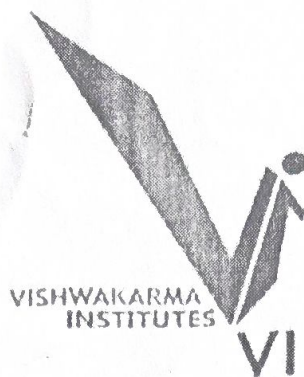




Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure and Syllabus of B.Tech.

Electronics and Telecommunication Engineering

Effective from Academic Year 2026-27

Prepared by: - Board of Studies in Electronics and Telecommunication

Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Chairman – BOS

Dean Academics

Chairman – Academic Board

Institute Vision

“To be a globally acclaimed institute in technical education and research for holistic socio-economic development.”

Institute Mission

- To ensure that 100% students are employable and employed in Industry, Higher Studies, become Entrepreneurs, Civil / Defense Services / Govt. Jobs and other areas like Sports and Theatre.
- To strengthen Academic Practices in terms of Curriculum, Pedagogy, Assessment and Faculty Competence.
- Promote Research Culture among Students and Faculty through Projects and Consultancy.
- To make students Socially Responsible Citizen.

Department Vision

“To be a centre of academic excellence in Electronics, Telecommunication and related domains through continuous learning and innovation.”

Department Mission

- To provide state of art education in Electronics and Telecommunication Engineering to meet current and future needs of society, industry, and academia.
- To strengthen collaborations with industries and institutes of repute to foster research culture among faculty members and students.
- To promote ethically conscious engineers demonstrating sustainable entrepreneurship and professional maturity in a social context.

Program Educational Objectives (PEOs)

Graduates of the program will

1. Have a comprehensive knowledge of Electronics engineering fundamentals to face the challenges of real-life complex problems.
2. Be professionals imbued with a spirit of leadership, ethical behavior, and societal commitment.
3. Be compliant to constantly evolving technology through lifelong learning.

Program Specific Objectives (PSOs)

E&TC Graduates will have the ability to:

1. Design, develop and analyze complex Electronic Systems for communication, Signal Processing, Embedded Systems, and VLSI applications.
2. Identify and apply domain-specific hardware and software tools to solve real-world problems in Electronics and Communication.

Program Outcomes (POs)

Engineering Graduate will be able to

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognise the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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Title: Course Structure D 26**Branch: E&TC****Year: B.Tech.****A.Y:2026-27****Module: VII, Sem 1**

Subject Head	Course Code	Course Name	Teaching Scheme (Hrs/Week)			Assessment Scheme (100-mark scale)									Credits
			Theory	Lab	Tut	ISA						ESA		Total	
						HA	LB	CP	PPT	GD	MSE	ESE	CVV	100	
OE 1	Bucket 1	Linkedin Learning Courses													2
	Bucket 2	Linkedin Learning Courses													2
OE2	ET4230	Natural Language Processing	2	0	0	10	-	-	-	-	30	30	30	100	2
	ET4232	Deep Learning	2	0	0	10	-	-	-	-	30	30	30	100	2
OE3	ET4430	VLSI Design Flow: RTL to GDS	1	0	0	10					30	20	20	100	2
	ET4292	Modern Digital Communication Techniques	1	0	0	10					30	20	20	100	2
S4	ET4431	Design Thinking - 7			1										1
S5	ET4207	Major Project	0	20	0	-	-	-	-	-	30	70	-	-	9

Bucket 1 MD4274-Large Language Models Skill Development MD4275-Mastering Microsoft Power BI MD4276-Generative AI Skills for Developers MD4277-Career in Data Analysis MD4278-Concepts of Data Visualization and Storytelling MD4279-AWS Certified Solutions Architect MD4280- IT Security Specialist MD4281-Technical Program Management	Bucket 2 MD4282-Natural Language Processing Skill Development MD4283-Prompt Engineering Skills MD4284-Essentials in Generative AI MD4285-Python in Finance MD4286-Understanding Quantum Computing MD4287-Foundational Maths for Machine Learning
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Title: Course Structure D 26

FF No. 653

Branch: E&TC**Year: B.Tech.****A.Y.: 2026-27 Module: VIII, Sem1**

Subject Head	Course Code	Course Name	Teaching Scheme (Hrs/Week)			Assessment Scheme (100-mark scale)									Credits
			Theory	Lab	Tut	ISA						ESA		Total	
						HA	LB	CP	PPT	GD	MSE	ESE	CVV	100	
S1	ET4222	Research Internship	-	40	-	-	-	-	-	-	30	100	-	100	15
	ET4250	Project Internship	-	40	-	-	-	-	-	-	30	100	-	100	15
	ET4251	Industry Internship	-	40	-	-	-	-	-	-	30	100	-	100	15
	ET4252	International Internship	-	40	-	-	-	-	-	-	30	100	-	100	15
S2	ET4431	Design Thinking - 7			1										1
		Total	-	40	-	-	-	-	-	-	30	100	-	100	16

A*: Second Semester Cours

Title: Course Structure D 26**Branch: E&TC****Year: B.Tech.****A.Y.: 2026-27****Module: VII Sem 2**

Subject Head	Course Code	Course Name	Teaching Scheme (Hrs/Week)			Assessment Scheme (100-mark scale)									Credits
			Theory	Lab	Tut	ISA						ESA		Total	
						HA	LB	CP	PPT	GD	MSE	ESE	CVV	100	
OE 1	Bucket 1	Linkedin Learning Courses													2
	Bucket 2	Linkedin Learning Courses													2
OE2	ET4230	Natural Language Processing	2	0	0	10	-	-	-	-	30	30	30	100	2
	ET4232	Deep Learning	2	0	0	10	-	-	-	-	30	30	30	100	2
OE3	ET443 2	Digital IC Design	1	0	0	10					30	20	20	100	2
	ET420 6	Digital Communication using GNU Radio	1	0	0	10					30	20	20	100	2
S5	ET4208	Major Project	0	20	0	-	-	-	-	-	30	70	-	-	10

Bucket 1 MD4274-Large Language Models Skill Development MD4275-Mastering Microsoft Power BI MD4276-Generative AI Skills for Developers MD4277-Career in Data Analysis MD4278-Concepts of Data Visualization and Storytelling MD4279-AWS Certified Solutions Architect MD4280- IT Security Specialist MD4281-Technical Program Management	Bucket 2 MD4282-Natural Language Processing Skill Development MD4283-Prompt Engineering Skills MD4284-Essentials in Generative AI MD4285-Python in Finance MD4286-Understanding Quantum Computing MD4287-Foundational Maths for Machine Learning
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Title: Course Structure D 26**Branch:** E&TC**Year:** B.Tech.**A.Y.:** 2026-27**Module:** VIII, Sem 2

Subject Head	Course Code	Course Name	Teaching Scheme (Hrs/Week)			Assessment Scheme (100-mark scale)									Credits
			Theory	Lab	Tut	ISA						ESA		Total	
						HA	LB	CP	PPT	GD	MSE	ESE	CVV	100	
S1	ET4403	Research Internship	-	40	-	-	-	-	-	-	30	100	-	100	16
	ET4404	Project Internship	-	40	-	-	-	-	-	-	30	100	-	100	16
	ET4401	Industry Internship	-	40	-	-	-	-	-	-	30	100	-	100	16
	ET4402	International Internship	-	40	-	-	-	-	-	-	30	100	-	100	16
		Total	-	40	-	-	-	-	-	-	30	100	-	100	16

MD4206: FINANCIAL MANAGEMENT AND COSTING

Teaching Scheme Theory: 2 Hours/Week

Credits: 2

Course Prerequisites

Basic concepts of cost, profit, loss, debit and credit.

Course Objectives:

1. Understand, analyze and interpret financial statements
2. Understand and concept of financial accounting for analysis of financial statements of a business.
3. Develop an ability of decision making about investments.

Course Relevance: Basic knowledge of Finance for working in an industry.

Course Outcomes:

Student will be able to

1. Understand and analyze financial statements and budgeting, interpret accounting ratios.
2. Understand the concepts of Capital Budgeting and Working Capital management.
3. Understand the mechanics of financial accounting for preparation of financial statements to ascertain the performance and financial position of a business.
4. Classify, apply different types of costs and overheads to ascertain costs of a product/ process.
5. Apply costing methods as per the suitability for various production processes and services.
6. Develop decision making of optimum product mix, profit planning, make or buy decisions

SECTION-1

1. Financial Statement Analysis- Nature and Scope of Finance Function; Financial goal profit vs. wealth, Maximization; Scope and Functions of Financial Management, Financial Planning and Forecasting. Budgets & Budgetary Control: Types of Budget, Preparation of Budgets: Operational & Financial Budgets, Financing and Dividend decisions. Types of accounts, bookkeeping, Profit and Loss Account and Balance Sheet, Cash Flow Statement

2. Capital Budgeting and ratio Analysis -Ratio Analysis Classification, Ratio Analysis and its limitations. Types of Ratios, Activity Turnover, Profitability, Liquidity, etc., B: Common Size Statement, Index Statement, Capital Budgeting - Nature of Investment decisions; Investment evaluation criteria - Non-DCF & DCF Techniques, PBP, Discounted PBP, PI, ARR, Annual Worth

3. Working Capital Management - Meaning, significance and types of working capital; calculating operating cycle period and estimation of working capital requirements; sources of working capital, NPV and IRR comparison; Capital rationing. Various committee reports on bank finance; Dimensions of working capital management.

