

Maulana Abdul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Computer Science and Engineering (Internet of Things)

(Applicable from the academic session 2022-2023)

Semester VII (Fourth year)								
Sl.No.		Type of Course	Code	Course Title	Hours per week			Credits
					L	T	P	
1	T H E O R Y	Professional Elective Course	PECICB701 (A/B/C)	Blockchain and Cryptocurrency/ Social Network Analysis/Ecommerce and ERP	3	0	0	3
2		Professional Elective Course	PECICB702 (A/B/C)	Machine Learning/Information Theory and Coding/Cyber security in Block chain Technology	3	0	0	3
3		Open Elective Course	OECICB701 (A/B/C)	Soft skill and Interpersonal Communication/ Bio Informatics/ Business Analytics	3	0	0	3
4		Humanities and Social Sciences including Management	HSMC701	Project Management and Entrepreneurship	2	0	0	2
5		Project	PROJICB781	Project II	0	0	12	6
TOTAL CREDITS								17

SEMESTER – VII

Subject: Blockchain and Crypto currency			
Course Code: PECICB701A		Semester: VII	
Duration: 36 Hrs.		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3		End Semester Exam: 70	
Tutorial: 0		Attendance: 5	
Practical: 0		Continuous Assessment: 25	
Credit: 3		Professional Elective Course	
Aim:			
CO			
1.	Explain cryptographic building blocks and reason about their security		
2.	Define Bitcoin's consensus mechanism		
3.	Learn how the individual components of the Bitcoin protocol make the whole system works: transactions, script, blocks, and the peer-to-peer network		
4.	Define how mining can be re-designed in alternative cryptocurrencies		
5.	Understand the basics of cryptocurrencies and use Ethereum programming.		
Objective:			
Sl. No.			
1.	To learn Blockchain systems: Nuts and Bolts		
2.	Able to analyse Decentralized systems		
3.	To understand Tokenization and ICOs		
4.	To describe Cryptography of Blockchain		
Pre-Requisite:			
Sl. No.			
1.	Database System		
2.	Cryptography		
3.	Basic Financial Knowledge		
Contents			4 Hrs./week
Chapter	Name of the Topic	Hours	Marks
01	INTRODUCTION Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Why Nakamoto Came up with Blockchain based cryptocurrency? Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc.	6	10
02	Basic Distributed Computing Atomic Broadcast, Consensus, Byzantine Models of fault tolerance	6	10
03	Basic Crypto primitives Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems	6	15

04	Blockchain 1.0 Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use	6	10
05	Blockchain 2.0 Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts	3	5
06	Blockchain 3.0 Hyperledger fabric, the plug and play platform and mechanisms in permissioned blockchain	3	10
07	Privacy, Security issues in Blockchain Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - -advent of algorand, and Sharding based consensus algorithms to prevent these	6	10
	Sub Total:	36	70
	Internal Assessment Examination & Preparation of Semester Examination	4	30
	Total:	40	100
List of Books			
Text Books:			
Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Don Tapscott, Alex Tapscott	Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies Is Changing the World Paperback		
Reference Books:			
William Mougayar	The Business Blockchain: Promise, Practice, and Application of the Next Internet Technology		Wiley

Mapping of Course Outcomes and Program Outcomes:

Course Outcome	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	3	2	2	2	2	2	1	2	2	2	2
2	2	3	-	2	-	2	2	1	-	2	-	2
3	3	2	3	2	2	1	1	1	-	2	2	2
4	2	2	2	1	-	1	-	1	-	3	1	-
5	2	2	2	-	1	-	-	1	2	3	1	2
Average	2	3	3	2	2	2	2	1	2	2	2	2

SOCIAL NETWORK ANALYSIS:

Course Code	PECICB701B					
Category	Professional Elective Course					
Course title	SOCIAL NETWORK ANALYSIS					
Scheme and Credits	L	T	P	Cr. Points	Lec. Hrs.	
	3	0	0	3	36	
Pre-requisites/ Co-requisites (if any)	- Data Mining and Graph Theory					

OBJECTIVES:

- To understand the concept of semantic web and related applications.
- To learn knowledge representation using ontology.
- To understand human behaviour in social web and related communities.
- To learn visualization of social networks.

