Faculty of Technology & Engineering
Chandubhai S. Patel Institute of Technology
Master of Technology Programme
Computer Engineering
(M.Tech. CE)

ACADEMIC REGULATIONS & SYLLABUS

(Choice Based Credit System)

Academic Year: 2023-2024

Chandubhai S. Patel Institute of Technology

Vision

To become a leading institute for creation and dissemination of knowledge in the frontiers of Technology.

Mission

To prepare world-class technocrats and researchers and facilitate enhanced deployment of technology for betterment of lives.

U & P U. Patel Department of Computer Engineering

Vision

To emerge as an eminent research driven entity in Education in the field of computer engineering to meet the needs of the fast paced modern society.

Mission

To develop competent and responsible Computer Professionals for amelioration of the society at large.

THE PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1	Apprise In-depth knowledge and sustainable learning leading to innovation, permutation, modernization and research in multidisciplinary fields to fulfil global interest.
PEO2	To enable graduates to acquire research and development competence to sustain in academia as well as industry.

PROGRAM OUTCOMES (POs)

At the end of the program, the student will be able to:

PO1	An ability to independently carry out research /investigation and development work to solve practical problems
PO2	An ability to write and present a substantial technical report/document
PO3	Students would be able to work individually and in the team for betterment of the society.

PROGRAM SPECIFIC OUTCOMES (PSOs)

At the end of the program, the student will be able to:

PSO1	Use research-based knowledge and tools for the analysis and interpretation of data to synthesize information for obtaining valid conclusions.
PSO2	Excellent adaptability to function in multi-disciplinary work environment, good interpersonal skills in appreciation of professional ethics and societal responsibilities.

FACULTY OF TECHNOLOGY AND ENGINEERING
ACADEMIC REGULATIONS
Master of Technology Programmes
Choice Based Credit System

To ensure uniform system of education, duration of undergraduate and post graduate programmes, eligibility criteria for and mode of admission, credit load requirement and its distribution between course and system of examination and other related aspects, following academic rules and regulations are recommended.

1. System of Education

Choice based Credit System with Semester pattern of education shall be followed across The Charotar University of Science and Technology (CHARUSAT) both at Undergraduate and Master's levels. Each semester will be at least 90 working day duration. Every enrolled student will be required to take a course works in the chosen subject of specialization and also complete a project/dissertation if any. Apart from the Programme Core courses, provision for choosing University level electives and Programme/Institutional level electives are available under the Choice based credit system.

2. Duration of Programme

(i)	Postgraduate programme	(M.Tech)
	Minimum	4 semesters (2 academic years)
	Maximum	6 semesters (3 academic years)

3. Eligibility for admissions

Minimum second class is required for admission into M.Tech programme.

4. Mode of admissions

Admission to M.Tech. programme will be as per Government of Gujarat guidelines. The eligibility norms require a condition to have a bachelor degree in related field and marks obtained in qualifying exam (like GATE) or common entrance test of Government of Gujarat. The detail eligibility norms will be as per Government of Gujarat guidelines.

5. Programme structure and Credits

As per annexure – I attached

6. Attendance

6.1 All activities prescribed under these regulations and listed by the course faculty members in their respective course outlines are compulsory for all students pursuing the courses. No exemption will be given to any student from attendance except on account of serious personal illness or accident or family calamity that may genuinely prevent a student from attending a particular session or a few sessions. However, such unexpected absence from classes and other activities will be required to be condoned by the Dean/Principal.

6.2 Student attendance in a course should be 80%.

7 Course Evaluation

7.1 The performance of every student in each course will be evaluated as follows:

7.1.1 Internal evaluation by the course faculty member(s) based on continuous assessment, for 30% of the marks for the course; and

7.1.2 Final examination by the University through written paper or practical test or oral test or presentation by the student or a combination of any two or more of these, for 70% of the marks for the course.

7.2 Internal Evaluation

7.2.1 A student shall be evaluated through Continuous Evaluation and Semester End Examination.

7.2.2 The weight of continuous assessment and End-semester examination shall be varying from UG to PG and from Faculty to Faculty as approved by Academic Council.

7.2.3 During the semester, a student shall be going through continuous assessment. The continuous assessment will be conducted by the respective Department / Institute. At the end of semester, a student shall be evaluated through semester end examination comprising of theory and/or practical, viva-voce, term work components as decided by Academic Council.

7.2.4 The performance of candidate in continuous assessment and in end-semester examination together shall be considered for deciding the final grade in a course.

7.3 University Examination

7.3.1 The final examination by the University for 70% of the evaluation for the course will be through written paper and 100% for practical test or oral test or presentation by the student or a combination of any two or more of these.

7.3.2 **In order to earn the credit in a course a student has to obtain grade other than FF.**

7.4 Performance at Internal & University Examination

7.3.1 Minimum performance with respect to internal marks as well as university examination will be an important consideration for passing a course.
Details of minimum percentage of marks to be obtained in the examinations (internal/external) are as follows

Minimum marks in University Exam per subject	Minimum marks Overall per subject
40%	50%

7.3.2 A student failing to score 50% of the final examination will get a FF grade.

7.3.3 If a candidate obtains minimum required marks per subject but fails to obtain minimum required overall marks, he/she has to repeat the university examination till the minimum required overall marks are obtained.

8 Grading

8.1 grading system

8.1.1 At the end of a semester, a histogram shall be prepared for results of each course. A committee mentioned hereunder shall finalize the histogram based on which results will be prepared.

8.1.2 Result Preparation committee: A committee chaired by Provost and comprising of Dean of Faculty, One Dean other than the faculty and one teacher having expertise of relative grading shall deliberate upon different scenarios of results based on histograms of all the courses. Thereafter, the committee shall finalize the results.

8.1.3 The histogram shall be prepared for each course. After the finalization by the committee, the results shall be declared within 3 weeks duration.