SECTION-II

4. Introduction to concept of Cost and Overheads - Cost, Cost Centre, Cost Unit, Elements of Cost: Material Cost. Different methods of pricing of issue of materials Labour Cost: Direct & Indirect cost, Different methods, Direct Expenses: Constituents and Significance, Prime Cost, Classification: Production, Office & Administration, Selling & Distribution. Treatment of Overheads: Collection ,Primary and Secondary Distribution and Absorption of Overheads Machine, Labour hour rate, Under/Over Absorption of Overheads, Preparation of Cost Sheet

5. Costing Methods - Job Costing, Unit Costing, Contract Costing, Process Costing, Activity Based Costing Simple numerical on various methods of costing to enable ascertains cost of product. Standard costing: Concept, Standard Cost, Standard costing. Calculation of Variance Numerical on calculation of variances, Variance – Variance Analysis

6. Marginal Costing and Break Even Analysis - Fixed & Variable (Marginal) Cost, Marginal Cost. Applications of Marginal Costing in Decision-making: Product Mix, Profit Planning, Make or Buy Decisions. Limiting Factor, Cost Volume Profit Analysis, Concept of Break-Even, P/V Ratio and Margin of Safety

List of Tutorials: (Any Three)

- 1.Capital financing
- 2.Working capital finance
- 3.Preparation of Journal entries, Ledgers
- 4.Profit and Loss Account and Balance Sheet
- 5.Ratio Analysis
- 6.Investment decisions
- 7.Product Costing
- 8.Service Costing.
- 9.Process Costing

List of Practicals: (Any Six)

1. Case study on sources of capital and working capital
2. Case study on assessment of working capital
3. Studying and understanding Financial Statements - Profit and Loss
4. Studying and understanding Financial Statements - Balance sheet
5. Studying and understanding various financial ratios used in practice
6. Studying and understanding various financial ratios for decision making
7. Case study on Analysis of published results of an organisation – Manufacturing
8. Case study on Analysis of published results of an organisation – Service industry
9. Prepare a cost sheet to estimate the cost of any product
10. Prepare a cost sheet any process
11. Case study on use Marginal Costing to determine Break Even Point and profitability
12. Case study on use Marginal Costing to determine profitability.

List of Projects:

1. Budgeting including sources of capital financing.
2. Budgeting including sources of working capital finance
3. Preparation of Journal entries, Ledgers.
4. Preparation Profit and Loss Account and Balance Sheet
5. Preparation of Balance Sheet.
6. Ratio Analysis based on real life data from project on Profit and loss and Balance sheet.
7. Compare Analysis of published results of organisations to enable investment decision.

8. Apply Product Costing to estimate cost of any process used in practice.
9. Apply Service Costing to estimate cost of any process used in practice .
10. Apply Process Costing to estimate cost of any process used in practice.
11. Apply Standard Costing to estimate cost of any process used in practice.
12. Apply Marginal Costing to determine Break Even Point and profitability

List of Course Seminar Topics:

1. Sources of Capital Financing
2. Working Capital Management
3. Profit and Loss Account
4. Balance Sheet
5. Turn over and Ratios.
6. Taxation
7. Product Costing
8. Service Costing
9. Process Costing.
10. Investment Decisions

List of Course Group Discussion Topics:

1. Sources of Capital Financing - Bank or Investors.
2. Working Capital Management - Which is better - Less or More?
3. Profit and Loss Account.
4. Balance Sheet - Effect on share prices.
5. Turnover and Ratios - which should be focused on?
6. Taxation - Fair or Unfair in India.
7. Product Costing - does it drive Profits or Markets?
8. Service Costing - Quality or Cost?
9. Process Costing - Automation or Manual Labour?
10. Investment Decisions - Guts or Statistics?

Textbooks:

1. Prasanna Chandra, Financial Management – Theory and Practice, Edition 8, 2011, Tata McGraw Hill Education,
2. B. K. Bhar, Cost Accounting– Methods and Problems, Academic Publishers, 1980
3. M. Y. Khan and P K Jain, Financial Management: Text, Problems and Cases, Tata McGraw Hill Education.
4. Amitabha Mukherjee and Mohammed Hani, Modern Accountancy, Edition 2, 2002, Tata McGraw Hill Education

Reference Books:

1. Paresh P. Shah, Financial Management, Reprint No. 2 2011, Biztantra, New Delhi,
2. S. N. Maheshwari, Introduction to Accountancy, Edition 11, 2013, Vikas Publishing House
3. M. Y. Khan, P. K. Jain, Management Accounting –Text, Problems, Cases, Edition No. Tata McGraw Hill Publishers, 2013

MD4203: BUSINESS PROPOSAL WRITING

Teaching Scheme Theory: 2 Hours/Week

Credits: 2

Course Outcomes:

Student will be able to

1. Understand basic bid and proposal management terminologies.
2. Conceptualize the entire process of bid and proposal management.
3. Know the techniques and tools for customer analysis and competitive intelligence.
4. Create business proposals with basic building blocks.
5. Can create customer-centric theme statements.
6. Present a business proposal and defend it.

SECTION-1

Introduction

The world of B2B Businesses, Pre-Sale Roles and Responsibilities, End to end bid management Process including costing.

Focus on Customer

Compliance, Responsiveness, Client Analysis and Competitive Intelligence, Strategies and win themes, Features, Benefits and Discriminators, Teaming/sub-contracting

SECTION-2

Manage Processes

Proposal development cycle, Business approvals, and reviews, lessons learned

Elements of persuasive writing

Assertive writing, Headings, graphics and action captions, Page and document design, and style guides.

Textbooks:

1. Tom Sant, Persuasive Business Proposal, AMACOM; 3rd edition
2. John Care and Aron Bohlig, Mastering Technical Sale- The Sales Engineer's Handbook, Artech House; 3rd ed. Edition.
3. Neil Cobb and Charlie Divine, Writing Business Bids and Proposal for Dummies, For Dummies; 1st edition, 2016.
4. Larry Newman, The Shipley Proposal Guide 4.0, Shipley Associates; 4th Edition, 2011.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	0	0	0	0	0	0	0	0	0	0	2	0	0	0
2	0	0	0	0	0	0	0	0	0	0	2	0	0	0
3	0	0	2	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	2	0	0	0	0	3	0	0	0	0	0
5	0	0	0	0	0	0	0	0	3	0	0	0	0	0
6	0	0	0	0	0	0	0	0	3	0	0	0	0	0

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO Attainment Level:

CO1: Level 3

CO2: Level 3

CO3: Level 3

CO4: Level 3

CO5: Level 3

CO6: Level 3

MD4228: IBM Full Stack Software Developer Prerequisites

1. Basic Programming Knowledge: Familiarity with any programming language (e.g., Python, JavaScript).
2. HTML/CSS Basics: Basic understanding of web page creation using HTML and CSS.
3. Problem-Solving Skills: Ability to approach and solve coding challenges.
4. Version Control Knowledge: Familiarity with Git is helpful but not mandatory.

Course Description

The IBM Full Stack Software Developer course equips students with skills in both front-end and back-end development. It covers essential technologies for full-stack development, including HTML, CSS, JavaScript (React.js), Node.js, Express.js, databases (SQL & NoSQL), DevOps tools (Docker, Kubernetes), and cloud computing.

Students will gain practical experience in building and deploying web applications and learn industry-standard practices in software development.

Professional Certificate - 15 course series

- 1: Introduction to Software Engineering (14 hours)
- 2: Introduction to Cloud Computing (12 hours)
- 3: Introduction to HTML, CSS, & JavaScript (10 hours)
- 4: Getting Started with Git and GitHub (10 hours)
- 5: Developing Front-End Apps with React (14 hours)
- 6: Developing Back-End Apps with Node.js and Express (13 hours)
- 7: Python for Data Science, AI & Development (25 hours)
- 8: Developing AI Applications with Python and Flask (11 hours)
- 9: Django Application Development with SQL and Databases (14 hours)
- 10: Introduction to Containers with Docker, Kubernetes & OpenShift (17 hours)
- 11: Application Development using Microservices and Serverless (14 hours)
- 12: Full Stack Application Development Capstone Project (16 hours)
- 13: Full Stack Software Developer Assessment (6 hours)
- 14: Generative AI: Elevate your Software Development Career (17 hours)
- 15: Software Developer Career Guide and Interview Preparation (11 hours)

Link : <https://www.coursera.org/professional-certificates/ibm-full-stack-cloud-developer?action=enroll#courses>

MD4229:Meta Back-End Developer

Prerequisite:

Students should have a foundational understanding of programming concepts and some experience with web development using technologies like HTML, CSS, and JavaScript. Familiarity with object-oriented programming and version control is also recommended.

Course Description:

The Meta Back-End Developer program provides comprehensive training in back-end development, covering topics such as databases, Python programming, APIs, Django, version control, and cloud-based containerization. Students will learn to build scalable and secure back-end systems, apply microservices and serverless architectures, and gain proficiency in modern DevOps practices.

List of Courses:

1. Introduction to Back-End Development (18 hours)
2. Programming in Python (44 hours)
3. Version Control (13 hours)
4. Introduction to Databases for Back-End Development (27 hours)
5. Django Web Framework (45 hours)
6. APIs (20 hours)
7. The Full Stack (24 hours)
8. Back-End Developer Capstone (20 hours)
9. Coding Interview Preparation (11 hours)

Course Link: <https://www.coursera.org/professional-certificates/meta-back-end-developer#courses>

MD4230:IBM Back-End Developer

Prerequisite:

Students should have basic knowledge of programming languages and foundational skills in web development, including HTML, CSS, and JavaScript. Familiarity with basic software development concepts will be beneficial.

Course Description:

The IBM Back-End Developer course offers comprehensive training in back-end development, covering essential topics such as Python programming, databases, Django web framework, API development, and cloud computing concepts. This course is designed to equip students with the skills required to build robust and scalable back-end systems, including the use of containers, microservices, and serverless architectures.