OUTCOMES:

Upon completion of the course, the students should be able to:

CO1: Develop and Remember semantic web related applications.

CO2: Represent and explain knowledge using ontology.

CO3: Predict and Analyze human behaviour in social web and related communities.

CO4: Understand and Visualize social networks.

UNIT I INTRODUCTION [7L]

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

UNIT II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION [8L]

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.

UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS [7L]

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.

UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES [7L]

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social

networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS

[7L]

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

References:

1. Jennifer Golbeck., *Analysing the Social Web*, Morgan Kaufmann publications, 2013
2. Charu C. Aggarwal, *Social Network Data Analytics*, Springer publications, 2011
3. John Scott, *Social Network Analysis*, (3e), Sage publications limited, 2013
4. Jay Goldman, *Facebook Cookbook*, O'Reilly, 2009.
5. Peter Mika, —Social Networks and the Semantic Web, First Edition, Springer 2007.
6. Borko Furht, —Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.

Mapping of Course Outcomes and Program Outcomes:

Course Outcome	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	2	2	2	-	2	2	-	2	2	2
2	2	3	3	-	2	2	2	-	2	2	-	2
3	3	2	3	2	2	1	1	2	3	2	2	2
4	2	2	2	1	-	1	-	1	-	3	1	2
Average	2	3	3	2	2	2	2	2	2	2	2	2

Course Code	PECICB701C					
Category	Professional Elective Course					
Course title	E-Commerce & ERP					
Scheme and Credits	L	T	P	Cr. Points	Lec. Hrs.	
	3	0	0	3	36	
Pre-requisites/ Co-requisites (if any)	- Software Engineering					

1. **Overview:** Definitions, Advantages & Disadvantages of E – Commerce, Threats of E – Commerce, Managerial Prospective, Rules & Regulations for Controlling E – Commerce, CyberLaws. [3 L]
2. **Technologies :** Relationship Between E – Commerce & Networking, Different Types of Networking Commerce, Internet, Intranet & Extranet, EDI Systems Wireless Application Protocol : Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce. [5 L]
3. **Business Models of e – commerce:** Model Based On Transaction Type,

Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance.
[2 L]

4. **E – strategy:** Overview, Strategic Methods for developing E – commerce. [2 L]
5. **Four C's:** (Convergence, Collaborative Computing, Content Management & Call Center). Convergence : Technological Advances in Convergence – Types, Convergence and its implications, Convergence & Electronic Commerce. Collaborative Computing: Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security. Content Management: Definition of content, Authoring Tools & Content Management, Content – partnership, repositories, convergence, providers, Web Traffic & Traffic Management; Content Marketing. Call Center: Definition, Need, Tasks Handled, Mode of Operation, Equipment, Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE). [6 L]
6. **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. [3 L]
7. **E – Payment Mechanism:** Payment through card system, E – Cheque, E – Cash, E – Payment Threats & Protections. [1 L]
8. **E – Marketing:** Home –shopping, E-Marketing, Tele-marketing [1 L]
9. **Electronic Data Interchange (EDI):** Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA). [2 L]
10. **Risk of E – Commerce:** Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures. [4 L]
11. **Enterprise Resource Planning (ERP):** Features, capabilities and Overview of Commercial Software, re-engineering work processes for IT applications, Business Process Redesign, Knowledge engineering and data warehouse. Business Modules: Finance, Manufacturing (Production), Human Resources, Plant Maintenance, Materials Management, Quality Management, Sales & Distribution ERP-Package.
12. **ERP Market:** ERP Market Place, SAP AG, PeopleSoft, BAAN, JD Edwards, Oracle Corporation ERP-Present and Future: Enterprise Application Integration (EAI), ERP and E-Commerce, ERP and Internet, Future Directions in ERP [10].