8.1.4 Post Result Mechanism: The Dean shall discuss the result of each course with the convener and the teacher who has taught the course along with the statistical distribution evident from histogram so as to bring out any anomalies, skewness, left-out topics etc. Its only after this discussion is over the results shall be declared.

8.2 The total of the internal evaluation marks and final University examination marks in each course will be converted to a letter grade on a ten-point scale as per the following scheme:

Table: Grading Scheme (PG)

Range of Marks (%)	≥80	≥75 <80	≥70 <75	≥65 <70	≥60 <65	≥55 <60	≥50 <55	<50
Letter Grade	AA	AB	BB	BC	CC	CD	DD	FF
Grade Point	10	9	8	7	6	5	4	0

8.2 The student's performance in any semester will be assessed by the Semester Grade Point Average (SGPA). Similarly, his performance at the end of two or more consecutive semesters will be denoted by the Cumulative Grade Point Average (CGPA). The SGPA and CGPA are calculated as follows:

(i) SGPA = $\Sigma C_i G_i / \Sigma C_i$ where C_i is the number of credits of course i
G_i is the Grade Point for the course i
and i = 1 to n, n = number of courses in the semester

(ii) CGPA = $\Sigma C_i G_i / \Sigma C_i$ where C_i is the number of credits of course i
G_i is the Grade Point for the course i

and i = 1 to n, n = number of courses of all semesters up to which CGPA is computed.

(iii) No student will be allowed to move further if CGPA is less than 3 at the end of every academic year.

9. Awards of Degree

9.1 Every student of the programme who fulfils the following criteria will be eligible for the award of the degree:

9.1.1 He should have earned at least minimum required credits as prescribed in course structure; and

9.1.2 He should have cleared all internal and external evaluation components in every course; and

9.1.3 He should have secured a minimum CGPA of 5.0 at the end of the programme;

9.1.4 **In addition to above, the student has to complete the required formalities as per the regulatory bodies, if any.**

9.2 The student who fails to satisfy minimum requirement of CGPA at the end of program will be allowed to improve the grades so as to secure a minimum CGPA for award of degree. Only latest grade will be considered.

10. Award of Class

The class awarded to a student in the programme is decided by the final CGPA as per the following scheme:

Distinction:	CGPA ≥ 7.5 & ≤10.0
First class:	CGPA≥ 6.0 & <7.5
Second Class:	CGPA≥ 5.0& <60.
Pass Class:	CGPA<5.0

11. Transcript

The transcript issued to the student at the time of leaving the University will contain a consolidated record of all the courses taken, credits earned, grades obtained, SGPA,CGPA, class obtained, etc.

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
(CHARUSAT)

FACULTY OF TECHNOLOGY & ENGINEERING (FTE)

CHOICE BASED CREDIT SYSTEM

FOR

MASTER OF TECHNOLOGY & ENGINEERING

A. Choice Based Credit System:

With the aim of incorporating the various guidelines initiated by the University Grants Commission (UGC) to bring equality, efficiency and excellence in the Higher Education System, Choice Based Credit System (CBCS) has been adopted. CBCS offers wide range of choices to students in all semesters to choose the courses based on their aptitude and career objectives. It accelerates the teaching-learning process and provides flexibility to students to opt for the courses of their choice and / or undergo additional courses to strengthen their Knowledge, Skills and Attitude.

1. CBCS – Conceptual Definitions / Key Terms (Terminologies)

1.1. Core Courses

1.1.1 University Core (UC)

University Core Courses are those courses which all students of the University of a Particular Level (PG/UG) will study irrespective of their Programme/specialisation.

1.1.2 Programme Core (PC)

A 'Core Course' is a course which acts as a fundamental or conceptual base for Chosen Specialisation of Engineering. It is mandatory for all students of a particular Programme and will not have any other choice for the same.

1.2 Elective Course (EC)

An 'Elective Course' is a course in which options / choices for course will be offered. It can either be for a Functional Course / Area or Streams of Specialization / Concentration which is / are offered or decided or declared by the University/Institute/Department (as the case may be) from time to time.

1.2.1 Institute Elective Course (IE)

Institute Courses are those courses which any students of the University/Institute of a Particular Level (PG/UG) will choose as offered or decided by the University/Institute from time-to-time irrespective of their Programme /Specialisation

1.2.2 Programme Elective Course (PE):

A 'Programme Elective Course' is a course for the specific programme in which students will opt for specific course(s) from the given set of functional course/ Area or Streams of Specialization options as offered or decided by the department from time-to-time

1.2.3 Cluster Elective Course (CE):

A 'Institutional Elective Course' is a course which students can choose from the given set of functional course/ Area or Streams of Specialization

options (eg. Common Courses to EC/CE/IT/EE) as offered or decided by the Institute from time-to-time.

1.3 Non Credit Course (NC) - AUDIT Course

A 'Non Credit Course' is a course where students will receive Participation or Course Completion certificate. This will not be reflected in Student's Grade Sheet. Attendance and Course Assessment is compulsory for Non Credit Courses

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY (Effective from CHARUSAT 2019 Batch)											
TEACHING & EXAMINATION SCHEME FOR M TECH PROGRAMME IN COMPUTER ENGINEERING											
CHOICE BASED CREDIT SYSTEM											
Sem	Course Code	Course Title	Teaching Scheme				Examination Scheme				
			Contact Hours			Credit	Theory		Practical		Total
			Theory	Practical	Total		Internal	External	Internal	External	
Sem 1	CE741	Information & Network Security	3	2	5	4	30	70	25	25	150
	CE742	Data Mining & Business Intelligence	3	2	5	4	30	70	25	25	150
	CE743	Mobile Computing & Application Development	3	4	7	5	30	70	50	50	200
	CEXXX	Programme Elective-I (PE-I)	3	2	5	4	30	70	25	25	150
	XXXXX	Cluster Elective-I (CT-I)	3	2	5	4	30	70	25	25	150
	HSXXX	HSS Elective - I	2	0	2	2	0	0	30	70	100
			17	**12**	**29**	**23**	**150**	**350**	**180**	**220**	**900**
Sem 2	CE744	Internet of Things	3	2	5	4	30	70	25	25	150
	CE745	Intelligent Networks	3	4	7	5	30	70	50	50	200
	CE746	Cloud Computing	3	2	5	4	30	70	25	25	150
	CEXXX	Programme Elective-II (PE-II)	3	2	5	4	30	70	25	25	150
	XXXXX	Cluster Elective-II (CT-II)	3	2	5	4	30	70	25	25	150
	HSXXX	HSS Elective - II	0	2	2	2	0	0	30	70	100
		University Elective	0	2	2	2	0	0	30	70	100
			15	**16**	**31**	**25**	**150**	**350**	**210**	**290**	**1000**