List of Courses:

1. Introduction to Back-End Development (18 hours)
2. Programming in Python (44 hours)
3. Version Control (13 hours)
4. Introduction to Databases for Back-End Development (27 hours)
5. Django Web Framework (45 hours)
6. APIs (20 hours)
7. The Full Stack (24 hours)
8. Back-End Developer Capstone (20 hours)
9. Coding Interview Preparation (11 hours)

Link: <https://www.coursera.org/professional-certificates/ibm-backend-development#courses>

FF No.: 654

MD4233:Microsoft Power BI Data Analyst**Prerequisites**

- 1: Basic Data Analysis Skills: Familiarity with Excel, including charts, tables, and basic formulas.
- 2: Understanding of Databases: Basic knowledge of databases and data structures.
- 3: Problem-Solving Skills.

Course Description

The Microsoft Power BI Data Analyst course teaches students how to use Power BI, a business intelligence tool, to create interactive dashboards, visualize data, and generate insights. It covers the entire process, from connecting data sources to cleaning and transforming data, and building reports to share with stakeholders.

Certificate Courses

1. Preparing Data for Analysis with Microsoft Excel
Duration: 19 hours
2. Harnessing the Power of Data with Power BI
Duration: 16 hours
3. Extract, Transform, and Load (ETL) Data in Power BI
Duration: 20 hours
4. Data Modelling in Power BI
Duration: 24 hours
5. Data Analysis and Visualization with Power BI
Duration: 28 hours
6. Creative Designing in Power BI
Duration: 20 hours
7. Deploy and Maintain Power BI Assets and Capstone Project
Duration: 24 hours
8. Microsoft PL-300 Exam Preparation and Practice
Duration: Self-paced

MD4234: Tableau Business Intelligence Analyst**Prerequisites**

- 1: Basic Data Analysis Skills: Familiarity with Excel or Google Sheets for data manipulation.
- 2: Understanding of Databases: Basic knowledge of relational databases and data structures.

Course Description

The Tableau Business Intelligence Analyst course provides a comprehensive understanding of Tableau, a leading data visualization tool used in business intelligence. The course equips students with the skills to analyze data, create interactive dashboards, and share insights with stakeholders, empowering data-driven decision-making in businesses.

Certificate Courses

- 1: Introduction to Business Analytics
Duration: 14 hours
- 2: Business Analysis Process
Duration: 22 hours
- 3: Data Ecosystem Duration: 14 hours
- 4: Introduction to Tableau
Duration: 19 hours
- 5: Data Visualization with Tableau
Duration: 26 hours
- 6: Advanced Data Visualization with Tableau
Duration: 21 hours
- 7: Data Analysis with Tableau
Duration: 26 hours
- 8: Communicating Data Insights with Tableau

4237: IBM Cybersecurity Analyst

Prerequisites

1. Basic IT Knowledge: Understanding of basic IT concepts such as networking, databases, and operating systems.
2. Familiarity with Computer Systems: Basic knowledge of how computer systems work, including hardware and software components.
3. Problem-Solving Skills.

Course Description

The IBM Cybersecurity Analyst course is designed to provide students with the foundational skills required for a career in cybersecurity. Students will learn how to detect, analyze, and respond to security incidents, as well as how to apply best practices to safeguard data and systems from cyber threats.

Certificate Courses

1. Introduction to Cybersecurity Careers (Duration: 7 hours)
2. Introduction to Cybersecurity Essentials (Duration: 12 hours)
3. Introduction to Cybersecurity Tools & Cyberattacks, Duration: 11 hours
4. Operating Systems: Overview, Administration, and Security, Duration: 17 hours
5. Computer Networks and Network Security, Duration: 14 hours
6. Database Essentials and Vulnerabilities, Duration: 14 hours
7. Cybersecurity Architecture, Duration: 12 hours
8. Cybersecurity Compliance Framework, Standards & Regulations Duration: 11 hours
9. Penetration Testing, Incident Response, and Forensics, Duration: 17 hours
10. Cyber Threat Intelligence, Duration: 27 hours
11. Cybersecurity Capstone: Breach Response Case Studies Duration: 13 hours
12. IBM Cybersecurity Analyst Assessment Duration: 4 hours
13. Generative AI: Boost Your Cybersecurity Career Duration: 9 hours
14. Cybersecurity Job Search, Resume, and Interview Prep

MD4238:Microsoft Cybersecurity Analyst

Prerequisites

- 1: Basic IT Knowledge: Understanding of fundamental IT concepts like networking, operating systems, and databases.
- 2: Familiarity with Security Concepts: Basic knowledge of cybersecurity concepts such as firewalls, encryption, and malware.
- 3: Problem-Solving Skills.

Course Description

The Microsoft Cybersecurity Analyst course is designed to equip students with the essential skills needed for cybersecurity roles. Students will learn how to protect systems, networks, and data through practical techniques and industry-standard tools. This course prepares students for roles such as Security Operations Center (SOC) Analyst, Network Security Analyst, and Penetration Tester.

Certificate Courses

1. Introduction to Computers
2. and Operating Systems and Security (15 hours)
3. Introduction to Networking and Cloud Computing (25 hours)
4. Cybersecurity Threat Vectors and Mitigation (20 hours)
5. Cybersecurity Identity and Access Solutions using Azure AD (20 hours)
6. Cybersecurity Solutions and Microsoft Defender (20 hours)
7. Cybersecurity Tools and Technologies (20 hours)
8. Cybersecurity Management and Compliance (20 hours)
9. Advanced Cybersecurity Concepts and Capstone Project (20 hours)
10. Microsoft SC-900 Exam Preparation and Practice

MD4239:Google Cybersecurity

Prerequisites

- Basic IT Knowledge: Familiarity with fundamental IT concepts such as networks, databases, and operating systems.
- Understanding of Security Concepts: Basic knowledge of cybersecurity principles, like firewalls, malware, and encryption.
- Problem-Solving Skills.

Course Description

The Google Cybersecurity course prepares students for a career in cybersecurity, equipping them with the practical skills needed to defend networks and systems from cyber threats. This course provides training on key cybersecurity concepts, tools, and Google-specific solutions for threat management and mitigation.

Certificate Courses

1. Foundations of Cybersecurity (14 hours)
2. Play It Safe: Manage Security Risks (11 hours)
3. Connect and Protect: Networks and Network Security (14 hours)
4. Tools of the Trade: Linux and SQL (27 hours)
5. Assets, Threats, and Vulnerabilities (26 hours)
6. Sound the Alarm: Detection and Response (24 hours)
7. Automate Cybersecurity Tasks with Python (30 hours)
8. Put It to Work: Prepare for Cybersecurity Jobs (21 hours)

MD4240:Google Data Analytics

Prerequisites

1. Basic Computer Skills: Familiarity with spreadsheets and basic data manipulation.
2. Problem-Solving Skills: Ability to approach data-related problems analytically.

Course Description

The Google Data Analytics course is designed to equip students with the essential skills required for a career in data analytics. It covers the complete data analysis process, from data cleaning to data visualization and presenting insights. This program prepares students for entry-level roles in data analytics and data-driven decision-making.

Certificate Courses

1. Foundations: Data, Data, Everywhere (18 hours)
2. Ask Questions to Make Data-Driven Decisions (20 hours)
3. Prepare Data for Exploration (24 hours)
4. Process Data from Dirty to Clean (26 hours)
5. Analyze Data to Answer Questions (32 hours)
6. Share Data Through the Art of Visualization (25 hours)
7. Data Analysis with R Programming (34 hours)
8. Google Data Analytics Capstone: Complete a Case Study

MD4243: IBM Data Engineering

Prerequisites

- Basic Programming Knowledge: Familiarity with Python, SQL, or other programming languages.
- Understanding of Databases: Basic knowledge of relational and non-relational databases.

Course Description

The IBM Data Engineering course is designed to provide students with the skills needed to become proficient in data engineering. This course covers data architecture, data pipelines, cloud integration, and more, equipping students to manage, analyze, and transform big data for businesses. It prepares students for roles like Data Engineer and Database Administrator.

Certification & Courses

Upon completing the program, students will earn a Professional Certificate in Data Engineering. The course includes the following modules:

- 1: Introduction to Databases (27 hours)
- 2: Version Control (13 hours)
- 3: Database Structures and Management with MySQL (32 hours)
- 4: Advanced MySQL Topics (18 hours)
- 5: Programming in Python (44 hours)
- 6: Database Clients (40 hours)
- 7: Advanced Data Modelling (18 hours)
- 8: Database Engineer Capstone (18 hours)
- 9: Coding Interview Preparation (11 hours)

MD4245: IBM Data Science

Prerequisites

1. Basic Math and Statistics Knowledge
2. Basic Programming Skills

Course Description

The IBM Data Science Professional Certificate is designed to provide students with a strong foundation in data science, covering data analysis, machine learning, Python programming, and practical applications using real-world datasets. It prepares students for entry-level roles in data science and analytics, equipping them with the skills needed to analyze data, create models, and derive insights.

Certification & Courses

Upon completion, students will earn the IBM Data Science Professional Certificate. The program consists of the following courses:

1. What is Data Science?(11hours)
2. Tools for Data Science (18 hours)
3. Data Science Methodology (6hours)
4. Python for Data Science, AI & Development (25 hours)
5. Python Project for Data Science (8 hours)
6. Databases and SQL for Data Science with Python (20 hours)
7. Data Analysis with Python (15 hours)
8. Data Visualization with Python (20 hours)
9. Machine Learning with Python (13 hours)
10. Applied Data Science Capstone (13 hours)
11. Generative AI: Elevate Your Data Science Career (12 hours)
12. Data Scientist Career Guide and Interview Preparation (9 hours)

MD4246: Fractal Data Science**Prerequisites**

- 1: Basic Math and Statistics Knowledge
- 2: Programming Knowledge

Course Description

The Fractal Data Science course is designed to provide a comprehensive understanding of data science, covering topics such as data analysis, machine learning, data visualization, and more. It prepares students for roles in data science by teaching them to analyze and model data using industry-standard tools and techniques.

