



MCKV INSTITUTE OF ENGINEERING

NAAC Accredited "A" Grade Autonomous Institute under UGC Act 1956
Approved by AICTE & affiliated to Maulana Abul Kalam Azad University of Technology, West Bengal

243 G.T. Road (N), Liluah, Howrah- 711204, West Bengal, India

Ph: +91 33 26549315/17 Fax +91 33 26549318 Web: www.mckvie.edu.in/

Curriculum for Undergraduate Degree (B.Tech.) in Computer Science and Engineering (AI and ML) (w.e.f. AY: 2022-23)

Part III: Detailed Curriculum

Eighth Semester

Course Name:	Professional Ethics and Project Management		
Course Code:	HM-HU 802	Category:	Management Science and Humanities Courses
Semester:	8th	Credit:	2
L-T-P:	2-0-0	Pre-Requisites:	Must have the knowledge on basic statistics and other decision-making tools
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:

1.	To understand the core values that shape the ethical behaviour of a professional.
2.	To understand the concepts of project planning and organization, budgeting and control, and project life cycles.
3.	To learn concepts related to organizational workflow including the staffing process, project planning elements, and the project plan contents and project communications.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1.	Morals, values and Ethics. Engineering Ethics & Professionalism. Code of Ethics. Profession and Professionalism- Models of professional roles- Theories about right action.	3
2.	Managing conflict. Whistle Blowing. Global Ethical Issues. Multinational Corporations- Environmental Ethics- Business Ethics- Computer Ethics - Role in Technological Development-Engineers as Managers- Consulting Engineers- Engineers as Expert witnesses and advisors-Moral leadership.	3
3.	Project Management: Definitions of Project and Project Management, Issues and Problems in Project Management, Project Life Cycle - Initiation / Conceptualization Phase, Planning Phase, Implementation / Execution Phase, Closure / Termination Phase [4L]	4
4.	Project Feasibility Studies – Pre-Feasibility and Feasibility Studies, Preparation of Detailed Project Report, Technical Appraisal, Economic/Commercial/Financial Appraisal including Capital Budgeting Process, Social Cost Benefit Analysis Project Planning – Importance of Project Planning, Steps of Project Planning, Project Scope, Work Breakdown Structure (WBS) and Organization Breakdown Structure (OBS), Phased Project Planning	4



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5.	Project Scheduling and Costing – Gantt chart, CPM and PERT Analysis, Identification of the Critical Path and its Significance, Calculation of Floats and Slacks, Crashing, Time Cost Trade-off Analysis, Project Cost Reduction Methods.	6
6.	Project Monitoring and Control – Role of Project Manager, MIS in Project Monitoring, Project Audit. Case Studies with Hands-on Training on MS-Project.	4
Total		24 L

Course Outcomes:

After completion of the course, students will be able to:

1.	Apply the knowledge of human values and social values to contemporary ethical values and global issues.
2.	Make a framework for analyzing a project and apply their knowledge systematically to value a business
3.	Applying the principles and practices while maintaining high standards of practice, making ethical judgments and decisions in a respectful, and sustaining professional standing through a commitment to life-long learning.
4.	Implements the generally recognized framework and good practices of project management, organizational influences; operations; strategic planning; programs; project life cycles; and project management cycles

Learning Resources:

1.	<i>Project Management - David I Cleland - Mcgraw Hill International Edition.</i>
2.	<i>Project Management – Gopalakrishnan – Mcmillan India Ltd</i>
3.	<i>Project Management – K Nagarajan</i>
4.	<i>Project Management- Erik Larson and Clifford Gray- SEI</i>



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Course Name:	Big Data Analytics		
Course Code:	PE-CS 801A	Category:	Professional Elective Courses
Semester:	8th	Credit:	3
L-T-P:	3-0-0	Pre-Requisites:	DBMS, JAVA, PYTHON
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To learn the concepts of Big Data and Hadoop
2	To understand and apply the concept of HDFS and MapReduce
3	To deal with Big Data using Hive, Pig, HBase, Impala, Sqoop

Course Contents:		
Module No.	Description of Topic	Contact Hrs.
1	Introduction to big data: Variety of Big Data. Big Data and its Importance of 3 V's, 4 V's, 6 V's of Big Data, Characteristics of Big Data. Introduction of Hadoop, Benefit of Hadoop, Core Components of Hadoop, Other Components of Hadoop, Hadoop Cluster, Hadoop Start-up Mode. Introduction to HDFS, Architecture of HDFS, Role and types of Name Node, HDFS Commands.	12
2	Introduction to MapReduce, Flow of Map Reduce, Word Count Problem by Using Map Reduce etc.	4
3	Introduction to Hive, Architecture of Hive, Data Types of Hive, Hive Query language, Handling Complex Data Types, Scripting in Hive, Different join operations on database tables. Introduction to PIG, Data Types in Pig, Pig Latin, Scripting in Pig.	10
4	Introduction to Sqoop, import data from HDFS To MySQL, Import data From Hive to MySQL. Exporting Data from Hive to Mysql.	4
5	Introduction to NoSQL, Types of NoSQL Databases. Introduction to HBase. Introduction to Impala. Introduction to Spark	6
Total		36L

Course Outcomes:	
After completion of the course, students will be able to:	
1	Describe the concept of Big Data, Hadoop and HDFS.
2	Describe the concept of Map Reduce, Hive, HBase, Pig, Sqoop and Impala.
3	Demonstrate the concept of data transfer between HDFS, MySQL and Hive.
4	Apply NoSQL for importing and exporting unstructured data.