References:

1. E-Commerce, M.M. Oka, EPH
2. Kalakotia, Whinston : Frontiers of Electronic Commerce , Pearson Education.
3. Bhaskar Bharat : Electronic Commerce - Technologies & Applications. TMH
4. Loshin Pete, Murphy P.A. : Electronic Commerce , Jaico Publishing Housing.
5. Murthy : E – Commerce , Himalaya Publishing.
6. E – Commerce : Strategy Technologies & Applications, Tata McGraw Hill.
7. Global E-Commerce, J. Christopher & T.H.K. Clerk, University Press
8. Beginning E-Commerce, Reynolds, SPD
9. Krishnamurthy, E-Commerce Mgmt, Vikas

CO1: To define and differentiate various types of Ecommerce.

CO2: To define and describe E-business and its Models.

CO3: To describe Hardware and Software Technologies for Ecommerce.

CO4: To understand the basic concepts of ERP and identify different technologies used in ERP.

CO5: To apply different tools used in ERP

Mapping of Course Outcomes and Program Outcomes:

Course Outcome	Program Outcomes

Name of the Course:		Information Theory and Coding	
Course Code: PECICB702B		Semester: VII	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:		3	
Unit	Content	Hrs/Unit	Marks/Unit
1	Source Coding [7L] Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes	7	
2	Channel Capacity And Coding [7L] Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit	7	
3	Linear And Block Codes For Error Correction [8L] Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes	8	
4.	Cyclic Codes [7L] Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes.	7	
5	BCH Codes [8L] Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes.	8	

6	Convolutional Codes [8L] Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding	8	
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Text book and Reference books:

1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Information and Coding - N Abramson; McGraw Hill.
3. Introduction to Information Theory - M Mansurpur; McGraw Hill.
4. Information Theory - R B Ash; Prentice Hall.
5. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall

CO1: Overview of Probability Theory, significance of “Information” with respect to Information Theory.

CO2: Derive equations for entropy, mutual information and channel capacity for all kinds of channels.

CO3: Implement the various types of source coding algorithms and analyse their performance.

CO4: Explain various methods of generating and detecting different types of error correcting codes

CO5: Understand the fundamentals of Field Theory and polynomial arithmetic

CO6: Design linear block codes and cyclic codes (encoding and decoding).

Mapping of Course Outcomes and Program Outcomes:

Course Outcome	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2									3	1
2	3	3	1								3	1
3	3	3		2	3						3	1
4	3	3		1							3	1
5	3	1									3	1
6	3	2			1						3	2
Average	3	2	1	1	1						3	1

Cyber Security in Block Chain Technology - PECICB702C

Course Code	PECICB702C					
Category	Professional Elective Course					
Course title	Cyber Security in Block Chain Technology					
Scheme and Credits	L	T	P	Cr. Points	Lec. Hrs.	
	3	0	0	3	36	
Pre-requisites/ Co-requisites (if any)						

Privacy, Security issues in Blockchain
Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation
attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - -advent of algorand
Sharding based consensus algorithms to prevent these attacks
Cryptography
Public Key Infrastructure (PKI) and Cryptography
Conventional PKI , Blockchain as a Form of Distributed PKI , Blockchain vs PKI
Blockchain - Public Key Cryptography, Decentralized Public Key Infrastructure (DPKI)
Digital Signature
Digital Signature from Blockchain context
Undeniable signature
Diffie–Hellman, Digital signature scheme for information non-repudiation in blockchain
Blockchain-based time stamping
Time stamping Metadata Using Blockchain
Decentralized Trusted Time stamping Based on Blockchain
Content Time stamping
Use Cases of Blockchain In Cyber security
Decentralized Storage Solutions, How Guard time uses blockchain technology to safeguard data
IoT Security, Safer DNS, Using blockchains to prevent DDoS attacks
Implementing Security in Private Messaging

Reference Books:

1. Blockchain Technology Basics: Blockchain cryptography and cybersecurity Kindle Edition by Raghava Shankar (Author), Srikanth RC Cherukupalli M.Tech (Author)
2. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks Kindle Edition by Imran Bashir (Author) Format: Kindle Edition.