Note:

- **University Elective (UE):-** University Electives are offered in common slots and offered by various departments. Students of any programme can select these electives. Subjects like Research Methodology, Occupational Health & Safety, Engineering Economics, Professional Ethics, and Project Management, Disaster Management, Risk Management etc. can be included.

- **Cluster Elective (CT):-** Institutional Electives means common electives among a cluster of programmes (eg. CE/IT/EC/EE etc.). If Institutional Electives are not applicable, it will be Programme electives
- **Programme Elective (PE):-** Programme Electives are electives offered by the respective department.

- **Institute Elective (IE):-** Institute Electives are common electives offered at the institute level.
- Provision for Auditing a course will be available
- Audit courses may be offered and decided based on need of the institute/program(s)

List of Electives

Code	Programme Elective - I (PE - I)
CE761	Service Oriented Architecture
CE762	Advanced Computer Architecture & Parallel Processing
CE763	Distributed System & Applications

Code	Programme Elective - II (PE - II)
CE764	Advanced Compiler Design
CE765	Machine Learning
CE766	Advanced Data Structures & Algorithms

Code	Cluster Elective - I (CT -I)
CS767	Knowledge Representation
EC767	Embedded System Design
CE767	Operating System Design & Concepts
EE771	Digital Signal Processing & its Application
ICT767	Information Theory & Coding

Code	Cluster Elective - II (CT -II)
CS768	Data Science
EC768	Digital Image & Speech Processing
CE768	Software Project Management & Quality Assurance
EE772	Restructuring & Deregulation of Power Systems
ICT768	Real Time System Programming

Code	HSS Elective - I
HS105.02 A	Academic speaking & presentation skills
HS141.02 A	Foreign Languages (French)
HS106.02 A	Academic writing

Code	University Electives
CE771.01	Project Management
ME781.01	Occupational Health and Safety
CA730	Internet and Web Designing
CA842.01	Mobile Application Development
PT796.01	Fitness and Nutrition
MB651	Software Based Statistical Analysis
NR755	First Aid and Life Support
OC733.01	Introduction to Polymer Science
PH892.01	Intellectual Property Rights
PH893	Clinical Data and Interpretation

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY (CHARUSAT) (Effective from Batch-2019)												
TEACHING & EXAMINATION SCHEME FOR M TECH PROGRAMME IN COMPUTER ENGINEERING												
CHOICE BASED CREDIT SYSTEM												
Sem	Course Code	Course Title	Teaching Scheme				Examination Scheme					
			Contact Hours			Credit	Internal		External			Total
			Theory	Practical	Total		Progress Report	Progress Seminar	Report	Seminar	Viva - voice	
Sem 3	CE811	Project Preliminaries	0	4	4	4	50	50	0	50	50	200
	CE812	Project Phase-I	0	36	36	18	100	100	100	100	100	500
			0	40	40	22	150	150	100	150	150	700
Sem 4	CE815	Project Phase-II	0	36	36	18	200	200	200	200	200	1000
			0	36	36	18	200	200	200	200	200	1000

M. Tech. (Computer Engineering) Programme

SYLLABI

(Semester – 1)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

CE741: INFORMATION & NETWORK SECURITY(PC-I)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Introduction	02
2	Mathematics of Cryptography	03
3	Tradition Symmetric Key Ciphers	03
4	Introduction to Modern Symmetric Key Ciphers	04
5	Data Encryption Standard	05
6	Advanced Encryption Standard	04
7	Mathematics of Cryptography	04
8	Asymmetric Key Cryptography	04
9	Key Management	04
10	Security at the application layer: PGP and S/MIME	04
11	Security at the transport layer: SSL and TSL	04
12	E -Commerce Security	04

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

Detailed Syllabus:

1 Introduction **02 Hours** **04%**

Security Goals, Attacks, Services and Mechanisms, Techniques

2. Mathematics of Cryptography **03 Hours** **06%**

Integer Arithmetic, Modular Arithmetic, Matrices, Linear Congruence

3. Tradition Symmetric Key Ciphers **03 Hours** **07%**

Introduction, Substitution Ciphers, Transposition Ciphers,

Stream and block Ciphers

4.	**Introduction to Modern Symmetric Key Ciphers** Modern Block Ciphers, Modern Stream Ciphers	**04 Hours**	**09%**
5.	**Data Encryption Standard** Introduction, DES Structure, DES Analysis, Multiple DES, Security of DES	**05 Hours**	**11%**
6.	**Advanced Encryption Standard** Introductions, Transformations, Key Expansions, Ciphers, Examples, Analysis of AES	**04 Hours**	**09%**
7.	**Mathematics of Cryptography** PRIMES, Preliminary Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Exponentiation and Algorithm	**04 Hours**	**09%**
8.	**Asymmetric Key Cryptography** Introduction, RSA Cryptosystem, RABIN Cryptosystem, ELGAMAL Cryptosystem	**04 Hours**	**09%**
9.	**Key Management** Symmetric Key Distribution, Kerberos, Symmetric Key agreement, Public Key Distribution	**04 Hours**	**09%**
10	**Security at the application layer: PGP and S/MIME** Email. PGP, S/MIME and Algorithm	**04 Hours**	**09%**
11	**Security at the transport layer: SSL and TSL** SSL Architecture, FOUR Protocols, SSL Message Formats, Transport Layer Security	**04 Hours**	**09%**
12	**E-commerce Security** Electronic Voting / Polling systems -Standards and Applications	**04 Hours**	**09%**

Course Outcome (COs):

At the end of the course, the students will be able to

CO1	Define and analyse various security goals and understand the security policies such as the CIA triad of Confidentiality, Integrity and Availability.