Certificate Courses

1. Structured Approach to Problem Solving (15 hours)
2. Data Analysis Using SQL (18 hours)
3. Insights of Power BI (14 hours)
4. Python for Data Science (39 hours)
5. Human Decision Making and its Biases (14 hours)
6. Foundations of Machine Learning (25 hours)
7. Advanced Machine Learning Algorithms (20 hours)
8. Data Storytelling

MD4241: IBM Data Analyst

Prerequisites

- 1: Basic Math and Statistics Knowledge.
- 2: Familiarity with Spreadsheets.

Course Description

The IBM Data Analyst course is designed to equip students with the skills needed to analyse data, present insights, and make data-driven decisions. This course covers essential data analysis tools such as Excel, SQL, Python, and data visualization techniques using tools like IBM Cognos Analytics. It prepares students for roles such as Data Analyst and Business Analyst.

Professional Certificate - 11 course series

Prepare for a career in the high-growth field of data analytics. In this program, students will learn in-demand skills like Python, Excel, and SQL to get job-ready in as little as 4 months.

Certificate Courses

1. Introduction to Data Analytics (10 hours)
2. Excel Basics for Data Analysis (11 hours)
3. Data Visualization and Dashboards with Excel and Cognos (15 hours)
4. Python for Data Science, AI & Development (25 hours)
5. Python Project for Data Science (8 hours)
6. Databases and SQL for Data Science with Python (20 hours)
7. Data Analysis with Python (15 hours)
8. Data Visualization with Python (20 hours)
9. IBM Data Analyst Capstone Project (18 hours)
10. Generative AI: Enhance your Data Analytics Career (14 hours)
11. Data Analyst Career Guide and Interview Preparation (10 hours)

MD4248:IBM DevOps and Software Engineering

Prerequisites

- 1: Basic Programming Knowledge.
- 2: Understanding of Software Development Life Cycle (SDLC): Basic knowledge of SDLC, including development and testing phases.

Course Description

The IBM DevOps and Software Engineering course is designed to equip students with the skills needed to manage the full software development lifecycle (SDLC) through DevOps principles. This program focuses on automation, continuous integration/continuous deployment (CI/CD), containerization, and cloud infrastructure management, preparing students for roles such as DevOps Engineer and Software Engineer.

Professional Certificate - 15 course series

Certificate Courses

1. Introduction to DevOps (9 hours)
2. Introduction to Cloud Computing (12 hours)
3. Introduction to Agile Development and Scrum (11 hours)
4. Introduction to Software Engineering (14 hours)
5. Getting Started with Git and GitHub (10 hours)
6. Hands-on Introduction to Linux Commands and Shell Scripting (14 hours)
7. Python for Data Science, AI & Development (25 hours)
8. Developing AI Applications with Python and Flask (11 hours)
9. Introduction to Containers with Docker, Kubernetes & OpenShift (17 hours)
10. Application Development using Microservices and Serverless (14 hours)
11. Introduction to Test and Behavior Driven Development (19 hours)
12. Continuous Integration and Continuous Delivery (CI/CD) (14 hours)
13. Application Security for Developers and DevOps Professionals (17 hours)
14. Monitoring and Observability for Development and DevOps (16 hours)
15. DevOps Capstone Project (18 hours)

MD4249: Google Digital Marketing and E-Commerce

Prerequisites

- 1: Basic Computer Skills: Familiarity with internet browsing and common applications.
- 2: Problem-Solving Skills.

Course Description

The Google Digital Marketing and E-Commerce course is designed to provide students with the skills needed to succeed in the fields of digital marketing and e-commerce. This program covers key aspects such as search engine optimization (SEO), social media marketing, email marketing, and building e-commerce stores. It prepares students for roles like Digital Marketing Specialist, E-Commerce Manager, and Social Media Manager.

Professional Certificate - 7 course series

Certificate Courses

1. Foundations of Digital Marketing and E-Commerce (18 hours)
2. Attract and Engage Customers with Digital Marketing (21 hours)
3. From Likes to Leads: Interact with Customers Online (28 hours)
4. Think Outside the Inbox: Email Marketing (25 hours)
5. Assess for Success: Marketing Analytics and Measurement (27 hours)
6. Make the Sale: Build, Launch, and Manage E-Commerce Stores (23 hours)
7. Satisfaction Guaranteed: Develop Customer Loyalty Online.

MD4250: Meta Front-End Developer

Prerequisites

1. Basic Computer Skills: Familiarity with web browsers and internet usage.
2. Problem-Solving Skills.

Course Description

The Meta Front-End Developer course provides students with the skills required to become proficient in front-end development. This program focuses on the essential tools and technologies used to build interactive, responsive websites and applications. By the end of the course, students will be able to create dynamic user experiences and build websites that function well on any device. This program prepares students for roles such as Front-End Developer and Web Developer.

Certificate Courses

1. Introduction to Front-End Development (18 hours)
2. Programming with JavaScript (42 hours)
3. Version Control (13 hours)
4. HTML and CSS in Depth (28 hours)
5. React Basics (26 hours)
6. Advanced React (26 hours)
7. Principles of UX/UI Design (21 hours)
8. Front-End Developer Capstone (27 hours)
9. Coding Interview Preparation (11 hours)

MD4251:IBM Front-End Developer

Prerequisites

1. Basic Computer Skills: Familiarity with using a web browser and navigating websites.
2. Problem-Solving Skills: Ability to think logically and solve coding-related problems.

Course Description

The IBM Front-End Developer course is designed to provide students with a comprehensive foundation in front-end web development. This program covers everything from the basics of HTML, CSS, and JavaScript to more advanced topics like React and responsive design. By the end of the program, students will be able to create functional, visually appealing, and responsive web applications. The course prepares students for roles such as Front-End Developer, Web Developer, and UI Developer.

Certificate Courses

1. Getting Started with Front-End and Web Development (14 hours)
2. Introduction to Software Engineering (14 hours)
3. Designing User Interfaces and Experiences (UI/UX) (18 hours)
4. Introduction to HTML, CSS, & JavaScript (10 hours)
5. Developing Websites and Front-Ends with Bootstrap (7 hours)
6. Getting Started with Git and GitHub (10 hours)
7. Developing Front-End Apps with React (14 hours)
8. Intermediate Web and Front-End Development (12 hours)
9. Get Started with Cloud Native, DevOps, Agile, and NoSQL (13 hours)
10. Front-End Development Capstone Project (20 hours)
11. Software Developer Career Guide and Interview Preparation (11 hours)

MD4253: Meta iOS Developer

Prerequisites

1. Basic Programming Knowledge: Familiarity with any programming language such as Python, Java, or Swift.
2. Problem-Solving Skills.

Course Description

The Meta iOS Developer course provides students with the skills necessary to design, develop, and deploy iOS applications. The course focuses on Swift programming, iOS frameworks, and Apple's development environment. By the end of the course, students will have built fully functional iOS apps, gaining the skills required for roles like iOS Developer and Mobile App Developer.

Certificate Courses

1. Introduction to iOS Mobile Application Development (11 hours)
2. Version Control (13 hours)
3. Programming Fundamentals in Swift (26 hours)
4. Principles of UX/UI Design (21 hours)
5. Create the User Interface with SwiftUI (20 hours)
6. Advanced Programming in Swift (19 hours)
7. Working with Data in iOS (18 hours)
8. Mobile Development and JavaScript (45 hours)
9. React Basics (26 hours)
10. React Native (38 hours)
11. iOS App Capstone (16 hours)
12. Coding Interview Preparation (11 hours)

MD4254:IBM IT Project Manager

Prerequisites

1. Basic IT Knowledge: Familiarity with information technology concepts and practices.
2. Problem-Solving Skills.

Course Description

The IBM IT Project Manager course is designed to equip students with the skills necessary to manage IT projects efficiently. This program covers project planning, execution, risk management, and the application of Agile and Scrum methodologies. It prepares students for roles such as IT Project Manager and Scrum Master, with a focus on managing technical teams and delivering projects on time and within budget.

Certificate Courses

1. Introduction to Project Management (9 hours)
2. Project Management Foundations, Initiation, and Planning (20 hours)
3. Project Lifecycle, Information Sharing, and Risk Management (16 hours)
4. Project Management Communication, Stakeholders & Leadership (19 hours)
5. Information Technology (IT) Fundamentals for Everyone (18 hours)
6. Introduction to Software Engineering (14 hours)
7. Introduction to Agile Development and Scrum (11 hours)
8. Introduction to Scrum Master Profession (9 hours)
9. Project Management Capstone (18 hours)
10. Practice Exam for CAPM Certification (5 hours)
11. Project Management Job Search, Resume, and Interview Prep

MD4255: Google IT Support

Prerequisites

1. Basic Computer Skills: Familiarity with computer operations and using common software.
2. Problem-Solving Skills.

Course Description

The Google IT Support course is designed to prepare students for a career in IT support, providing them with the skills needed to troubleshoot, manage, and resolve IT-related issues. It covers a wide range of topics, including computer networking, operating systems, system administration, and security. By the end of the program, students will be equipped for roles like IT Support Specialist, Systems Administrator, and Network Administrator.