CO1: Understanding Blockchain Security.

CO2: Implementing Secure Blockchain Architectures.

CO3: Understand and explain Cryptographic Techniques for Blockchain Security.

CO4: Apply time-stamping for Blockchain.

CO5: Apply different use-cases of Blockchain in cybersecurity.

Mapping of Course Outcomes and Program Outcomes:

[illegible]

Soft Skill & Interpersonal Communication**Code: OECICB701A****Contact: 3L**

Name of the Course:		Soft Skill & Interpersonal Communication
Course Code: OECICB701A		Semester: VII
Duration: 6 months		Maximum Marks: 100
Teaching Scheme		Examination Scheme
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: A New Approach To Learning, Planning And Goal-Setting, Human Perceptions: Understanding People, Types Of Soft Skills: Self-Management Skills, Aiming For Excellence: Developing Potential And Self- Actualization, Need Achievement And Spiritual Intelligence	5	
2	Conflict Resolution Skills: Seeking Win-Win Solution, Inter-Personal Conflicts: Two Examples, Inter-Personal Conflicts: Two Solutions, Types Of Conflicts: Becoming A Conflict Resolution Expert Types Of Stress: Self-Awareness About Stress, Regulating Stress: Making The Best Out Of Stress	5	
3	Habits: Guiding Principles, Habits: Identifying Good And Bad Habits, Habits: Habit Cycle, Breaking Bad Habits, Using The Zeigarnik Effect For Productivity And Personal Growth, Forming Habits Of Success.	5	
4.	Communication: Significance Of Listening, Communication: Active Listening, Communication: Barriers To Active Listening, Telephone Communication: Basic Telephone Skills , Telephone Communication: Advanced Telephone Skills, Telephone Communication: Essential Telephone Skills	5	
5.	Technology And Communication: Technological Personality, Technology And Communication: Mobile Personality?, Topic: Technology And Communication: E-Mail Principles, Technology And Communication: How Not To Send E-Mails!, Technology And Communication: Netiquette, Technology And Communication: E-Mail Etiquette	5	

6	Communication Skills: Effective Communication, Barriers To Communication: Arising Out Of Sender/Receiver's Personality, Barriers To Communication: Interpersonal Transactions, Barriers To Communication: Miscommunication, Non-Verbal Communication: Pre-Thinking Assessment-1, Non-Verbal Communication: Pre-Thinking Assessment-2	5	
7	Nonverbal Communication: Introduction And Importance, Non-Verbal Communication: Issues And Types, Non- Verbal Communication: Basics And Universals, Non- Verbal Communication: Interpreting Non- Verbal Cues, Body Language: For Interviews, Body Language: For Group Discussions, Presentation Skills: Overcoming Fear,	5	
8	Presentation Skills: Becoming A Professional, Presentation Skills: The Role Of Body Language, Presentation Skills: Using Visuals, :Reading Skills: Effective Reading, Human Relations: Developing Trust And Integrity	5	

TEXT BOOKS AND REFERENCES

2. Dorch, Patricia. *What Are Soft Skills?* New York: Execu Dress Publisher, 2013.
3. Kamin, Maxine. *Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders.* Washington, DC: Pfeiffer & Company, 2013.
4. Klaus, Peggy, Jane Rohman & Molly Hamaker. *The Hard Truth about Soft Skills.* London: HarperCollins E-books, 2007.
5. Petes S. J., Francis. *Soft Skills and Professional Communication.* New Delhi: Tata McGraw-Hill Education, 2011.
6. Stein, Steven J. & Howard E. Book. *The EQ Edge: Emotional Intelligence and Your Success.* Canada: Wiley & Sons, 2006.