CO2	Understand and evaluate the mathematical formulations used in symmetric key and Asymmetric key cryptography to design various security solutions.
CO3	Illustrate a basic symmetric key and modern symmetric key cryptography techniques, how it has evolved, and evaluate in today's world.
CO4	Evaluate Asymmetric key encryption techniques, key distribution scenario and calculate public and private components of asymmetric key encryption techniques.
CO5	Explore the various key distribution of symmetric and asymmetric key crypto system applicable in real application.

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2
CO1	2	1	1	1	-
CO2	3	2	2	-	-
CO3	3	2	1	-	1
CO4	3	2	1	2	1
CO5	1	1	2	1	-

Enter correlation levels 1, 2 or 3 as defined below:

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

If there is no correlation, put "-"

Recommended Study Material:

- **Text Books:**
  1. Behrouz A. Forouzan, "Cryptography and Network Security" , THM, ISBM: 978-0-07-066046-5
- **Reference Books:**
  1. Eric Cole, Ronald Krutz, "Network Security Bible", Wiley ISBN:81-265-0576-1
  2. Vijay K Bhargava, "Communications, Information and network Security", Kluwer Academics Publication;ISBN-1-4020-7251-1
  3. Bruce Scheneir: "Applied Cryptography", 2/E, John Wiley, 1996.

4. Menezes, Oorschot, Vanstone: "Handbook of Applied Cryptography", CRC Press, 1996.
5. D Stinson, "Cryptography: Theory and Practice", 2/E, Chapman & Hall, 2002

❖ **Web Materials:**

1. http://www.interhack.net/pubs/network-security/

CE742: DATA MINIMG & BUSINESS INTELLIGENCE(PC-II)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1.	Introduction to Data Warehousing and Business Intelligence	05
2.	The Architecture of BI and DW	07
3.	Introduction to data mining (DM)	04
4.	Data Pre-processing	07
5.	Concept Description & Association Rule Mining	07
6.	Classification and Prediction	07
7.	Data Mining for Business Intelligence Applications	04
8.	Advance topics	04

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

Detailed Syllabus:

1. **Overview and concepts Data Warehousing and Business Intelligence** — **05 Hours 12%**

   Why reporting and Analysing data, Raw data to valuable information-Lifecycle of Data - What is Business Intelligence - BI and DW in today's perspective - What is data warehousing - The building Blocks: Defining Features - Data warehouses and data 1marts - Overview of the components - Metadata in the data warehouse - Need for data warehousing - Basic elements of data warehousing - trends in data warehousing.

2.	**The Architecture of BI and DW**	**07 Hours**	**16%**

BI and DW architectures and its types - Relation between BI and DW - OLAP (Online analytical processing) definitions - Difference between OLAP and OLTP - Dimensional analysis - What are cubes? Drill-down and roll-up - slice and dice or rotation - OLAP models - ROLAP versus MOLAP - defining schemas: Stars, snowflakes and fact constellations

3.	**Introduction to data mining (DM)**	**04 Hours**	**08%**

Motivation for Data Mining - Data Mining-Definition and Functionalities – Classification of DM Systems - DM task primitives - Integration of a Data Mining system with a Database or a Data Warehouse - Issues in DM – KDD Process

4.	**Data Pre-processing**	**07 Hours**	**16%**

Why to pre-process data? - Data cleaning: Missing Values, Noisy Data - Data Integration and transformation - Data Reduction: Data cube aggregation, Dimensionality reduction - Data Compression - Numerosity Reduction - Data Mining Primitives - Languages and System Architectures: Task relevant data - Kind of Knowledge to be mined - Discretization and Concept Hierarchy.

5.	**Concept Description and Association Rule Mining**	**07 Hours**	**16%**

What is concept description? - Data Generalization and summarization-based characterization - Attribute relevance - class comparisons Association Rule Mining: Market basket analysis - basic concepts - Finding frequent item sets: Apriori algorithm - generating rules – Improved Apriori algorithm – Incremental ARM – Associative Classification – Rule Mining

6.	**Classification and Prediction**	**07 Hours**	**16%**

What is classification and prediction? – Issues regarding Classification and prediction:

- Classification methods: Decision tree, Bayesian Classification, Rule based, CART, Neural Network
- Prediction methods: Linear and nonlinear regression, Logistic Regression

Introduction of tools such as DB Miner /WEKA/DTREG DM Tools

7. Data Mining for Business Intelligence Applications **04 Hours 08%**

Data mining for business Applications like Balanced Scorecard, Fraud Detection, Clickstream Mining, Market Segmentation, retail industry, telecommunications industry, banking & finance and CRM etc.

8. Advance topics **04 Hours 08%**

Introduction and basic concepts of following topics.

Multirelational Data Mining, Clustering, Spatial mining, web mining, text mining, Ensemble Classifier (Multiple Classifier, Bagging, Boosting, Stacking), Incremental learning

Course Outcome (COs):

At the end of the course, the students will be able to

CO1	Interpret the contribution of data warehousing and data mining to the decision-support level of organizations business intelligence.
CO2	Apply pre-processing statistical methods for any given raw data.
CO3	Design and Evaluate different dimensional modelling used for OLAP.
CO4	Categorize and differentiate between situations for applying different data-mining techniques: frequent pattern mining, association, correlation, classification, prediction, cluster, and outlier analysis.
CO5	Evaluate the performance of different data-mining models/algorithms with respect to their accuracy.
CO6	Conceptualise a data mining solution to a practical problem.