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Learning Resources:

1	Michael Minelli, Michehe Chambers, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business", 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.
2	DT Editorial Services, "Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization", Dreamtech Press India Pvt. Ltd., 2020
3	Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
4	Rajkumar Buyya, "Big Data Principles and Paradigms", MK
5	Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly, 2012.
6	Lars George, "HBase: The Definitive Guide", O'Reilley, 2011
7	Alan Gates, "Programming Pig", O'Reilley, 2011.
8	Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons, 2014



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Course Name:	Cryptography & Network Security		
Course Code:	PE-CS801B	Category:	Professional Elective
Semester:	8th	Credit:	3
L-T-P:	3-0-0	Pre-Requisites:	Discrete Mathematics
Full Marks:	100		
Examination Scheme:	Semester Examination: -70	Continuous Assessment: - 25	Attendance: -5

Course Objectives:	
1	To understand basics of Cryptography and Network Security
2	To be able to secure a message over insecure channel by various means.
3	To learn about how to maintain the Confidentiality, Integrity and Availability of a Data.
4.	To understand various protocols for network security to protect against the threats in the networks.

Course Contents:		
Module No.	Description of Topic	Contact Hrs.
1	Introduction to Cryptography Introduction to security attacks - services and mechanism - introduction to cryptography -Conventional Encryption: Conventional encryption model - classical encryption techniques -substitution ciphers and transposition ciphers – cryptanalysis – steganography - stream and block ciphers introduction only.	5
2	Confidentiality and Modular Arithmetic Confidentiality using conventional encryption - traffic confidentiality - key distribution – random number generation - Introduction to graph - ring and field - prime and relative prime numbers - modular arithmetic - Fermat's and Euler's theorem - primality testing - Euclid's Algorithm - Chinese Remainder theorem - discrete algorithms.	10
3	Public key cryptography and Authentication requirements Principles of public key crypto systems - RSA algorithm - security of RSA - key management – Diffie-Hellman key exchange algorithm - introductory idea of Elliptic curve cryptography – Elgamel encryption - Message Authentication and Hash Function: Authentication requirements -authentication functions - message authentication code - hash functions - birthday attacks –security of hash functions and MACS.	6
4	Integrity checks and Authentication algorithms MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS)	5
5.	Web and System Security Web Security: Secure socket layer and transport layer security - secure electronic transaction (SET) - System Security: Intruders - Viruses and related threads - firewall design principals –trusted systems.	5



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6.	Introduction to Blockchain and Cryptocurrency, Concept of Consensus, Ethereum and application of Blockchain and Cryptocurrency in different domains considering the security aspects.	5
Total		36L

Course Outcomes:

After completion of the course, students will be able to:

1.	Explain the principle of cryptography with different types of cipher generation and modular arithmetic's role in Cryptoanalysis.
2.	Illustrate the concept of symmetric and asymmetric algorithm with advanced concepts like ECC, Elgamel and Hash functions.
3.	Interpret integrity checks and authentication algorithms and web and system security.
4.	Explain Blockchain and Cryptocurrency and its role in different domains.

Learning Resources:

1.	William Stallings, "Cryptography and Network security Principles and Practices", Pearson/PHI.
2.	Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory", Pearson.
3.	Ferouzen "Cryptography & Network Security", TMH Publication.



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Course Name:	Web and Internet Technology		
Course Code:	PE-CS801C	Category:	Professional Elective Courses
Semester:	Eighth	Credit:	3
L-T-P:	3-0-0	Pre-Requisites:	Computer Networks
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To develop an understanding of modern network concepts.
2	To introduce different technologies for web development
3	To provide basic concepts of network security

Course Contents:		
Module No.	Description of Topic	Contact Hrs.
1	<p>Introduction (1L): Overview, Network of Networks, Intranet, Extranet and Internet.</p> <p>World Wide Web (1L): Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP.</p> <p>Review of TCP/IP (1L): Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6.</p> <p>IP Subnetting and addressing (1L): Classful and Classless Addressing, Subnetting. NAT, IP masquerading, IP tables.</p> <p>Internet Routing Protocol (1L): Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast.</p> <p>Electronic Mail (1L): POP3, SMTP.</p>	6
2	<p>HTML (3L): Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Color name, Color value.</p> <p>Image Maps (1L): map, area, attributes of image area.</p> <p>Extensible Markup Language (XML) (4L): Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief.</p> <p>CGI Scripts (1L): Introduction, Environment Variable, GET and POST Methods.</p>	9
3	<p>PERL (3L): Introduction, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling.</p> <p>JavaScript (4L): Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation.</p>	10



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	<p>Cookies (1L): Definition of cookies, Create and Store a cookie with example.</p> <p>Java Applets (2L): Container Class, Components, Applet Life Cycle, Update method; Parameter passing applet, Applications.</p>	
4	<p>Client-Server programming In Java (2L): Java Socket, Java RMI.</p> <p>Threats (1L): Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks.</p> <p>Network security techniques (2L): Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH).</p> <p>Firewall (1L): Introduction, Packet filtering, Stateful, Application layer, Proxy.</p>	6
5	<p>Internet Telephony (1L): Introduction, VoIP.</p> <p>Multimedia Applications (2L): Multimedia over IP: RSVP, RTP, RTCP and RTSP. Streaming media, Codec and Plugins, IPTV.</p> <p>Search Engine and Web Crawler (2L): Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.</p>	5
Total		36L

Course Outcomes:

After completion of the course, students will be able to:

1	Recall the concepts of network and internet, technologies and protocols
2	Apply different technologies such as HTML, CSS, javascript, Perl, applet and other Web technologies to develop static/ dynamic web pages for a given web application
3	Apply javascript to implement cookie
4	Design dynamic and interactive web pages by embedding javascript code in HTML to validate the user input
5	Design security issues for devices like firewall