- **CO 1 – Soft Skills** – At the end of the course, the students will have the ability to communicate convincingly and negotiate diplomatically while working in a team to arrive at a win-win situation. They would further develop their inter-personal and leadership skills.
- **CO 2 – Soft Skills** – At the end of the course, the students shall learn to examine the context of a Group Discussion topic and develop new perspectives and ideas through brainstorming and arrive at a consensus.
- **CO 3 – Aptitude** – At the end of the course, students will be able to identify, recall and arrive at appropriate strategies to solve questions on geometry. They will be able to investigate, interpret and select suitable methods to solve questions on arithmetic, probability and combinatorics.
- **CO 4 – Verbal** – At the end of the course, the students will have the ability to relate, choose, conclude and determine the usage of right vocabulary.
- **CO 5 – Verbal** – At the end of the course, the students will have the ability to utilize prior knowledge of grammar to recognize structural instabilities and modify them.

Mapping of Course Outcomes and Program Outcomes:

Course Outcome	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1								2	3	3		3
2									2	3		3
3		3		2								
4										3		3
5										3		3
Average	2	3	3	2	2	2	2	2	2	2	2	2

Subject: Bioinformatics	
Course Code: OECICB701B	Semester: VII
Duration: 36 Hrs.	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3hrs./week	End Semester Exam: 70
Tutorial:	Attendance : 5
Practical: 0	Continuous Assessment: 25
Credit:3	
Aim:	
Sl. No.	
1.	To give students an introduction to the basic practical techniques of bioinformatics. Emphasis will be given to the application of bioinformatics and biological databases to problem solving in real research problems.
2.	The students will become familiar with the use of a wide variety of internet applications, biological database and will be able to apply these methods to research problems.
Course Outcome:	
Sl. No.	After completion of the course, students will be able to:
CO1.	Knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics.
CO2.	Describe the contents and properties of the most important bioinformatics databases, perform text- and sequence-based searches, and analyze and discuss the results in light of molecular biological knowledge
CO3.	Explain the major steps in pairwise and multiple sequence alignment, explain the principle for, and execute pairwise sequence alignment by dynamic programming
CO4.	Predict the secondary and tertiary structures of protein sequences.
CO5.	Understanding and Applying the concept of machine learning & probabilistic modelling over biological data analysis.
Contents	3 Hrs./week
Chapter	Name of the Topic
	Hours Marks

01	Concepts of Cell, tissue, types of cell, components of cell, organelle. Functions of different organelles. Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept. Concepts of RNA: Basic structure, Difference between RNA and DNA. Types of RNA. Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Translation Introduction to Metabolic Pathways	7	12
02	Sequence Databases 2 Introduction to Bioinformatics. Recent challenges in Bioinformatics. Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed;	7	14
03	DNA SEQUENCE ANALYSIS 14 Syllabus for B.Tech(Information Technology) Up to Fourth Year Revised Syllabus of B.Tech IT DNA Mapping and Assembly : Size of Human DNA ,Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays,	8	18
	Cutting DNA into Fragments, Sequencing Short DNA Molecules, Mapping Long DNA Molecules. DeBruijn Graph. Sequence Alignment: Introduction, local and global alignment, pair wise and multiple alignment, Dynamic Programming Concept. Alignment algorithms: Needleman and Wunsch algorithm, Smith-Waterman.		
04	Introduction Probabilistic models used in Computational Biology 8 Probabilistic Models; Hidden Markov Model: Concepts, Architecture, Transition matrix, estimation matrix. Application of HMM in Bioinformatics: Genefinding, profile searches, multiple sequence alignment and regulatory site identification. Bayesian networks Model :Architecture, Principle ,Application in Bioinformatics.	7	12
05	Biological Data Classification and Clustering 6 Assigning protein function and predicting splice sites: Decision Tree	7	14
	Sub Total:	36	70
	Internal Assessment Examination & Preparation of Semester Examination	4	30
	Total:	40	100

List of Books Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Des Higgins (Editor), Willie Taylor.	Bioinformatics: Sequence, Structure and Databanks: A Practical Approach	ISBN: 978-0199637904. 1st edition,	Oxford University Press.
David W. Mount.	Bioinformatics: Sequence and Genome Analysis	ISBN: 978-0879697129 2nd edition,	Cold spring harbor laboratory press.