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2
CO1	2	1	-	2	-
CO2	2	1	2	1	-
CO3	-	2	3	1	2
CO4	2	2	1	2	-
CO5	1	2	2	1	-

CO6	-	2	3	1	-

Enter correlation levels 1, 2 or 3 as defined below:

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

If there is no correlation, put "-"

Recommended Study Material:

- **Text Books:**
  1. J. Han, M. Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann
  2. M. Kantardzic, "Data mining: Concepts, models, methods and algorithms, John Wiley &Sons Inc.

- **Reference Books:**
  1. Paulraj Ponnian, "Data Warehousing Fundamentals", John Willey.
  2. M. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education.
  3. G. Shmueli, N.R. Patel, P.C. Bruce, "Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner", Wiley India.

CE743: MOBILE COMPUTING & APPLICATION DEVELOPMENT(PC-III)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	4	7	5
Marks	100	100	200	

Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1.	Wireless transmission	02
2.	Telecommunication systems	04
3.	Medium access control	04
4.	Wireless LAN	10
5.	Mobile network layer	05
6.	Mobile transport layer	10
7.	Android Programming	10

Total hours (Theory): 45

Total hours (Lab): 60

Total hours: 105

Detailed Syllabus:

1 Wireless transmission **02 Hours 05%**

Frequencies for radio transmission , signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum , Cellular system

2 Telecommunication systems **04 Hours 09%**

GSM, Digital enhanced cordless telecommunications(DECT)

3 Medium access control **04 Hours 09%**

Wireless Medium Access control and CDMA- based communication – Medium access control, Introduction to CDMA-based systems,

	Spread spectrum in CDMA systems, coding methods in CDMA		
4	**Wireless LAN** Infra red vs radio transmission, infrastructure and ad hoc networks, IEEE 802.11, Bluetooth	**10 Hours**	**22%**
5	**Mobile network layer** Mobile IP, Dynamic host configuration protocol, Mobile ad-hoc networks, Wireless sensor networks	**05 Hours**	**11%**
6	**Mobile transport layer** Traditional TCP, Classical TCP improvements, snooping TCP, Mobile TCP, TCP over 2.5/3G wireless networks.	**10 Hours**	**22%**
7	**Android Programming** Architecture of Android, Android application life cycle, Activities, Fragments, Intent, Layout Design, View and View-group, Menu, Action Bar. Location Based Services, Publishing Android Application.	**10 Hours**	**22%**

Course Outcome (COs):

At the end of the course, the students will be able to

CO1	Classify the fundamental concepts of Wireless Networks and its access techniques
CO2	Understand the concepts and features of mobile computing technologies and applications
CO3	Be able to distinguish between and write mobile programs that use the following: Resources, Activities, Views (Buttons, EditText, etc), Layouts, Intents, Adapters
CO4	Identify the important issues of mobile computing devices, systems and applications
CO5	To gain knowledge about different mobile platforms and application development

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2
CO1	3	1	2	1	1

CO2	3	1	3	-	1
CO3	-	-	2	-	2
CO4	2	1	2	2	2
CO5	3	-	3	1	2

Enter correlation levels 1, 2 or 3 as defined below:

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

If there is no correlation, put "-"

Recommended Study Material:

- **Text Books:**
  1. "Mobile Communications" by John Schiller, Pearson Edition, ISBN:81-7808-170-9.
  2. "Mobile Computing: Technology, Applications and Service Creation" by Asoke K Talukder and Roopa R Yavagal, TMH,ISBM: 0-07-058807-4
  3. "Beginning Android 4 Application Development" Wei-Meng Lee, Wrox
- **Reference Books:**
  1. "Any Time, Any Where Computing: Mobile Computing Concepts and Technology" by Richard Brice, Darrell Woelk, Kluwer Academic Publishers, ISBN:0-7923-8610-8

CE761: SERVICE ORIENTED COMPUTING (PE - I)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Overview of SOA	02
2	SOA Fundamentals	05
3	SOA Planning and Analysis	08
4	SOA Design and implementation	08
5	Managing SOA Environment	05
6	SOA and WS	10
7	Implementation of SOA and WS	07

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

Detailed Syllabus:

1 Overview of SOA **02 Hours 05%**

Concepts; Service governance, characteristics; Business and technical benefits

2. SOA Fundamentals **05 Hours 11%**

Defining SOA, Business Value of SOA, Evolution of SOA, SOA characteristics, concept of a service in SOA, misperceptions about SOA, Basic SOA architecture, infrastructure services, Enterprise Service Bus (ESB), SOA Enterprise Software models, IBM On Demand operating environment.

3. SOA Planning and Analysis **08 Hours 18%**

Stages of the SOA lifecycle, SOA Delivery Strategies, service-

oriented analysis, Capture and assess business and IT issues and drivers, determining non-functional requirements (e.g., technical constraints, business constraints, runtime qualities, non-runtime qualities), business centric SOA and its benefits, Service modeling, Basic modeling building blocks, service models for legacy application integration and enterprise integration, Enterprise solution assets(ESA).

4.	**SOA Design and implementation**	**08 Hours**	**18%**

Service-oriented design process, design activities, determine services and tasks based on business process model, choosing appropriate standards, articulate architecture, mapping business processes to technology, designing service integration environment (e.g., ESB, registry), Tools available for appropriate designing, implementing SOA, security implementation, implementation of integration patterns, services enablement, quality assurance.

5.	**Managing SOA Environment**	**05 Hours**	**11%**

Distributing service management and monitoring concepts, operational management challenges, Service-level agreement considerations, SOA governance (SLA, roles and responsibilities, policies, critical success factors, and metrices), QoS compliance in SOA governance, role of ESB in SOA governance, impact of changes to services in the SOA lifecycle.