Certification & Courses

Upon completion, students will earn a Professional Certificate in IT Support from Google. The program includes the following courses:

1. Technical Support Fundamentals Duration: 14 hours
2. The Bits and Bytes of Computer Networking Duration: 20 hours
3. Operating Systems and You: Becoming a Power User Duration: 25 hours
4. System Administration and IT Infrastructure Services Duration: 23 hours
5. IT Security: Defence against the Digital Dark Arts Duration: 30 hours

MD4257: IBM Mainframe Developer

Prerequisites:

1. Basic understanding of programming concepts.
2. Familiarity with any programming language (Python, Java, or C) is helpful.
3. Knowledge of computer systems and software development lifecycle.
4. No prior mainframe knowledge is required.

Description

This professional certificate program is designed to equip learners with the necessary skills and knowledge to become proficient in IBM Mainframe Development. The course covers key concepts and technologies related to mainframe computing, including COBOL programming, JCL (Job Control Language), z/OS, database management, and more. Learners will gain hands-on experience with real-world projects and challenges, enabling them to work effectively as Mainframe Developers in enterprise environments. Upon completion, learners will have the foundational skills to understand and manage mainframe systems, which remain crucial in industries like finance, insurance, and government.

Professional Certificate - 7 course series

List of courses with their durations in parentheses:

1. Introduction to Enterprise Computing (9 hours)
2. IBM COBOL Basics (13 hours)
3. IBM COBOL Core (10 hours)
4. IBM COBOL Software Development Practices (17 hours)
5. IBM COBOL Data and File Management (16 hours)
6. IBM COBOL Basic Testing and Debugging (13 hours)
7. IBM COBOL Software Development Process (17 hours)

MD4258:Meta Marketing Analytics

Prerequisites:

1. Basic knowledge of digital marketing.
2. Familiarity with key digital marketing platforms is helpful but not required.
3. No prior experience in data analytics is required.

Description:

The Meta Marketing Analytics Professional Certificate is designed to provide learners with the skills needed to analyze data, measure the effectiveness of marketing campaigns, and make data-driven marketing decisions. This program equips learners with practical experience using key marketing analytics tools and platforms, preparing them for a career in digital marketing and analytics. Learners will explore key concepts such as data collection, data visualization, marketing strategies, and attribution modeling, with a focus on real-world applications using Meta's marketing platforms.

List of courses for the **Meta Marketing Analytics** Professional Certificate from Coursera with their durations:

1. Marketing Analytics Foundation (11 hours)
2. Introduction to Data Analytics (17 hours)
3. Data Analysis with Spreadsheets and SQL (25 hours)
4. Python Data Analytics (21 hours)
5. Statistics Foundations (21 hours)
6. Data Analytics Methods for Marketing (12 hours)
7. Marketing Analytics with Meta (13 hours)
8. Meta Marketing Science Certification Exam

MD4259:Akamai Network Engineering

Prerequisites:

1. Basic understanding of computer networking and internet protocols (TCP/IP, DNS, HTTP).
2. Familiarity with cloud computing and content delivery concepts.
3. Prior experience with network administration or a similar technical role is helpful but not mandatory.

Description:

The Akamai Network Engineering course is designed to provide learners with comprehensive knowledge of Akamai's content delivery network (CDN) architecture, edge computing, and internet performance optimization techniques. The course covers key concepts in networking, CDN technologies, traffic management, load balancing, and security protocols to ensure efficient and secure web traffic delivery. By the end of the course, learners will gain practical experience in implementing and managing Akamai's network solutions, making them proficient in addressing the challenges of modern internet infrastructure.

List of courses for the Akamai Network Engineering program without the ratings:

1. Operating Systems Fundamentals (30 hours)
2. Networking Fundamentals (26 hours)
3. Managing Relational Databases (17 hours)
4. Python Scripting Fundamentals (33 hours)
5. Introduction to IT Security (22 hours)

MD4260:Google Project Management

Prerequisites:

- Basic computer literacy and familiarity with productivity tools (like Google Workspace or Microsoft Office) is helpful.

Description

The Google Project Management Professional Certificate equips learners with essential project management skills that are in high demand across various industries. The course covers project planning, execution, and management, focusing on agile methodologies, stakeholder communication, risk management, and tools like Gantt charts and project management software. This program is ideal for individuals looking to start or enhance their careers in project management without prior experience. By completing this course, learners will gain practical knowledge and hands-on experience in managing projects efficiently, preparing them for roles like Project Coordinator, Project Manager, or Scrum Master.

List of courses for the Google Project Management Professional Certificate with their durations:

1. Foundations of Project Management (18 hours)
2. Project Initiation: Starting a Successful Project (23 hours)
3. Project Planning: Putting It All Together (33 hours)
4. Project Execution: Running the Project (30 hours)
5. Agile Project Management (26 hours)
6. Capstone: Applying Project Management in the Real World

FF No.: 654

MD4266:SAP Technology Consultant

Prerequisites:

1. Basic understanding of enterprise resource planning (ERP) concepts.
2. Familiarity with IT systems and database management is recommended.

Description:

The SAP Technology Consultant Professional Certificate is designed to prepare learners for a career in SAP consultancy, focusing on the technical aspects of SAP systems. The course covers key topics like SAP architecture, SAP HANA, system configuration, integration, and cloud solutions. Learners will gain hands-on experience with SAP technologies, learning how to implement, configure, and manage enterprise systems effectively. The program prepares learners for roles in enterprise resource planning (ERP) system management, SAP consulting, and technical implementation. By the end of the course, learners will have the foundational skills to work as SAP Technology Consultants, aiding organizations in optimizing their SAP systems for business processes.

List of courses for the SAP Technology Consultant program with their durations:

1. SAP Professional Fundamentals (14 hours)
2. Understanding the Enterprise Systems Environment (11 hours)
3. SAP Customer Engagement and Discovery (13 hours)
4. Designing an SAP Solution (13 hours)
5. Implementing an SAP Solution (14 hours)
6. SAP Technology Consultant Hands-on Project (18 hours)
7. Becoming an SAP Professional (8 hours)

MD4267:AWS Cloud Technology Consultant**Prerequisites:**

1. Basic understanding of IT systems and networking.
2. Familiarity with cloud computing concepts is recommended but not required.
3. Knowledge of Python or any programming language is beneficial but not mandatory.

Description:

The AWS Cloud Technology Consultant Professional Certificate equips learners with the foundational skills needed to excel as cloud technology consultants specializing in Amazon Web Services (AWS). This program covers key aspects of cloud architecture, AWS workload support, DevOps, automation, and data analytics. Learners gain hands-on experience working with AWS services, developing Python-based applications, managing cloud infrastructures, and providing technical consulting. Graduates will be well-prepared for roles such as cloud consultant, AWS support technician, and cloud project manager.

Course Breakdown and Duration:

1. Introduction to Information Technology and AWS Cloud (6 hours)
2. AWS Cloud Technical Essentials (26 hours)
3. Providing Technical Support for AWS Workloads (7 hours)
4. Developing Applications in Python on AWS (9 hours)
5. Skills for Working as an AWS Cloud Consultant (10 hours)
6. DevOps on AWS and Project Management (8 hours)
7. Automation in the AWS Cloud (8 hours)
8. Data Analytics and Databases on AWS (9 hours)
9. Capstone: Following the AWS Well Architected Framework (11hours)

MD4268:Google UX Design

Prerequisites:

- Basic computer skills are helpful.

Description:

The Google UX Design Professional Certificate prepares learners to become job-ready UX designers. This program provides a thorough understanding of the user experience design process, including research, wireframing, prototyping, and testing. Learners will gain hands-on experience using industry-standard tools like Figma and Adobe XD, as well as conduct user research to create effective and impactful designs. By the end of the course, learners will be able to develop intuitive, accessible, and aesthetically pleasing user interfaces, ready to launch their careers as UX designers.

Course Breakdown and Duration:

1. Foundations of User Experience (UX) Design (19 hours)
2. Start the UX Design Process: Empathize, Define, and Ideate (21 hours)
3. Build Wireframes and Low-Fidelity Prototypes (17 hours)
4. Conduct UX Research and Test Early Concepts (20 hours)
5. Create High-Fidelity Designs and Prototypes in Figma (29 hours)
6. Build Dynamic User Interfaces (UI) for Websites (22 hours)
7. Design a User Experience for Social Good & Prepare for Jobs (27 hours)

FF No.: 654

MD4244: Meta Database Engineer**Prerequisites**

1. Basic Database Knowledge: Familiarity with relational databases and SQL.
2. Programming Skills: Understanding of at least one programming language like Python or JavaScript.
3. Problem-Solving Skills.

Course Description

The Meta Database Engineer course is designed to provide students with the skills needed to design, implement, and manage large-scale databases. This course covers topics like database architecture, advanced SQL, data modelling, and database performance optimization. It prepares students for roles like Database Engineer, Data Architect, and Database Administrator.

Certification & Courses

Upon completion, students will receive a Professional Certificate in Database Engineering. The course includes the following modules:

1. Introduction to Database Systems Duration: 14 hours
2. SQL for Database Management Duration: 18 hours
3. Advanced SQL for Data Engineers Duration: 22 hours
4. Data modelling and Database Design Duration: 24 hours
5. Database Optimization and Tuning Duration: 20 hours
6. NoSQL Databases Duration: 16 hours
7. Cloud Databases and Distributed Systems Duration: 25 hours
8. Capstone Project: Designing a Large-Scale Database Duration: 30 hours

ET4230: NATURAL LANGUAGE PROCESSING

Course Prerequisites:

1. Probability and statistics.
2. Linear Algebra
3. Python programming language

Course Objectives:

1. Learn fundamentals of Text processing
2. Understand the different Language Models
3. Implement POS tagging
4. Implement Text classification
5. Implement sentiment analysis
6. Implement Machine translation

Credits: 2

Teaching Scheme Theory: 2 Hours/Week

Course Relevance:

Natural Language Processing is a branch of artificial intelligence that deals with the interaction between computers and humans using the natural language. The common applications of NLP involves, Google translator, Word Processors such as Microsoft, Interactive Voice Response, Personal assistant applications.