Reference Books:			
	Introduction to Bioinformatics	ISBN: 978-8178085074 1st edition	Pearson Education.
	Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins	ISBN: 978-0471478782. Second Edition,	John Wiley & Sons, Inc., Publication.

Mapping of Course Outcomes and Program Outcomes:

Course Outcome	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	3	2	1		2					1
2	3	3	2	2	1	1	2					
3	3	2	3	2	1		3					
4	3	2	2	2	1	1	2					
5	3	2	3	3	2		3					1
Average	3	2	3	2	1	1	2					1

FUNDAMENTALS OF BUSINESS ANALYTICS:

Course Code	OECICB701C					
Category	Open Elective Course					
Course title	FUNDAMENTALS OF BUSINESS ANALYTICS					
Scheme and Credits	L	T	P	Cr. Points	Lec. Hrs.	
	3	0	0	3	36	
Pre-requisites/ Co-requisites (if any)						

Data-Analytic Thinking for Business:**[9L]**

The Ubiquity of Data Opportunities, Data Science as a strategic asset, data analytic thinking, Business Enterprise and its functions, Enterprise Applications – ERP, CRM, MIS.

Difference between Business Intelligence and Business Analytics,

Database systems for Business: OLTP and OLAP systems for business overview and architecture overview.

Business Problems and Data Science Solutions using CRISP-DM Approach:**[9L]**

Business Understanding, preparation, modeling, evaluation, deployment. Performance Metrics in Analytics - Key performance, Indicators (KPIs), KPI based balanced score card, KPIs on Dashboards.

Project Management:**[9L]**

Project Management, phases, tools, techniques and methodologies in project management, Agile Framework and Scrum Approach. Quality Management - quality management philosophy, concepts and tools, Statistical Quality Control methods, Lean and Six Sigma, SERVQUAL model of service quality.

Case studies:**[9L]**

Human Capital Analytics, IT Analytics, Sales and Marketing Analytics, Analytics in telecom, Retail, healthcare, financial markets, social media, sports and other related business fields.

Reference/Text Books:

1. Prasad, R, N. and Acharya, Seema *Fundamentals of Business Analytics*. Wiley India Pvt, Ltd, New Delhi, 2016.
2. Provost and Fawcett, *Data Science for Business*, O'Reilly, 2013.
3. Shmueli, Patel, and Bruce, *Data Mining for Business Intelligence, Concepts, Techniques and Applications*. Wiley, 2009.
4. Clifford F. Gray, Erik W. Larson, Gautam V. Desai - *Project Management* - Tata McGraw Hill, 2014.
5. Schwaber Ken *Agile project management with scrum*, WP Publishers and Distributors, Bangalore, 2004.
6. Sridhar Bhatta, *Total Quality Management, concepts and cases*-Himalaya Publishing House, 2015.

Course Outcomes:

- CO1. Explain the background of business analytics.
- CO2. Demonstrate programming methods to locate, warehouse and wrangle data.
- CO3. Utilize decision analysis as a means to build solutions for business queries.
- CO4. Relate ethical principles to the collection, storage and use of data by business and government.

Mapping of Course Outcomes and Program Outcomes:

Course Outcome	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	2	2	2	2	2	2	2	2	2	2
2	2	3	3	2	2	2	2	2	2	2	2	2
3	3	2	3	2	2	1	1	2	3	2	2	2
4	2	2	2	1	-	1	-	1	3	3	1	2
Average	2	3	3	2	2	2	2	2	2	2	2	2

Course Code	HSMC701					
Category	Humanities and Social Science and Management Course					
Course title	Project Management and Entrepreneurship					
Scheme and Credits	L	T	P	Cr. Points	Lec. Hrs.	
	2	0	0	2	30	
Pre-requisites/ Co-requisites (if any)	- Fundamentals of Management, Elementary Mathematics					

Course Objective:**The objectives of the course are:**

- 1) To impart among students, the concept of project, its characteristics, and its management subject to given constraints to successfully deliver the agreed outcomes of the project.
- 2) To imbibe students with the knowledge of effective project planning, project evaluating, and project scheduling with optimal resource allocation.
- 3) To impart among students, the legal aspect and quality aspect of project management.
- 4) To familiarize the students with the concept of entrepreneurship, its theoretical and practical approach.