6.	**SOA and WS**	**10 Hours**	**23%**

The WS platform (XML, SOAP, WSDL, UDDI); Service contracts; Service-level data model, security and interaction patterns; Business process management; Maturity models

Principles of Service-Oriented Architecture- Service-orientation and objectorientation, SOA Standards Stack, SOA with Web Services, Key Principles of SOA,WS-* Specifications:Message Exchange Pattern,Coordination,Atomic Transactions, Business Activities, Orchestration, Choreography, WS-Addressing,WSReliableMessaging, WS-Policy (including WS-

PolicyAttachments and WSPolicyAssertions), WS-MetadataExchange, WS-Security (including XMLEncryption, XML-Signature, and SAML),WS-Notification Framework (including WS-BaseNotification, WS-Topics, and WS-BrokeredNotification),WS-Eventing

7. Implementation of SOA and WS **07 Hours 14%**

Frameworks; Building contract-first web services based on framework; Building code-first web services

Course Outcome (COs):

At the end of the course, the students will be able to

CO1	Comprehend the need for SOA and its systematic evolution.
CO2	Apply SOA technologies to enterprise domain.
CO3	Design and analyse various SOA patterns and techniques
CO4	Compare and evaluate best strategies and practices of SOA
CO5	Analyse requirements towards the creation of a service;
CO6	Apply major standards in WSDL-*, together with SOAP and REST concepts.

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2
CO1	1	1	-	-	-
CO2	1	2	-	-	-
CO3	2	1	2	-	-
CO4	1	2	2	-	-
CO5	1	-	3	1	-
CO6	-	2	3	-	1

Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
If there is no correlation, put "-"

Recommended Study Material:

- **Text Books:**

1. Thomas Erl, “Service-Oriented Architecture: Concepts, Technology, and Design”, Prentice

❖ **Reference Books:**

1. GRAHAM, S.; Building Web services with Java : making sense of XML, SOAP, WSDL and UDDI; Sams, 2001, ISBN: 0672321815
2. Eric Newcomer, Greg Lomow, “Understanding SOA with Web Services”, Addison Wesley Publication, 2004

CE762: ADVANCED COMPUTER ARCHITECTURE & PARALLEL PROCESSING (PE - I)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Introduction to Advanced Computer Architecture	2
2	Introduction to Parallel Processing	5
3	Parallel Computer Models	7
4	Program and Network Properties	5
5	Principles of Scalable Performance	7
6	Processor and Memory Hierarchy	6
7	Bus, Cache & Shared Memory	6
8	Pipelining & Superscalar Techniques	7

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

Detailed Syllabus:

1 Introduction to Advanced Computer Architecture **02 Hours 04%**

Four Decades of Computing

Flynn's Taxonomy of Computer Architecture

SIMD Architecture

MIMD Architecture

Interconnection Networks

2 Introduction to Parallel Processing **05 Hours 11%**

Parallelism in Uniprocessor System

	Parallel Computer Structure		
	Architectural Classification Schemes		
	Parallel Processing Applications		
3	**Parallel Computer Models**	**07 Hours**	**16%**
	Multiprocessors and Multicomputers		
	Multivector and SIMD Computers		
	PRAM & VLSI Models		
	Architectural Development Tracks		
4	**Program and Network Properties**	**05 Hours**	**11%**
	Conditions of Parallelism		
	Program Partitioning and Scheduling		
	Program Flow Mechanisms		
	System Interconnect Architectures		
5	**Principles of Scalable Performance**	**07 Hours**	**15%**
	Performance Metrics and Measures		
	Speedup Performance Laws		
	Scalability Analysis and Approaches		
6	**Processor and Memory Hierarchy**	**06 Hours**	**13%**
	Advanced Processor Technology		
	Superscalar and Vector Processors		
	Memory Hierarchy Technology		
	Virtual Memory Technology		
7	**Bus, Cache & Shared Memory**	**06 Hours**	**14%**
	Bus Systems		
	Cache Memory Organizations		
	Shared Memory Organizations		
	Sequential and Weak Consistency Model		

8 Pipelining & Superscalar Techniques 07 Hours 16%

Linear Pipeline Processors

Non Linear Pipeline Processors

Instruction Pipeline Design

Arithmetic Pipeline Design

Superscalar & Superpipeline Design

Course Outcome (COs):

At the end of the course, the students will be able to

CO1	Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.
CO2	Consider various techniques of instruction-level parallelism, including superscalar execution, branch prediction, and speculation, in design of high-performance processors
CO3	Design basic and intermediate RISC pipelines, including the instruction set, data paths, and ways of dealing with pipeline hazards
CO4	Verify the performance of computing systems with extended components.
CO5	Develop an understanding of various basic concepts associated with parallel computing environments

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2
CO1	1	-	1	1	1
CO2	1	2	-	-	1
CO3	2	1	1	-	2
CO4	2	1	1	2	2
CO5	1	-	3	1	2

Enter correlation levels 1, 2 or 3 as defined below:

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

If there is no correlation, put "-"

Recommended Study Material:

- **Text Books:**
  1. Kai Hwang, "Advanced Computer Architecture", Tata McGraw Hill.

❖ **Reference Books:**

1. Kai Hwang, Faye A. Briggs, “Computer Architecture and Parallel Processing”, Tata McGraw Hill .
2. Hesham El-Rewini,Mostafa Abd-El-Barr “Advanced Computer Architecture and Parallel Processing”, Wiley.
3. Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, By Pearson Publication.
4. Introduction to Parallel Processing, M. SasiKumar, Dinesh Shikhare, P.Raviprakash By PHI Publication
5. Steven Brawer, Introduction To Parallel Programming, Academic Pr
6. M.Sasikumar, Dinesh Shikhare And P. Ravi Prakash, Introduction To Parallel Processing, Prentice hall of India
7. V. Rajaraman And C. Siva Ram Murthy, Parallel Computers – Architecture And Programming, Prentice hall of India

CE763: DISTRIBUTED SYSTEM & APPLICATIONS (PE - I)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Fundamentals of Distributed System	06
2	Interprocess Communication	10
3	Synchronization	10
4	XML and XML Web services	03
5	Enterprise Application Integration, Web Services	10
6	Introduction to Cluster Computing , Grid Computing and Cloud Computing	04
7	Advanced Research Topics	02