SECTION-1

Text Processing: Basics, Empirical Laws, Spelling Correction: Edit Distance, N-Gram Language Models, Basic Smoothing, POS Tagging, Hidden Markov Models for POS Tagging, Viterbi Decoding for HMM and Parameter Learning, Maximum Entropy Models.

SECTION-2

Maximum Entropy Models, Name entity recognition, Syntax, Dependency Grammars and Parsing, Semantic, text classification, sentiment analysis, Machine Translation, Question Answering.

List of Course Seminar Topics:

1. SemEval-2016 task 4: Sentiment analysis in Twitter
2. Modelling user attitudes using hierarchical sentiment-topic model
3. Multilingual dynamic topic model
4. Document-Level Text -classification Using Single-Layer Multisize Filters Convolutional Neural Network
5. Twitter Storytelling Generator Using Latent Dirichlet Allocation and Hidden Markov Model POS-TAG (Part-of-Speech Tagging)

6. Part-of-speech Tagging and Named Entity Recognition Using Improved Hidden Markov Model and Bloom Filter
7. Part of speech tagging for Twitter conversations using Conditional Random Fields model
8. A system for named entity recognition based on local grammars
9. A Maximum-Entropy Segmentation Model for Statistical Machine Translation
10. Mobile embodied conversational agent for task specific applications.

List of Course Group Discussion Topics:

1. Smoothing Technique
2. N-gram models
3. POS tagging
4. Ambiguities in NLP
5. Challenges in NLP
6. Challenges in designing Language Translators
7. Challenges in designing text classification
8. Challenges in designing sentiment analysis
9. Challenges in designing Question and Answering system
10. Challenges in designing text summarization

List of Home**Assignments: Design:**

1. POS tagging using HMM
2. Build Chatbot
3. Summarization of customers reviews
4. Social media Information extraction
5. SMS spam classification

Case Study:

1. Hiring and recruitment
2. Advertising
3. Healthcare
4. Market intelligence
5. Sentiment analysis

Blog:

1. Social media Information extraction
2. Name Prediction in Multiple Languages using Recurrent Neural Networks
3. Text Classification using Sentiment Analysis
4. Image Caption Generator
5. gender identification in Marathi names

Surveys

1. POS tagging techniques
2. SMS and email spam classification
3. Categorization of sport articles
4. Machine translation Techniques
5. Name entity recognition methods

Assessment Scheme:

Mid Semester Examination - 30 Marks

Home Assignment - 10 Marks

End Semester Examination - 30 Marks

Comprehensive Viva Voce - 30 Marks

Textbooks:

1. Jurafsky & Martin "Speech and Language Processing" Prentice Hall, 2000
2. Akshar Bharati, Rajeev Sangal and Vineet Chaitanya: "Natural Language Processing: Paninian Perspective", Prentice-Hall of India, New Delhi, 1995.

Reference Books:

1. Steven Bird, Ewan Klein, and Edward Loper "Natural Language Processing"

MOOCS Links and additional reading material:

1. <https://nptel.ac.in/courses/106/105/106105158/>
2. <https://nptel.ac.in/courses/106/106/106106211/>

Course Outcomes: The student will be able to –

1. Have broad understanding of the field of natural language processing.
2. Get acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, and pragmatics.
3. Apply mathematical models and algorithms in applications of NLP.
4. Design and implementation issues in various NLP applications such as information retrieval and information extraction.
5. Demonstrate crucial ideas in linguistics (e.g., syntax, semantics, pragmatics), artificial intelligence (e.g., knowledge representation), and machine learning (e.g., deep learning) to natural language processing.
6. Identify one of the contemporary (sub) problems of natural language processing and implement, in the form of a complete computer program as a possible solution to it.

CO attainment levels

- | | | |
|-----------------|-----------------|-----------------|
| 1. CO1- Level 3 | 2. CO2- Level 3 | 3. CO3- Level 4 |
| 4. CO4- Level 4 | 5. CO5- Level 4 | 6. CO6- Level 5 |

Job Mapping:

Natural Language engineers, Data Scientist and Algorithm Architect with industries in domains Media & Entertainment, Healthcare and Finance.

ET4232: DEEP LEARNING**Course Prerequisites:**

Linear algebra, probability theory and statistics, Digital signal processing, Computer vision

Course Objectives:

1. To present the mathematical, statistical and computational concepts for stable representations of high-dimensional data, such as images, text
2. To introduce NN and techniques to improve network performance
3. To introduce Convolutional networks
4. To introduce Sequential models of NN
5. To build deep nets with applications to solve real world problem

Credits: 2**Teaching Scheme Theory: 2 Hours/Week****Course Relevance:**

Deep learning is revolutionizing the technology and business world today. It is a subfield of machine learning concerned with algorithms to train computers to perform tasks by exposing neural networks to large amounts of data, its analysis and prediction. It is an incredibly powerful field with capacity to execute feature engineering on its own, uses multiple neural network layers to extract patterns from the data. Top applications of Deep learning involve, self-driving cars, natural language processing, robotics, finance, and healthcare.

SECTION-1

Foundations of neural networks and deep learning, Logistic regression as a neural network, different activation function, logistic regression cost function, logistic regression gradient descent, vectorizing logistic regression, forward and backward propagation, Techniques to improve neural networks: regularization and optimizations, hyperparameter tuning, batch normalization, data augmentation, deep learning frameworks, Implementation of neural network for a case study.

SECTION-2

Convolutional Neural Networks, padding, strided convolution, pooling layers, convolutional implementation of sliding windows, Applications: object classification, object detection, face verification. ResNet, inception networks, bounding boxes, anchor boxes. Sequence modelling: recurrent nets, architecture, vanishing and exploding gradient problem, Applications & use cases.

List of Course Seminar Topics:

1. Deep learning for Stock Market Clustering
2. Application of Deep Networks in health care
3. Credit card fraud detection
4. Classification of skin cancer with deep neural networks
5. ALEXNET
6. VCGNET

7. Accelerating Deep Network Training by Reducing Internal Covariate Shift
8. Deep learning applications for predicting pharmacological properties of drugs
9. GAN (Generalised Adversarial network)
10. Auto encoders
11. LSTM

List of Course Group Discussion Topics:

1. Recurrent or Recursive Networks for sequential Modelling?
2. Initializing network weights vs performance
3. Difficulty of training deep feedforward neural networks
4. Hyperparameter tuning: Is there a rule of thumb?
5. Problem of overfitting: How to handle?
6. Which cost function: Least squared error or binary cross entropy?
7. How to tackle with loss of corner information in CNN
8. Need of hundred classifiers to solve real world classification problem
9. Which optimization: Batch gradient descent or stochastic gradient descent
10. Activation functions: Comparison of trends
11. Remedy of problem of vanishing gradient and exploding gradient in RNN

List of Home**Assignments: Design:**

1. Deep learning for library shelf books identification
2. Development of control system for fruit classification based on convolutional neural networks
3. Classifying movie review using deep learning
4. Sentiment analysis of the demonetization of economy 2016 India
5. Predicting Students Performance in Final Examination

Case Study:

1. Deep learning for security
2. Bag of tricks for efficient text classification
3. Convolutional Neural Networks for Visual Recognition
4. Deep Learning for Natural Language Processing
5. Scalable object detection using deep neural networks

Blog:

1. Brain tumour segmentation with deep neural networks
2. Region-based convolutional networks for accurate object detection and segmentation.
3. Human pose estimation via deep neural networks
4. Content Based Image Retrieval
5. Visual Perception with Deep Learning
6. Music genre classification system

Surveys:

1. Machine translation using deep learning - survey
2. Shaping future of radiology using deep learning
3. Training Recurrent Neural Networks
4. Text generation with LSTM
5. Deep learning applications in Biomedicine

Assessment Scheme:

Mid Semester Examination - 30

Marks Home Assignment - 10 Marks

End Semester Examination - 30 Marks

Comprehensive Viva Voce - 30 Marks

Text Books:

1. Goodfellow, I., Bengio, Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. C., M., Pattern Recognition and Machine Learning, Springer, 2006.

Reference Books:

1. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
2. Golub, G., H., and Van Loan, C., F., Matrix Computations, JHU Press, 2013.
3. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

MOOCS Links and additional reading material:

1. www.nptelvideos.in
2. <https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs11>
3. <https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs50>

Course Outcomes: Students will be able to

1. Demonstrate understanding of a logistic regression model, structured as a shallow Neural network.
2. Build and train a deep Neural Network.
3. Apply techniques to improve neural network performance.
4. Demonstrate understanding of functionality of all layers in a convolutional neural network.
5. Implement convolutional networks for image recognition/classification tasks.
6. Demonstrate Understanding of Recurrent nets and their applications.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	2	3	1	-	0	2	1	1	2	1	1
2	3	3	3	2	3	2	-	0	2	1	1	2	3	3
3	3	3	3	3	3	2	-	0	2	1	1	2	3	3
4	3	3	3	3	3	2	-	0	2	1	1	2	3	3
5	3	3	3	3	3	2	-	0	2	1	1	2	3	3
6	3	3	3	3	3	2	-	0	2	1	1	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels

CO1 - Level 3

CO 2 - Level 3

CO 3 - Level 5

CO 4 - Level 4

CO 5 - Level 5

CO 6 - Level 4

Future Courses Mapping:

Advanced course on Deep learning including Autoencoders and Boltzmann machines, Reinforcement Learning.