Course Content:

MODULE-I [10 Lectures]

Project Management Concepts: Concept and Characteristics of a Project, Types of Projects, Project Management (Need, Knowledge Areas, Project Manager, Project Management Triangle, Project Scope and Scope Creep, Importance of Project Management).

Project Management Life Cycle: Project Management Life Cycle Phases, Project Management Process (Project Process, Process Group, Process Interactions, Customization, Process Group and Knowledge Area Matrix)

Project Planning: Planning Need, Importance of Planning, Planning Process, Work Breakdown Structure and Organization Breakdown Structure, Roles, Responsibility and Team Work, Feasibility Studies.

Project Cost Control: Direct and Indirect Cost, Normal Cost and Crash Cost, Time– Cost Trade-off Analysis - Optimum Project Duration, Resource Allocation and Leveling.

MODULE – II [10 Lectures]

Project Evaluation: Investment Analysis of Projects (Time Value of Money, Interest Rates, Compounding/Discounting, Payback Period, Average Rate of Return, Net Present Value, Profitability Index, Internal Rate of Return), Sources of Finance.

Project Scheduling: Importance of Project Scheduling, Scheduling Techniques (Gantt Chart and Line of Balance, Network Analysis – CPM/PERT, Slack and Float)

MODULE-III [4 Lectures]

Legal and Quality Aspects of Project Management: Project Contract (Types of Contract, Sub-Contracting, Tenders, Payment to Contractors), Project Audit.

IT in Projects: Overview of types of Software for Projects, Major Features of Project Management Software like MS Project, Criterion for Software Selection.

MODULE-IV [6 Lectures]

Entrepreneurship: Meaning & Concept of Entrepreneurship, Conditions needed for Entrepreneurship (Social Factors, Economic Factors, Psychological Factors, Legal Factors, Education & Technical Knowhow, Financial Assistance), Qualities of a Prospective Entrepreneur.

Entrepreneurial Motivation: McClelland's N-Ach Theory (Need for Affiliation, Need for Power, Need for Achievement), Self-Analysis, Personal Efficacy, Culture & Values, Risk- taking Behaviour, Technology Backup.

Entrepreneurial Skills: Creativity, Problem Solving, Decision Making, Communication, Leadership Quality.

Textbooks:

1. P. Gopalkrishnan and R. M. Moorthy; Text Book of Project Management, Macmillan
2. K. Nagarajan; Project Management, New Age International Publishers; 5th Edn.
3. P. Chandra; Projects; Tata McGraw Hill; 6th Edn.
4. J. M. Nicholas; Project Management for Business and Technology – Principles and Practice; Prentice Hall India; 2nd Edn.
5. H. Maylor; Project Management; Pearson; 3rd Edn.
6. D. F. Kuratko and R. M. Hodgetts; Entrepreneurship; Thomson Learning; 7th Edn.
7. R. Roy; Entrepreneurship; Oxford University Press.

Reference Books:

8. S. A. Kelkar; Software Project Management: A concise Study; Prentice Hall India; 2nd Edn.

- Course Outcome (CO):**

- CO1.** Learn general concept of a project and project management, the importance of project life cycle and essential elements of project planning.
- CO2.** Analysis of project evaluation, project scheduling as well as project cost control through application of financial and mathematical tools.
- CO3.** Learn details of legal and quality aspects of project management to face various issues.
- CO4.** Study and demonstrate the features of different project management softwares with special emphasis on “MS Project” and can able to select the best PMS subject to desired requirements.
- CO5.** Develop skills of entrepreneurship both theoretical and practical approach and can take initiative of starting a new business.
- CO6.** Align the successful approach of entrepreneurship in undertaking large investment projects for the necessity and benefit of the society.

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