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

Detailed Syllabus:

1 Fundamentals of Distributed System **06 Hours 13%**

Architectures for Distributed Systems, Distributed Computing ,Models, Workstation Model, Workstation-Server Model , Processor-pool Model ,Comparison of the Distributed Computing Models, Advantages of Distributed Systems , Disadvantages of Distributed Systems ,Software Concepts ,Network Operating System , Distributed Operating System , Multiprocessor Time-Sharing System ,Comparison of Different Operating Systems ,Transparency ,Flexibility , Reliability , Performance , Scalability , Security , Fault Tolerance , Client-Server Model , Client-Server Addressing , Client-Server Implementation ,

Client-Server Architecture

2.	**Interprocess Communication** Message Passing ,Introduction to Message Passing ,Advantages and Features of Message-Passing Systems ,IPC Message Format , IPC Synchronization , Message Buffering Strategies , Multidatagram Messaging , Process Addressing Techniques Failure Handling Mechanism, Group Communication , Typesof Group Communication , Group Management ,Group Addressing and Message Delivery ,Reliability Mechanism , Message Ordering.	**10 Hours**	**23%**
3.	**Synchronization** Clock Synchronization, Physical Clocks, Clock Synchronization Algorithms ,Use of Synchronized Clocks ,Logical Clocks, Event Ordering, Implementation of Logical Clocks, Lamport's Timestamps, Vector Timestamps, Global State, Mutual Exclusio, Centralized Algorithm, Distributed Algorithm, Token Ring Algorithm, Comparison of Various Algorithms, Election Algorithms, Bully Election Algorithm, Ring Election Algorithm, Election in a Wireless Network, Deadlocks in Distributed Systems, Deadlock Modelling, Handling Deadlocks in Distributed Systems, Distributed Deadlock Prevention, Distributed Deadlock Detection, Distributed Deadlock Recovery.	**10 Hours**	**23%**
4.	**XML and XML Web services** Introduction to XML, APIs for XML Processing, XML Web services	**03 Hours**	**06%**
5.	**Enterprise Application Integration, Web Services** Web services: Concepts, Protocols: SOAP, WSDL, UDDI, Development of Web services, J2EE and .Net Interoperability	**10 Hours**	**23%**
6.	**Introduction to Cluster Computing , Grid Computing and Cloud Computing** Overview of Cluster Computing: The Role of Clusters, Definition and Taxonomy, Distributed Computing, Limitations, Cluster Planning, Architecture and Cluster Software, Design Decisions, Network Hardware, Network Software, Protocols, Distributed File Systems,	**04 Hours**	**08%**

Virtualization technologies, Benchmarks.

Introduction: What is a grid?, Infrastructure of hardware and software, Main Projects and Applications, The Open Grid Forum, International Grid Trust Federation, Grid Architecture: Overview of Resource Managers, Overview of Grid Systems, Application Management, Grid Application Description Languages, Application Partitioning, Meta-scheduling, Mapping, Monitoring, Web Services, Grid Portals.

What is Cloud computing and its history and evolution? Cloud Computing architecture and industry frameworks such as Map Reduce, Cloud computing infrastructure requirements and limitations, Practical applications of cloud computing for various industries, including a case study.

7. Advanced Research Topics **02 Hours 04%**

Advanced Research Topics & Issues

Course Outcome (COs):

At the end of the course, the students will be able to

CO1	To Explain the basic fundamentals of Distributed OS. like models, features, concept, design issues and fundamentals of distributed system. (Understand)
CO2	To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems. (Understand)
CO3	Demonstrate Synchronization the deadlock detection and agreement protocol of distributed OS. (Apply)
CO4	Design and Implement Distributed applications using Technologies like RMI, threads. (Create)
CO5	Demonstrate the application of XML in distributed communications enabling, enterprise systems assurance, web enabling, application enabling, and enterprise data enabling. (Create)
CO6	Understand and explain the basic concepts of Grid Computing, Cluster computing and cloud computing.

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2
CO1	-	1	-	1	1
CO2	1	2	-	-	1
CO3	2	1	2	-	2
CO4	2	-	3	2	2
CO5	1	-	3	1	2
CO6	-	2	-	1	-

Enter correlation levels 1, 2 or 3 as defined below:

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

If there is no correlation, put "-"

Recommended Study Material:

- **Text Books:**
  1. Sunita Mahajan & Seema Shah, "Distributed Computing", Oxford University Press
- **Reference Books:**
  1. Karanjit S. Siyan, "Inside TCP/IP", third edition, New Riders Publishing , ISBN: 1-56205-714-6
  2. Marko Boger "Java in Distributed System" , John Wiley and Sons Ltd.
  3. David Reilly and Michael Reilly " Java Network Programming and Distributed Computing" , Addison-Wesley

CE767: OPERATING SYSTEM & DESIGN CONCEPTS (CT - I)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Basics of operating system	02
2	The Process and The kernel	08
3	Threads and Lightweight Processes	04
4	The Buffer Cache	06
5	System Calls for the file system	08
6	Signal and Session Management	06
7	Interposes Communications	06
8	Case Study: Multiprocessor Systems, Distributed Unix Systems	05

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

Detailed Syllabus:

1. **Basics of operating system** **02 Hours 04%**

   Introduction to an operating system, history of an Operating system, computer hardware review, Operating system Concepts, System Calls

2. **The Process and The kernel** **08 Hours 18%**

   Introduction, architecture of Unix operating system, Mode space and context, The process abstraction, kernel data structure, Executing in kernel mode, System administrator

3. **Threads and Lightweight Processes** **04 Hours 08%**

   Process control, Fundamentals abstraction, Lightweight Process design,

User-level threads libraries, Multithreading in Solaris and SVR4, Threads in Mach, Digital Unix, Mac 3.0 continuations

4. The Buffer Cache **06Hours** **14%**

Buffer headers, Structure of the buffer pool, Scenario for retrieval of a buffer, Reading and writing disk blocks, Advantages and disadvantages of duffer cache.

