera.org/specializations/wharton-fintech

Scheme of Teaching and Examination:

The performance of the learners shall be evaluated in two components: Internal Assessment with 40% marks by way of continuous evaluation and by Semester End Examination with 60% marks by conducting the theory examination.

Examination Pattern as per NEP 2020 (Academic Year 2023-2024)

1) Evaluation of Major and Minor Subjects

Subject	Formative Assessment (Marks)	Summative Assessment (Marks)
Major Subject	15	60
Minor Subject	15	60
Major (Practical based Subject)	-	25
Minor (Practical based Subject)	-	25

.

FORMATIVE ASSESSMENT:- It is defined as the assessment of the learners on the basis of continuous evaluation as envisaged in the credit based system by way of participation of learners in various academic and correlated activities in the given semester of the programme.

A) Formative Assessment – 40% 40 marks

Practical's (internal Components of the Practical Course)

1. For Theory Courses

Sr.No.	Particulars	Marks
1	One class open book test / online examination to be conducted in the given semester/Project	25 Marks
2	Self-Learning Evaluation with Active participation in routine class instructional deliveries	10+5 Marks

2. For Courses with Practicals

Each practical course can be conducted out of 50 marks with 10 marks for internal component of the Practical and 40 marks for formative assessment which will be converted to 25 marks.

Practical's (Internal component of the Practical Course)

Sr. No	Evaluation type	Marks
1	Journal	5
2	Viva	5

B). SUMMATIVE ASSESSMENT =SEMESTER END EXAMINATION :-

It is defined as the examination of the learners on the basis of performance in the semester end theory / writtenexaminations.

The semester end examination (external component) of 60 % for each course will be as follows:

a. For Theory Courses
   i) Duration – 2 Hours ii) Theory Question Paper Pattern:-

i. There shall be three questions each of 20 marks from each unit
ii. All questions shall be compulsory with internal choice within the questions. Question may be subdivided into sub-questions a, b, c… and the allocation of marks depend on the weightage of the topic.

b. For Practical Courses
   i) Duration – 2 Hours ii) Practical Question Paper Pattern:-

1. There shall be three questions each of 10 marks. On each unit there will be one question based on the syllabus and the fourth one will be based on entire syllabus.
2. All questions shall be compulsory with internal choice within the questions. Question may be subdivided into sub-questions a, b, c… and the allocation of marks depend on the weightage of the topic.