Learning Resources:

1	Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. (Chapters 1-5,7,8,9).
2	Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011. (Chapters 5,6,12)
3	Web Technologies, Uttam K. Roy, Oxford University Press



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Course Name:	Generative AI		
Course Code:	PE-CS801D	Category:	Professional Elective
Semester:	8th	Credit:	3
L-T-P:	3-0-0	Pre-Requisites:	Artificial Intelligence (PE-CS701D) Programming Language - Python
Full Marks:	70		
Examination Scheme:	Semester Examination: -70	Continuous Assessment: - 25	Attendance: -5

Course Objectives:	
1	Understand the principles and architectures of Generative AI models and their applications
2	Develop skills in understanding the application of Generative AI models for real-world problems
3	Implement Generative AI solutions using modern frameworks and deploy them responsibly.
4	Critically analyze the ethical, societal, and technical challenges of deploying GenAI systems

Course Contents:		
Module No.	Description of Topic	Contact Hrs.
1	Introduction to Generative AI: Overview of GenAI, comparison with discriminative models, history of generative models (Markov chains to transformers), applications in text, image, audio, and video, current trends (e.g., LLMs, text-to-video)	4
2	Neural Networks & Transformer Fundamentals: Neural network basics, Attention mechanisms, Transformer architecture, applications in generative tasks. Transformer-Based Generative Models Transformer architecture, large language models (e.g., GPT-4o, LLaMA 3.1), text-to-image models (e.g., DALL-E 3, CLIP-ViT), Prompt engineering, finetuning, Multimodal GenAI. Core Generative Models: GANs, VAEs, and Diffusion Models	6
3	Building LLM Applications with RAG and Prompt Engineering: Prompting Fundamentals & Best Practices, Retrieval-Augmented Generation (RAG), embeddings, Vector Search, Vector Databases, Rag Systems in Production Practice– Google Codelabs: RAG with Cloud SQL - Building an LLM and RAG-based chat application using Cloud SQL databases and LangChain https://codelabs.developers.google.com/codelabs/cloud-db-retrieval-app	6
4	Generative AI Agents: Agent fundamentals, Introduction to Agentic Frameworks (Smolagents, LangGraph, LlamaIndex), building autonomous AI agents, use cases in automation and decision-making. MCP Fundamentals, Architecture and Core Concepts, use case Practice– Google Codelabs: Building AI Agents with Vertex AI Agent Builder https://codelabs.developers.google.com/devsite/codelabs/building-ai-agents-vertexai - Microsoft Learn: Create and Publish Agents with Copilot Studio https://learn.microsoft.com/en-us/training/paths/work-power-virtual-agents	8

5	<p>MLOps for Generative AI: Tuning & Training of LLM systems, Deployment of GenAI systems, Model versioning, deployment pipelines, monitoring, scaling generative AI systems, continuous integration for AI models.</p> <p>Practice: Fine-Tuning Large Language Models: How Vertex AI Takes LLMs to the Next Level</p>	3
6	<p>Assistive Coding with GenAI: Assistive coding with GenAI tools (e.g., GitHub Copilot, CodeLlama) for code generation, autocompletion, debugging and code review.</p> <p>Concepts of Vibe Coding</p> <p>Evaluate LLM Applications: RAGAs & DeepEval Framework</p> <p>Practice:- https://learn.microsoft.com/en-us/training/modules/introduction-vibe-coding/ Vibe-code a kids game with Gemini and publish with Firebase!</p>	3
7	<p>Ethics, Evaluation and Deployment: Bias and fairness, deepfakes, misinformation, intellectual property, energy consumption, evaluation metrics (FID, IS, perplexity), responsible AI frameworks.</p>	3
8	<p>Case Studies of Gen AI Covering:</p> <ul style="list-style-type: none"> • Prompting • Document understanding • Image understanding • Video understanding • Audio understanding • Function Calling • Agents • Context caching 	5
Total		38

Course Outcomes:

After completion of the course, students will be able to:

1	Explain the principles and architectures of Generative AI models
2	Understand the evolution of Large Language Models (LLMs), from transformers to techniques like fine-tuning, inference acceleration, and reasoning models. Get trained with the art of prompt engineering for optimal LLM interaction.
3	Design and deploy GenAI solutions for applications. Learn to build sophisticated AI agents by understanding their core components and the iterative development process.
4	Adapt MLOps practices for Generative AI and leverage tools for foundation models and generative AI applications.
5	Assess the ethical and societal implications of GenAI, including bias, fairness, and intellectual property concerns

Learning Resources:

1.	Goodfellow, I., Bengio, Y., & Courville, A., Deep Learning, MIT Press, 2016.
2.	Foster, D., Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play, O'Reilly Media, 2023
3.	Russell, S., & Norvig, P., Artificial Intelligence: A Modern Approach, Pearson, 2020.
4.	Vaswani, A., et al., Attention is All You Need, arXiv, 2017 (Transformers Paper)
5.	Sutton, R. S., & Barto, A. G., Reinforcement Learning: An Introduction, MIT Press, 2018.
6.	Zhang, A., et al., Dive into Deep Learning, Cambridge University Press, 2023 (Open Access).
7.	Ho, J., et al., <i>Denosing Diffusion Probabilistic Models</i> , arXiv, 2020 (https://arxiv.org/abs/2006.11239).
8.	Radford, A., et al., <i>Learning Transferable Visual Models From Natural Language Supervision</i> , arXiv, 2021 (https://arxiv.org/abs/2103.00020).