Job Mapping:

Deep learning engineer, Data Scientist and Algorithm Architect with industries in domains Healthcare, Industrials & Energy, Automobiles, Finance & Insurance, Human Resources, Agriculture, Cybersecurity, Ad & Marketing, Media and Entertainment, Government, Defense

FF No. : 654

ET 4292: MODERN DIGITAL COMMUNICATION TECHNIQUES**Teaching Scheme : Theory: 2 Hours/Week****Credits:.2****Section 1: Topics/Contents**

Introduction to digital communication systems, Source Coding, Characterization of Communication Signals & Systems, Signal space Representation, Representation of Memory less Modulation Methods, Nonlinear modulation methods

Section2: Topics/Contents

Optimal receivers of AWGN, Receiver for non-ideal channel, Probability of error of different modulation schemes, Fundamentals of estimation and detection theory used in digital communication, Carrier phase and symbol timing synchronization techniques, Channel estimation and equalization techniques, Power Adaptation methods for coloured noise channel

Text Books:

1. Digital Communications by John G. Proakis
2. Digital Communications by Bernard Sklar
3. Digital Communications by Robert Gallager
4. Digital Communications by Simon Haykin
5. Modern Digital and Analog communications by B.P. Lathi.

ET4230: VLSI Design Flow: RTL To GDS

Teaching Scheme : **Theory:** 2 Hours/Week

Credits: 2

ABOUT THE COURSE:

This course covers the entire RTL to GDS VLSI design flow, going through various stages of logic synthesis, verification, physical design, and testing. Besides covering the fundamentals of various design tasks, this course will develop skills in modern chip design with the help of activities and demonstrations on freely available CAD tools. This course will enhance the employability of the students and will make them ready to undertake careers in the semiconductor industry.

PREREQUISITES:

Basic Course on Digital Circuits (typically taught in the first/second year of UG Program)

INDUSTRY SUPPORT:

The course develops skills to use design automation tools for chip designing. The course will be valued by companies working on semiconductors, such as Qualcomm, Intel, Texas Instruments, NXP, ST Microelectronics, Micron, IBM, Cadence, Synopsys, Siemens, ARM, AMD, NVidia, Apple, and Google.

Course layout

- Week 1: Basic Concepts of Integrated Circuit: Structure, Fabrication, Types, Design Styles, Designing vs. Fabrication, Economics, Figures of Merit Overview of VLSI Design Flow: Design Flows and Abstraction; Pre-RTL Methodologies: Hardware-software Partitioning, SoC Design, Intellectual Property (IP) Assembly, Behavioural Synthesis.
- Week 2: Overview of VLSI Design Flow: RTL to GDS Implementation: Logic Synthesis, Physical Design; Verification and Testing; Post-GDS Processes.
- Week 3: Hardware modelling: Introduction to Verilog Functional verification using simulation: testbench, coverage, mechanism of simulation in Verilog.
- Week 4: RTL Synthesis: Verilog Constructs to Hardware Logic Optimization: Definitions, Two-level logic optimization
- Week 5: Logic Optimization: Multi-level logic optimization, FSM Optimization Formal Verification: Introduction, Formal Engines: BDD, SAT Solver
- Week 6: Formal Verification: Model Checking, Combinational Equivalence Checking Technology Library: Delay models of Combinational and Sequential Cells
- Week 7: Static Timing Analysis: Synchronous Behavior, Timing Requirements, Timing Graph, Mechanism, Delay Calculation, Graph-based Analysis, Path-based Analysis, Accounting for Variations
- Week 8: Constraints: Clock, I/O, Timing Exceptions Technology Mapping Timing-driven Optimizations
- Week 9: Power Analysis, Power-driven Optimizations Design for Test: Basics and Fault Models, Scan Design Methodology
- Week 10: Design for Test: ATPG, BIST Basic Concepts for Physical Design: IC Fabrication, FEOL, BEOL, Interconnects and Parasitics, Signal Integrity, Antenna Effect, LEF files.
- Week 11: Chip Planning: Partitioning, Floor planning, Power Planning Placement: Global Placement, Wirelength Estimates, Legalization, Detailed Placement, Timing-driven Placement, Scan Cell Reordering, Spare Cell Placement

Week 12: Clock Tree Synthesis: Terminologies, Clock Distribution Networks, Clock Network Architectures, Useful Skews Routing: Global and Detailed, Optimizations Physical Verification: Extraction, LVS, ERC, DRC, ECO and Sign-off.

Books and references

1. Sneha Saurabh, "Introduction to VLSI Design Flow", Cambridge University Press, 2023 (expected) <https://www.cambridge.org/highereducation/books/introduction-to-vlsi-design-flow/93E6832E63FE6B795181D6D67B552333#overview>
2. M.J.S. Smith, "Application-specific integrated circuits", Addison-Wesley, 1997
3. L. Lavagno, I. L. Markov, G. Martin, and L. K. Scheffer (Editors), "Electronic Design Automation for IC Implementation, Circuit Design, and Process Technology", CRC Press, 2016
4. S. Palnitkar, "Verilog HDL: a guide to digital design and synthesis", Pearson Education India, 2003
5. J. Bhasker and R. Chadha, "Static timing analysis for nanometer designs: A practical approach", Springer Science Business Media, 2009
6. G. D. Micheli, "Synthesis and optimization of digital circuits", McGraw-Hill Higher Education, 1994
7. M. Bushnell and V. Agrawal, "Essentials of electronic testing for digital, memory and mixed-signal VLSI circuits", Springer Science & Business Media, 2004.

ET4432: Digital IC Design

Teaching Scheme : Theory: 2 Hours/Week

Credits: 2

This is a most fundamental Digital Circuit Design course for pursuing a major in VLSI. We do not deal with any Verilog coding during this course and instead discuss transistor level circuit design concepts in detail course are:

Course Objectives:

- Characterize the key delay quantities of a standard cell
- Evaluate power dissipated in a circuit (dynamic and leakage)
- Design a circuit to perform a certain functionality with specified speed
- Identify the critical path of a combinational circuit
- Convert the combinational block to pipelined circuit
- Calculate the maximum (worst case) operating frequency of the designed circuit

Course layout

Week 1: The CMOS Inverter construction and Voltage Transfer Characteristics
Week 2: Resistance and Capacitance and transient response.
Week 3: Dynamic, Short Circuit and Leakage power – Stacking Effect.
Week 4: Combinational Circuit Design and capacitance
Week 5: Parasitic Delay, Logical Effort and Electrical Effort Week 6: Gate sizing and Buffering
Week 7: Asymmetric gate, Skewed gates, Ratio'ed logic
Week 8: Dynamic Gates and Domino logic and Static Timing Analysis
Week 9: Sequential circuits and feedback. Various D flip flop circuits – Static and Dynamic
Week 10: Setup and Hold Time measurement. Timing analysis of latch/ flop-based systems
Week 11: Adders – Mirror adder, Carry Skip adder, Carry Select adder, Square Root adder
Week 12: Multipliers – Signed and Unsigned arithmetic, Carry Save Multiplier implementation

ET4206: Digital Communication using GNU Radio**Teaching Scheme :****Theory: 2 Hours/Week****Credits: 2****ABOUT THE COURSE:**

This course covers the fundamentals of Digital Communications, and explores the building blocks of modern communication systems ranging from smartphones to optical fibres. Using the open source GNU Radio software, students will be able to design, simulate and analyze communication system models with ease.

REREQUISITES: Signals and Systems, Probability and random processes**Course layout**

Week 1: The GNU Radio Signal Model
Week 2: Complex baseband model and Analog modulation
Week 3: Transmission spectrum, bandwidth and pulse design
Week 4: Digital modulation, detection and noise
Week 5: Digital modulation, detection and noise (contd.)
Week 6: Symbol errors and bit errors
Week 7: Matched filtering, synchronization and channel estimation
Week 8: Matched filtering, synchronization and channel estimation (contd.)
Week 9: Digital Equalization
Week 10: Channels with inter-symbol interference and OFDM
Week 11: Introduction to binary error control coding
Week 12: Miscellaneous topics on GNU Radio and Digital Communication

Books and references

1. Fundamentals of Digital Communication, Upamanyu Madhow
2. Principles of Digital Communication, Robert Gallager
3. Digital Communications. Fifth Edition. John G. Proakis.

FF No.:654

ET4207: MAJOR PROJECT**Teaching Scheme** Lab: 20 Hours/Week**Credits:** 9**Course Prerequisites:** Basic Electronics, Physics, Engineering Mathematics, Statistics, Programming Languages**Course Objectives:**

1. To develop critical thinking and problem-solving ability by exploring and proposing solutions to realistic/social problems.
2. To Evaluate alternative approaches, and justify the use of selected tools and methods,
3. To emphasize learning activities those are long-term, inter-disciplinary and student-centric.
4. To engage students in rich and authentic learning experiences.
5. To provide every student the opportunity to get involved either individually or as a group to develop team skills and learn professionalism.
6. To develop entrepreneurship attitude

Course Relevance:

Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Students can solve socially relevant problems using various technologies from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Défense, Education, Smart City, Smart Energy and Swachha Bharat Abhiyan. Students can be evaluated for higher order skills of Blooms taxonomy like ‘analyze, design and apply’. This course is capable of imparting hands-on experience and self-learning to the students which will help them throughout their career. It emphasizes on learning by doing for a complete project life cycle, requirement analysis, realistic planning and transforming ideas into product. This is a step ahead in line with national policy of Atmanirbhar Bharat.