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9.	Fairness and Machine Learning: Limitations and Opportunities by Solon Barocas, Moritz Hardt, and Arvind Narayanan.
10.	Natural Language Processing with Transformers: Building Language Applications with Hugging Face by Lewis Tunstall, Leandro von Werra, and Thomas Wolf.
11.	Deep learning.AI Courses - https://www.deeplearning.ai/courses/
12.	Hugging Face GenAi Courses - https://huggingface.co/learn
13.	Google Cloud – GenAi Learnings
14.	<u>Readings & Resources: Module-1</u> Primary Reference – Textbook: Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville: Online Ref: Chap20: https://www.deeplearningbook.org -Google GenAI Learning - https://www.cloudskillsboost.google/paths/118 Supporting Reference – Textbook: Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig.- OpenAI Blog: GPT-4o: https://openai.com/research/gpt-4o
15.	<u>Readings & Resources: Module-2</u> Primary Reference: The Illustrated Transformer: https://jalammar.github.io/illustrated-transformer - Vaswani et al., Attention is All You Need: https://arxiv.org/abs/1706.03762 Text Book: Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play by David Foster. Supporting Reference: Deep Learning Specialization, Coursera (Can be taken in Audit Mode) https://www.coursera.org/specializations/deep-learning - Goodfellow et al., Generative Adversarial Nets: https://arxiv.org/abs/1406.2661 - LLM Course from HuggingFace: https://huggingface.co/learn/llm-course/chapter1/1
16.	<u>Readings & Resources: Module-3</u> Primary Reference - ChatGPT Prompt Engineering for Developers - DeepLearning.ai https://www.deeplearning.ai/short-courses/chatgpt-prompt-engineering-for-developers/ - Retrieval Augmented Generation (RAG) Course – DeepLearning.ai https://www.deeplearning.ai/courses/retrieval-augmented-generation-rag/ Text book: Natural Language Processing with Transformers: Building Language Applications with Hugging Face by Lewis Tunstall, Leandro von Werra, and Thomas Wolf. Supplementary Reference - LangChain RAG Tutorial - https://academy.langchain.com/courses/intro-to-langsmith
17.	<u>Readings & Resources: Module-4</u> Primary Reference - Agents Course from Hugging Face: https://huggingface.co/learn/agents-course/unit0/introduction - MCP Course from Hugging Face: https://huggingface.co/learn/mcp-course/unit0/introduction Supplementary Reference - LangChain Academy: Introduction to LangGraph (https://academy.langchain.com)
18.	<u>Readings & Resources: Module-5</u> Primary Reference - Agents Course from Hugging Face: https://huggingface.co/learn/agents-course/unit0/introduction - MCP Course from Hugging Face: https://huggingface.co/learn/mcp-course/unit0/introduction Supplementary Reference - LangChain Academy: Introduction to LangGraph (https://academy.langchain.com)
19.	<u>Readings & Resources: Module-6</u> - GitHub Copilot Documentation : https://docs.github.com/en/copilot - Gemini Code Assist Documentation: https://developers.google.com/gemini-code-assist/docs/overview A List of metrics for evaluating LLM-generated content https://learn.microsoft.com/en-us/ai/playbook/technology-guidance/generative-ai/working-with-llms/evaluation/list-of-eval-metrics Ragas Framework: https://docs.ragas.io/en/stable/ Deep Eval Framework: https://www.confident-ai.com/
20.	<u>Readings & Resources: Module-7</u> Primary Reference: Textbook: Fairness and Machine Learning: Limitations and Opportunities by Solon Barocas, Moritz Hardt, and Arvind Narayanan. - xAI Responsible AI Guide : https://x.ai/responsible-ai Supplementary Reference : Bender et al., On the Dangers of Stochastic Parrots https://dl.acm.org/doi/10.1145/3442188.3445922



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Open Elective -III

Subject Code	Subject Name	Offered by
OE-HU801B	Business Intelligence	MSH Department
OE-HU801G	Introduction to Philosophical Thoughts	MSH Department
OE-IT801B	E-Commerce	IT Department
OE-IT801C	Internet of Things	IT Department

Course Name:	Business Intelligence		
Course Code:	OE-HU801B	Category:	Open Elective Courses
Semester:	Eighth Semester	Credit:	3
L-T-P:	3-0-0	Pre-Requisites:	Basic Knowledge of Data Mining
Full Marks:	100		
Examination Scheme:	Semester Examination:70	Continuous Assessment:25	Attendance:05

Course Objectives:	
1	To facilitate students with the basic concept of BI as a methodology and technique for gathering, storing, analyzing, sharing and providing access to data, to help University, Enterprise or any other organization to make a better decision.
2	To develop the ability to apply the knowledge of Analytics for solution of Business problems by: developing techniques through which raw data can be converted into Information dashboard design, data visualization and performance analysis
3	To assist students to identify the Future of BI.

Course Contents:		
Module No.	Description of Topic	Cont act Hrs.
01	Introduction to Business Intelligence: BI concept, BI architecture, BI in today's perspective, BI Process, Applications of BI like Financial analysis, statistical analysis, sales analysis, CRM, result pattern and ranking analysis, Balanced Scorecard, BI in Decision Modeling: Optimization, Decision making under uncertainty. Ethics and business intelligence.	6
02	Data Science: The concept, process and typical tools in data science. Example of different algorithms i.e. segmentation, classification, validation, regressions, recommendations. Exercises using Python to work on histograms, regression, clustering and text analysis. Co-relation between Algorithm and Code in data science	6
03	Data Visualization and Dashboard Design: Responsibilities of BI analysts by focusing on creating data visualizations and dashboards. Importance of data visualization, types of basic and composite charts.	6



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04	Performance Dashboard: Measuring, Monitoring and management of Business, KPIs and dash board, the types of dashboards, the common characteristics of Enterprise dash board, design of enterprise dashboards, and the common pitfalls of dashboard design.	6
05	Modelling and Analysis: Exploring Excel Modeling capabilities to solve business problems, summarize and present selected data, introduction to business metrics and KPIs, creating cubes using Microsoft Excel	6
06	Future of Business Intelligence: Emerging Technologies, Machine Learning, Predicting the Future with the help of Data Analysis, BI Search & Text Analytics– Advanced Visualization–Rich Report, Future beyond Technology.	6
Total		36L

Course Outcomes:

After completion of the course, students will be able to:

01	Understand BI concepts and techniques involving predictive and statistical approach.
02	Learn the concept, process, and practice of the Data Science and methodologies applied for data visualization.
03	Illustrate Dashboard design along with KPIs
04	Implement BI techniques by using various tools

Learning Resources:

01	Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9th Edition, Pearson 201
02	R. N. Prasad and Seema Acharya, "Fundamentals of Business Analytics", Wiley
03	"Business Intelligence– Grundlagen und praktische Anwendungen: Eine Einführung in die IT" by Hans-Georg Kemper and Henning Baars
04	David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager's Guide", Second Edition, 2012.
05	Carlo Verzellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications, 2009.



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Course Name:	Introduction to Philosophical Thoughts		
Course Code:	OE- HU 801G	Category:	Open Elective Courses
Semester:	Seventh	Credit:	3
L-T-P:	3-0-0	Pre-Requisites:	Human Values
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1.	To understand the Philosophical values and learn the various school of Philosophical thoughts.
2.	To apply concise explanations and arguments about basic philosophical problems

Course Contents:		
Module No.	Description of Topic	Contact Hrs.
1.	Nature of Indian Philosophy: Plurality as well as common concerns. Basic concepts of the Vedic and Upanisadic: Atman, Jagrata, Svapna, Susupti, Turiya, Brahman, Karma, Rta, Rna	16
2.	Carvaka school: its epistemology, metaphysics and ethics. Mukti Jainism: Concepts of sat, dravya, guna, paryaya, jiva, ajiva, anekantavada, syadvada, and nayavada ; pramanas, ahimsa, bondage and liberation.	10
3.	Buddhism: theory of pramanas, theory of dependent origination, the four noble truths; doctrine of momentaryness; theory of no soul. The interpretation of these theories in schools of Buddhism: Vaibhasika, Sautrantrika, Yogacara, Madhyamika.	5
4.	Nyaya: theory of Pramanas; the individual self and its liberation ; the idea of God and proofs for His existence.	5
Total		36 L

Course Outcomes:	
After completion of the course, students will be able to:	
1.	Describe and distinguish key philosophical concepts in the main subfields of philosophy, including concepts such as free will, mind, knowledge, belief, reality, faith, reason, good, etc.
2.	Discuss core philosophical problems, such as whether there is a god, what does it mean to be conscious, are we free to make choices, what is justice, etc.
3.	Explain and defend a position on basic philosophical problems.
4.	Read and comprehend philosophical texts, both classical and contemporary and concise explanations and arguments about basic philosophical problems



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Learning Resources:

1.	M. Hiriyanna : Outlines of Indian Philosophy.
2.	C.D.Sharma : A Critical Survey of Indian Philosophy.
3.	S.N.Das Gupta : A History of Indian Philosophy Vol – I to V.
4.	S.Radhakrishnan : Indian Philosophy Vol – I & II.
5.	T.R.V.Murti : Central Philosophy of Buddhism.



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Course Name:	E-Commerce		
Course Code:	OE-IT801B	Category:	Open Elective Courses
Semester:	8th	Credit:	3
L-T-P:	3-0-0	Pre-Requisites:	DBMS, Computer Networks
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 5

Course Objectives:	
1	To facilitate the students about the concept of E-commerce.
2	To develop the ability to distinguish different business models.
3	To impart the knowledge of electronic payment system.
4	To provide knowledge of different legal and security issues related with E-Commerce.

Course Contents:		
Module No.	Description of Topic	Contact Hrs.
1	Introduction to E-Commerce : Definition, Scope of E-Commerce, E-Commerce and Trade Cycle, Electronic Markets, Mobile Commerce, Electronic Data Interchange (EDI): Technology, Standards (UN/EDIFACT), Communications, EDI and Business, Relationship Between E – Commerce & Networking, Different Types of Networking: Internet, Intranet & Extranet, Wireless Application Protocol: Definition, Hand Held Devices, Infrastructure Requirement for E – Commerce, Rules & Regulations for Controlling E – Commerce	8
2	Business Model of E-Commerce: Model Based on Transaction Type, Model Based on Transaction Party Business-to-Consumer (B2C) – Business-to-Business (B2B) – Consumer-to-Consumer (C2C) – Consumer-to-Business (C2B). Brokerage Model – Value Chain Model – Advertising Model.	4
3	Supply Chain Management: E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, Internet's effect on Supply Chain Power.	4
4	Legal Issues Legal issues: Risks, Paper Document vs. Electronic document, Authentication of Electronic document, Laws, Legal issues for Internet Commerce: Trademarks and Domain names, Copyright, Jurisdiction issues, Service provider liability, Enforceable online contract.	4
5	Security Issues: Security Issues and solutions: Risk of E – Commerce: Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Symmetric and Asymmetric Cryptosystems, Digital certificates, RSA, DES, and Digital Signature, Protocols for secure messaging, Internet Security, Cyber Laws.	8



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6	Electronic Payment System: Types of electronic payment systems; Digital token based electronic payment system: E-cash, properties of e-cash, electronic cash in action, business issues and electronic cash, operational risk and electronic cash, electronic cheques; smart cards and electronic payment system; credit card based electronic payment system; Risk and electronic payment system; designing electronic payment system.	4
7	E-business and E-Marketing: Internet bookshops, Electronic Newspapers, Virtual Auctions, Online Share Dealing, Gambling on the net, Home –shopping, E-Marketing, Tele-marketing, E-Diversity, Case studies through internet.	4
Total		36L

Course Outcomes:

After completion of the course, students will be able to:

1	Explain the concept of E-Commerce and Business models.
2	Describe how procurement and supply chains relate to B2B E-commerce.
3	Discuss legal issues surrounding e-commerce.
4	Identify the key security threats and its solution in the E-commerce environment.