Major-Project Guidelines:

- The Major-project is a team activity having 3-4 students in a team. This is electronic product design work
- The Major-project may be a complete hardware or a combination of hardware and software work. The software part in Major-project should be less than 50% of the total work.
- After interactions with course instructor and based on comprehensive literature survey / requirement analysis, the student shall identify the title and define objectives of the Major-project.
- Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
- The student is expected to meet the timelines on design, development and testing of the proposed work.
- The student is instructed to have discussion with faculty instructor on standard practices used for electronic circuit / product design, converting the circuit design into a complete electronic product, PCD design using suitable simulation software, estimation of power budget analysis of the product, front panel / user interface design and mechanical aspects of the product.
- Completed Major-project and documentation in the form of Major-project report is to be submitted at the end of the semester. The project group will deliver the presentation of the Project Work which will be assessed by the panel.

Note: The student can identify a technological problem in the following sectors (The list is open ended):

1. Social relevance (Agriculture/ Water Management / Transportation / Waste Management / etc.)
2. Renewable Energy (Solar / Wind / Waves / etc.)
3. Green Technology (Carbon footprint / Pollution control / etc)
4. Assistive System for Weaker People (Blind / Deaf / Handicap assistive)
5. Security Enhancement (Cyber Security / Forensics)
6. Government Projects (Smart City / Smart Grid / Smart Gram / Swach Bharat / etc.)

Core Technology domains identified for E&TC Engg are as below. However, this list can be extended as per the need of project and multidisciplinary approach

1. VLSI Design
2. Embedded System
3. Signal Processing
4. Communication Engineering
5. Machine Learning

Assessment Scheme:

Mid Semester Examination - 30 Marks

Semester Examination - 70 Marks

MOOCS Links and additional reading material:

www.nptelvideos.in <https://worldwide.espacenet.com/>

Course Outcomes:

1. Review the literature to formulate problem statement to solve real world problems.
2. Apply knowledge of technology and modern tools to design solution considering sustainability and environmental issues.
3. Manage project ethically as team member/ lead.
4. Demonstrate effectively technical report/ research paper/ prototype/ patent.

CO PO Map

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
1	3	3	2	3	1	0	0	3	3	3	1	2	2	2
2	3	3	3	3	3	3	3	3	3	2	1	2	3	3
3	1	1	1	1	1	2	0	3	3	3	3	2	1	1
4	3	1	1	1	0	0	0	3	1	3	3	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels

CO1-Level 3

CO2- Level 4

CO3- Level 3

CO4- Level 4

FF No. 654

ET4208: MAJOR PROJECT**Teaching Scheme** Lab: 20 Hours/Week**Credits:** 10**Course Prerequisites:** Basic Electronics, Physics, Engineering Mathematics, Statistics, Programming Languages**Course Objectives:**

1. To develop critical thinking and problem-solving ability by exploring and proposing solutions to realistic/social problems.
2. To Evaluate alternative approaches, and justify the use of selected tools and methods,
3. To emphasize learning activities those are long-term, inter-disciplinary and student-centric.
4. To engage students in rich and authentic learning experiences.
5. To provide every student the opportunity to get involved either individually or as a group to develop team skills and learn professionalism.
6. To develop entrepreneurship attitude

Course Relevance:

Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Students can solve socially relevant problems using various technologies from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Defense, Education, Smart City, Smart Energy and Swaccha Bharat Abhiyan. Students can be evaluated for higher order skills of Blooms taxonomy like 'analyze, design and apply'. This course is capable of imparting hands-on experience and self learning to the students which will help them throughout their career. It emphasizes on learning by doing for a complete project life cycle, requirement analysis, realistic planning and transforming ideas into product. This is a step ahead in line with national policy of Atmanirbhar Bharat.

Major-Project Guidelines:

- The Major-project is a team activity having 3-4 students in a team. This is electronic product design work
- The Major-project may be a complete hardware or a combination of hardware and software work. The software part in Major-project should be less than 50% of the total work.
- After interactions with course instructor and based on comprehensive literature survey / requirement analysis, the student shall identify the title and define objectives of the Major-project.
- Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
- The student is expected to meet the timelines on design, development and testing of the proposed work.
- The student is instructed to have discussion with faculty instructor on standard practices used for electronic circuit/product design, converting the circuit design into a complete electronic product, PCD design using suitable simulation software, estimation of power budget analysis of the product, front panel / user interface design and mechanical aspects of the product.
- Completed Major-project and documentation in the form of Major-project report is to be submitted at the end of the semester. The project group will deliver the presentation of the Project Work which will be assessed by the panel.

Note: The student can identify a technological problem in the following sectors (The list is open ended):

1. Social relevance (Agriculture/ Water Management / Transportation / Waste Management / etc.).
2. Renewable Energy (Solar / Wind / Waves / etc.)
3. Green Technology (Carbon footprint / Pollution control / etc)
4. Assistive System for Weaker People (Blind / Deaf / Handicap assistive)
5. Security Enhancement (Cyber Security / Forensics)
6. Government Projects (Smart City / Smart Grid / Smart Gram / Swach Bharat / etc.)

Core Technology domains identified for E&TC Engg are as below. However, this list can be extended as per the need of project and multidisciplinary approach

1. VLSI Design
2. Embedded System
3. Signal Processing
4. Communication Engineering
5. Machine Learning

Assessment Scheme:

Mid Semester Examination - 30 Marks

End Semester Examination - 70 Marks

MOOCS Links and additional reading material:

www.nptelvideos.in <https://worldwide.espacenet.com/>

Course Outcomes:

1. Review the literature to formulate problem statement to solve real world problems.
2. Apply knowledge of technology and modern tools to design solution considering sustainability and environmental issues.
3. Manage project ethically as team member/ lead.
4. Demonstrate effectively technical report/ research paper/ prototype/ patent.

CO PO Map

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
1	3	3	2	3	1	0	0	3	3	3	1	2	2	2
2	3	3	3	3	3	3	3	3	3	2	1	2	3	3
3	1	1	1	1	1	2	0	3	3	3	3	2	1	1
4	3	1	1	1	0	0	0	3	1	3	3	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels

CO1-Level 3

CO2- Level 4

CO3- Level 3

CO4- Level 4

ET4431: DESIGN THINKING-7**Teaching Scheme Tut: 1 Hour/Week****Credits: 1****Course Objectives:**

To provide ecosystem for students and faculty for paper publication and patent filing

Contents:

Structure of The paper

Journal List (Top 50 Journals)

Selection of the journal

Use of various online journal selection tools

Plagiarism checking

Improving contents of the paper

Patent drafting Patent search Filing of patent

Writing answers to reviewer questions

Modification in manuscript

Checking of publication draft

Assessment Scheme:

Publication of paper or patent

CO- PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	1	1	0	0	0	0	0	0	1	2	2
2	1	1	1	1	1	0	0	0	0	0	0	1	0	1
3	2	2	3	3	2	2	1	2	2	3	0	1	2	1
4	3	3	3	3	3	2	1	2	2	3	1	1	0	0
5	1	1	1	1	1	0	0	0	0	0	0	1	0	1
6	2	2	2	2	2	2	1	3	2	3	3	1	0	1

ET4251: INDUSTRY INTERNSHIP
ET4222: RESEARCH INTERNSHIP
ET4250: PROJECT INTERNSHIP
ET4252: INTERNATIONAL INTERNSHIP

Credits: 1

Teaching Scheme Lab: 32 Hours/Week

Industry/ Research/ Global Internship is an educational innovation seeking to link industry experience with university instruction. Internship enables students to acquire learning by applying the knowledge and skills they possess in open-ended real-life situations of a rapidly changing needs and challenges in a professional workplace. Internship provides the required platform for experiential and cooperative learning and education, by providing students with an opportunity to work on industry assignments, under the guidance of professional experts and under the supervision of faculty. Students are offered 18 weeks industry internship to enhance their skillset and get exposure of industry front. Internship facilitates and promotes partnership and intellectual exchange between academia and industry.

Course Outcomes:

1. Acquire practical knowledge within the chosen area of technology for project development.
2. Identify, analyze, formulate and develop projects with a comprehensive and systematic approach.
3. Cooperate with diverse teams and effectively communicate with all the stake holders.
4. Produce solutions within the technological guidelines and standards.
5. Develop effective communication skills for presentation of project related activities.

Assessment Scheme:

Mid Semester Examination - 30 Marks

End Semester Examination - 70 Marks

CO PO Map:

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels:**CO1:-** Level 1**CO2:-** Level 1**CO3:-** Level 1**CO4:-** Level 1**CO5:-** Level 1

ET4401: INDUSTRY INTERNSHIP
ET4403: RESEARCH INTERNSHIP
ET4404: PROJECT INTERNSHIP
ET4402: INTERNATIONAL INTERNSHIP

Credits: 16

Teaching Scheme Lab: 32 Hours/Week

Industry/ Research/ Global Internship is an educational innovation seeking to link industry experience with university instruction. Internship enables students to acquire learning by applying the knowledge and skills they possess in open-ended real-life situations of a rapidly changing needs and challenges in a professional workplace. Internship provides the required platform for experiential and cooperative learning and education, by providing students with an opportunity to work on industry assignments, under the guidance of professional experts and under the supervision of faculty. Students are offered 18 weeks industry internship to enhance their skillset and get exposure of industry front. Internship facilitates and promotes partnership and intellectual exchange between academia and industry.

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Assessment Scheme:

Mid Semester Examination - 30 Marks

End Semester Examination - 70 Marks

CO PO Map:

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels:**CO1:-** Level 1**CO2:-** Level 1**CO3:-** Level 1**CO4:-** Level 1**CO5:-** Level 1