Learning Resources:

E-Commerce-Strategy, Technologies & Applications by David Whitley, TMH

E-Commerce- The cutting edge of business by Kamlesh K. Bajaj, TMH

E-Commerce through ASP by W Clarke- BPB

Bhaskar Bharat : Electronic Commerce - Technologies & Applications.TMH

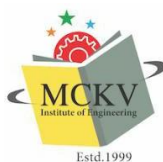
Krishnamurthy, E-Commerce Mgmt, Vikas

Beginning E-Commerce, Reynolds, SPD

E – Commerce : Strategy Technologies & Applications, Tata McGraw Hill.

Global E-Commerce, J. Christopher & T.H.K. Clerk, University Press

Murthy : E – Commerce , Himalaya Publishing.



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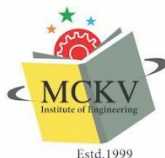
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Course Name:	Internet of Things		
Course Code:	OE-IT801C	Category:	Open Elective Courses
Semester:	8th	Credit:	3
L-T-P:	3-0-0	Pre-Requisites:	Fundamentals of computer network, Network Security
Full Marks:	100		
Examination Scheme:	Semester Examination:70	Continuous Assessment:25	Attendance:05

Course Objectives:	
1	In this course, students will explore various components of Internet of things such as Sensors, internetworking, and cyber space.
2	In the end they will also be able to design and implement IoT circuits and solutions.

Course Contents:		
Module No.	Description of Topic	Contact Hrs.
1	Introduction to IoT: Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs. Environmental Parameters Measurement and Monitoring: Why measurement and monitoring are important, effects of adverse parameters for the living being for IOT	8
2	Sensors: Working Principles: Different types; Selection of Sensors for Practical Applications Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc	4
3	M2M to IoT: Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT,	4
4	IoT Reference Architecture- Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment. Constraints affecting design in IoT world-Introduction, Technical design Constraints.	6
5	Domain specific applications of IoT: Home automation, Industry applications, Surveillance applications, Other IoT application.	4
6	Developing IoT solutions: Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi Implementation of IoT with Arduino and Raspberry, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT. Recent trends in smart sensor for day to day life, evolving sensors and their architecture.	8
Total		34L



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Course Outcomes:

After completion of the course, students will be able to:

1	Explain general concepts of Internet of Things (IoT).
2	Recognize various devices, sensors and applications.
3	Explain M2M and IoT architectures.
4	Explain the application of IoT solutions.
5	Apply IoT solutions in various domain using sensors, actuators and Devices.

Learning Resources:

1	Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1 st Edition, Academic Press, 2014.
2	Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on Approach)", 1st Edition, VPT, 2014
3	Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013
4	Cuno Pfister, Getting Started with the Internet of Things, O'Reilly Media, 2011, ISBN: 978-1-4493-9357-1



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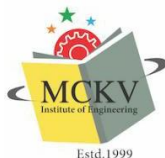
Open Elective -IV

Subject Code	Subject Name	Offered by
OE-EC801A	Information and Coding Theory	ECE Department
OE-HU801A	Business Analytics and Entrepreneurship	MSH Department
OE-HU801E	Financial Management	MSH Department
OE-IT801D	Social Media and Web Analytics	IT Department

Course Name:	Information and Coding theory		
Course Code:	OE-EC 801A	Category:	Open Elective
Semester:	8th	Credit:	3
L-T-P:	3-0-0	Pre-Requisites:	Communication Engineering
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	Students will be capable to explain Information, Entropy of various types of channel
2	Students can discuss various Source coding mechanism in order to enhance average bit rate
3	Students will acquire knowledge about numerous channel coding techniques to accomplish error free transmission

Course Contents:		
Module No.	Description of Topic	Contact Hrs.
1	Information and Entropy: Basic concept of Information, Uncertainty, average information, Mutual information, Entropy, Concept of Discrete memory less Source and Discrete memory less channel, Loss less channel, Deterministic channel, Binary symmetrical channel, Maximum Entropy, Channel matrix, Information measure	7
2	Discrete Channel Capacity: Shanon – Hertley channel capacity theorem, Information rate, Error probability, Gaussian channel noise, Bandwidth SNR trade off, Information Capacity Theorem, Shanon Limit	4
3	Source Coding: Basic source coding mechanism, Shanon Fano coding, Hauffman Coding hypothesis, Source Coding theorem,	4
4	Channel Coding: Hamming code and hamming distance, Linear block code, Generator matrix, Parity check matrix, Syndrom calculation, error matrix, cyclic properties of coding, Division algorithm for polynomial, Systematic cyclic coding, Generator and parity check polynomial, Cyclic redundancy check	6



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5	Galois algorithm and BCH Codes: Galois field and minimal polynomial, GF(8) and GF(16) field elements primitive polynomial, Irreducible polynomial, BCH generator polynomial construction for single dual and triple error detection and correction, BCH decoding, Reed solomon codes. RS encoders and Decoders	8
6	Convolution Code Viterbi algorithm: Introduction of convolution codes, Sequential coding and Decoding using shift Registers, Code Tree, Code Trellis, State diagram for encoder, Rate $\frac{1}{2}$ Convolution Encoder, Generating Function and Modified state diagram, Viterbi Decoding algorithm of convolution code, Turbo codes	7
Total		36

Course Outcomes:	
After completion of the course, students will be able to:	
1	Define Information, Uncertainty, Entropy and channel capacity of AWGN channel
2	Student will able to introduce various source coding scheme
3	Students can evaluate error control coding techniques to detect and correct the channel error

Learning Resources:	
1	Ranjan Bose, Information Theory coding and cryptography, 2/e, TMH
2	Salvatore Gravano, Error control Codes, Oxford University press
3	Shu Lin & Danial J castalo, Error control Coding, 2/e, Pearson



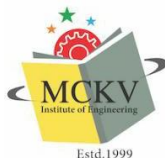
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Course Name:	Business Analytics and Entrepreneurship		
Course Code:	OE-HU 801A	Category:	Open Elective Courses
Semester:	8 th	Credit:	3
L-T-P:	3-0-0	Pre-Requisites:	Machine Learning
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 5

Course Objectives:	
1	To gain an understanding of how to use business analytics to formulate and solve business problems and to support managerial decision making.
2	To learn how to use and apply Excel and analytical Modeling to solve business problems.
3	To inculcate the entrepreneurial skills to potential entrepreneurs.
4	To make the potential entrepreneurs. understand the legal procedures and norms involved establishing a new venture.

Course Contents:		
Module No.	Description of Topic	Contact Hrs.
1	Foundations of Business Analytics and Gap Analysis: Introduction to Business Analytics, Analytics on Spreadsheets, Gap Analysis, Carrying Out Gap Analysis, Steps in Gap Analysis, Conducting a representative Survey for Gap Analysis, Case study on Predicting Consumer Behavior and Gap Analysis in Smartphone Market.	8
2	Analytical Modeling: Factor Analysis Concepts, Application of Factor Analysis, Concepts of Cluster Analysis, Similarity Measures, Application of Cluster Analysis, Linear Discriminant Analysis Model, Predictive Modelling and its Application, Theoretical Formulation and Mathematical Interpretation of Logistics Regression, Indicator for Model Fit, Applying Logistics Regression, Application of Logistics Regression in Predicting Risk in Portfolio Management	10
3	Segmentation of target market: Introduction to RFM Analysis, Enhancing Response Rates with RFM Analysis, Introduction to Chi-square Automatic Interaction Detection (CHAID), Predictive Modelling by CHAID.	6
4	Entrepreneurship: Entrepreneurship: Introduction and importance, Factors influencing entrepreneurship, psychological factors, Social factors, Economic factors, Environmental factors, Characteristics and Skills of an entrepreneur Types of entrepreneurs: according to type of business, Technology, Motivation, Growth, Stages, New generations of entrepreneurship viz. social entrepreneurship, Ideapreneurship, Health entrepreneurship, Tourism entrepreneurship, Women entrepreneurship etc. & Barriers to entrepreneurship	6
5	Entrepreneurial Motivation & Creativity, Rules, and Legislation Motivation: Maslow's theory, Herzberg's theory, McClelland's Need – achievement theory, Values / Ethics, Risk taking behavior	6



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	<p>Creativity: Creativity and entrepreneurship, Steps in Creativity, Innovation and inventions, using left brain skills to harvest right brain ideas.</p> <p>Legal Protection of innovation, Industries Development (Regulations) Act, 1951, Factories Act, 1948, The Industrial Employment (Standing Orders) Act, 1946, Environment (Protection) Act, 1986, Industrial Dispute Act 1947 etc.</p>	
Total		36L

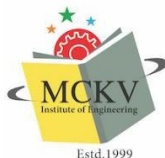
Course Outcomes:

After completion of the course, students will be able to:

1	Explain the concept and methods of business analytics.
2	Apply appropriate analytical methods to find solutions to business problems.
3	Explain the importance of different factors and skills for entrepreneurship.
4	Describe the rules and regulations to establish a new venture.

Learning Resources:

1	"Business Analytics: An Application Focus", Purba Halady Rao, Prentice Hall.
2	"Business Analytics" James R. Evans, Pearson.
3	"Modeling Techniques in Predictive Analytics", Thomas W. Miller, Pearson
4	"Enterprise Analytics: Optimize Performance, Process, and Decisions Through Big Data", Thomas H. Davenport, Pearson.
5	"Fundamentals of Business Analytics", Seema Acharya, Wiley India.
6	"Business Intelligence: A Managerial Perspective on Analytics", Ramesh Sharda, Dursun Delen, Efraim Turban, David King, Prentice Hall



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Course Name:	Financial Management		
Course Code:	OE-HU 801E	Category:	Management Science and Humanities Courses
Semester:	Eighth	Credit:	3
L-T-P:	3-0-0	Pre-Requisites:	To have basic knowledge about mathematics.
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1.	To understand the concepts of Financial Management and its application for managerial decision making.
2.	To provide an in depth study of the Generally Accepted Cost Accounting Principles and Techniques for identification, analysis and classification of cost components to facilitate managerial decision making.

Course Contents:		
Module No.	Description of Topic	Contact Hrs.
1.	Overview of Financial Management <ul style="list-style-type: none"> Financial Management – meaning, objectives, scope, related finance disciplines, planning environment, key-decision areas Sources of Finance (Shares, Debentures, Debt, Public Deposits, Lease Financing, etc.); criteria for selecting sources of finance including finance for International Investments and Venture Capital Funds Financial Decision Making – Emerging role of finance managers 	4
2.	Working Capital Management and Leverage Analysis <ul style="list-style-type: none"> Working Capital policies related to Inventory, Receivables, Payables, Cash and Marketable securities Financing of working capital Concepts and nature of Leverages, Analysis of Operating and Financial Leverages, Operating Risk and Financial Risk and Combined Leverages Operating leverages and Cost-Volume-Profit (CVP) analysis, Earning Before Interest and Tax (EBIT), Earning Per Share (EPS), Indifference point 	8
3.	Cost of Capital Meaning, components, methods of determination of cost of capital related to debt, preference shares, equity shares, retained earnings, depreciation fund Capital Asset Pricing Models (CAPM) Weighted Average Cost of Capital and Marginal Cost of Capital	7



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4.	<p>Capital Budgeting</p> <ul style="list-style-type: none"> • Purpose, objective, process • Understanding different types of projects • Techniques of decision making: non-discounted and discounted cash flow approaches – payback period method, accounting rate of return, net present value, internal rate of return, and profitability index. • Ranking of competing projects, ranking of projects with unequal lives. • Modelling and forecasting cash flows and financial statements based on expected values for variables-economic and business 	8
5.	<p>Business Process Analysis</p> <ul style="list-style-type: none"> • Cost Centre and Cost Allocation • Scrap, wastage, pilferage, obsolescence, normal loss, abnormal loss • Direct expenses and problems connected therewith • Overhead - Classification of overheads; Overhead Cost Accounting, Accounting and control of overheads, computation of pre-determined overhead recovery rates, treatment of over and under absorption of overhead costs. Reports of control of overhead costs, Miscellaneous items of expenses – capacity costs, treatment of depreciation in costs • Unit Costing, Job Costing, Batch Costing and Cost Audit. 	9
Total		36L

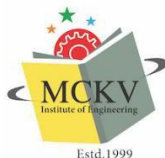
Course Outcomes:

After completion of the course, students will be able to:

1.	Identify and apply the concepts of Financial Management
2.	Explain the basic concepts and processes in determination of products and services cost
3.	Understand and explain the conceptual framework of Cost & Management Accounting
4.	Analyse and understand major interest valuation models.

Learning Resources:

1.	<i>Management Accounting- Khan & Jain</i>
2.	<i>Cost Accounting and Financial Management- M.N. Arora, Vikash Publication</i>
3.	<i>Cost Accounting – Charles T Homgren, Foster and Datar, Pearson Education Asia</i>



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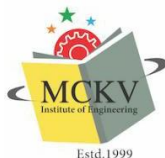
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Course Name:	Social Media and Web Analytics		
Course Code:	OE-IT 801D	Category:	Open Elective-IV
Semester:	8th	Credit:	3
L-T-P:	3-0-0	Pre-Requisites:	Graph Theory, Python Programming
Full Marks:	100		
Examination Scheme:	Semester Examination:70	Continuous Assessment:25	Attendance :5

Course Objectives:	
1.	Understand the role of social media data and analytics in helping organizations achieve their goals and understand their policies.
2.	Familiarize the learners with the concept of social media analytics and understand its significance as well monitor consumers and competitors and glean deeper consumer insights based on advanced social media data modeling.
3.	Enable the learners to develop skills required for analyzing the effectiveness of social media for business purposes.

Course Contents:		
Module No.	Description of Topic	Contact Hrs.
1.	Introduction: - Web and social media (Web sites, web apps, mobile apps and social media)-Usability, user experience, customer experience, customer sentiments, web marketing, conversion rates, ROI, brand reputation, competitive advantages- Web analytics and a Web analytics 2.0 framework (clickstream, multiple outcomes analysis, experimentation and testing, voice of customer, competitive intelligence, Insights)	10
2.	Data (Structured data, unstructured data, metadata, Big Data and Linked Data), Lab testing and experiment design (selecting participants, within-subjects or between subjects' study, counterbalancing, independent and dependent variable; A/B testing, multivariate testing, controlled experiments). Data analysis basics (types of data, metrics and data, descriptive statistics, comparing means, correlations, nonparametric tests, presenting data graphically)	8
3.	Measuring user experience: - Usability metrics (performance metrics, issues-based metrics, self-reported metrics), Planning and performing a usability study (study goals, user goals, metrics and evaluation methods, participants, data collection, data analysis), Typical types of usability studies and their corresponding metrics (comparing alternative designs, comparing with competition, completing a task or transaction, evaluating the impact of subtle changes)	8
4.	Social media analytics (what and why), social media KPIs (reach and engagement), Performing social media analytics (business goal, KPIs, data gathering, analysis, measure and feedback)	6



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5	Web Metrics and Web Analytics: - PULSE metrics (Page views, Uptime, Latency, Seven-day active users) on business and technical issues; HEART metrics (Happiness, Engagement, Adoption, Retention, and Task success) on user behavior issues; On-site web analytics, off-site web analytics, the goal-signal-metric process.	4
Total		36L

Course Outcomes:

After completion of the course, students will be able to:

1. Explain web2.0 Framework along with different multidimensional, multivariate data structures using data Analytics techniques.
2. Investigate different methods of user experience measurement.
3. Implement web metrics and web analytics using several methodologies.

Learning Resources:

1. Avinash Kaushik, Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity, John Wiley & Sons; Pap/Cdr edition (27 Oct 2009).
2. Tom Tullis, Bill Albert, Measuring the User Experience: Collecting, Analyzing, and Presenting Usability Metrics, Morgan Kaufmann; 1 edition (28 April 2008).
3. Jim Sterne, Social Media Metrics: How to Measure and Optimize Your Marketing Investment, John Wiley & Sons (16 April 2010).
4. Brian Clifton, Advanced Web Metrics with Google Analytics, John Wiley & Sons; 3rd Edition edition (30 Mar 2012).