5. System Calls for the file system **08 Hours** **18%**

Open, read , write , file and record locking, adjusting the position of File I/O - Iseek , close, file creation, creation of special file, change directory and change root, change owner and change mode, STATE and FSTATE, Pipes, Dup, mounting and unmounting file systems, link and unlink, file system abstractions and maintenance

6. Signal and Session Management **06 Hours** **14%**

Single generation and handling, Unreliable single, Reliable single, Singles in SVR4, Signals implementations, Exceptions, Mach exception handling, Process groups and Terminal Management, The SVR4 sessions architecture

7. Interprocess Communications **06 Hours** **14%**

Universal IPC facilities, System V IPC, Mach IPC, Messages, Ports, Message passing, Port operations, Extensibility Mach 3.0 enhancements, discussion

8. Case Study: Multiprocessor Systems, Distributed Unix Systems **05 Hours** **10%**

overview, Solutions with master and slave processors, solutions with semaphore, performance limitation, Satellite Processors, The Newcastle connection, transparent distributed file systems

Course Outcome (COs):

At the end of the course, the students will be able to:

CO1	Understand the basics, history and required hardware of operating system
CO2	Define process, thread and kernel. Visualize & understand the structure of process and thread
CO3	Visualize the internals of buffer cache and implement algorithm related to buffer cache
CO4	Define system calls, signal. Understand and implement file system related system calls

CO5	Explain and analyse different IPC techniques.
CO6	Understand Linux operating system, multiprocessor systems, distributed unix systems and Linux commands

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2
CO1	1	-	-	1	1
CO2	-	-	-	-	1
CO3	2	-	3	-	2
CO4	2	-	2	2	2
CO5	-	1	2	1	2
CO6	3	-	1	1	-

Enter correlation levels 1, 2 or 3 as defined below:

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

If there is no correlation, put "-"

- Students will make substantial contributions to the operating systems project

Recommended Study Material:

❖ **Text Books:**

1. "UNIX Internals" by Uresh Vahalia Prentice Hall Press
2. "The Design of the Unix Operating System" by Maurice J. Bach Tata McGraw Hill

❖ **Reference Books:**

1. Advanced Concepts in Operating Systems, Singhal and Niranjan G.Shivaratna.
2. OS: Advanced Concepts, Maekawa, Oldehoeft. Addison-Wesley.
3. "Distributed Systems", Sape Mullender, Addison-Wesley.
4. Multithreaded Programming with Pthreads, Bil Lewis, Daniel J. Berg.

HS105.02 A: ACADEMIC SPEAKING AND PRESENTATION SKILLS

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	--	30/15	--	30/15	**02**
Marks	--	100	--	100	

Pre-requisite courses:

- Beginner/Intermediate level language proficiency

Outline of the Course:

Sr. No.	Title of the unit	Minimum number of hours
1.	Foundations of Advance Communication	04
2.	Art of Conversation	06
3.	Science of Power Speaking	06
4.	Academic Speaking Application – Part I	08
5.	Academic Speaking Application – Part II	06
	Total hours (Theory) :	--
	Total hours (Practical) :	30
	Total hours :	30

Detailed Syllabus:

1.	Foundations of Advance Communication	04 Hours	14%
	Meaning and Definition of Advance Communication; Advance Communication in Digital, Social, Mobile World; Strategies for Advance Communication; Meaning and Concept of Academic Language; High Frequency Academic Vocabulary		
2.	Art of Conversation	06 Hours	20%
	Describing people, places and things; Expressing opinions; Making suggestions; Persuading someone; Interpreting and Summarizing		

3.	Science of Power Speaking	06 Hours	20%
	Phonemes, Word Stress, Pronunciation, Intonation, Pause, Register, Fluency, Prosody, Lexical Range		
4.	Academic Speaking Application – Part I	08 Hours	26%
	Art of Oratory, Formal Presentation, Speech Analysis – Decoding Best Speeches		
5.	Academic Speaking Application – Part II	06 Hours	20%
	Job Interview, Group Discussion, Meeting		

Course Outcome (COs):

At the end of the course, the students will be able to

CO1	understand and demonstrate advance communication and academic speaking skills
CO2	demonstrate ability to communicate in diverse situations
CO3	activate and extend their linguistic and communicative competence
CO4	demonstrate the formal presentation skills
CO5	demonstrate performing ability at group discussion and personal interview

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2
CO1	1	-	1	-	1
CO2	-	1	-	-	1
CO3	1	-	-	-	1
CO4	1	-	-	2	2
CO5	-	1	-	1	2

Enter correlation levels 1, 2 or 3 as defined below:

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

If there is no correlation, put "-"

Recommended Study Material:

❖ **Reference book:**

1. *Business Communication Today* (Thirteenth Edition) by Courtland L. Bovee, John V. Thill and Roshan Lal Raina
2. *Effective Speaking Skills* by Terry O' Brien
3. *Speak Better Write Better* by Norman Lewis
4. *Well Spoken: Teaching Speaking to All Students* by Erik Palmer
5. *Let Us Hear Them Speak : Developing Speaking – Listening Skills in English* by Jayshree Mohanraj (Publisher – Sage Publication)
6. *The craft of scientific presentations: Critical steps to succeed and critical errors to avoid*. New York: Springer by Michael Alley
7. *Presentation Skills in English* by Bob Dignen (Publisher: Orient Black Swan)

❖ **Web material:**

1. TED Talk : How to speak so that people want to listen https://www.ted.com/talks/julian_treasure_how_to_speak_so_that_people_want_to_listen?language=en
2. TED Talk: The 110 techniques of communication and public speaking https://www.ted.com/talks/david_jp_phillips_the_110_techniques_of_communication_and_public_speaking

HS141.02 A: FOREIGN LANGUAGES (French)

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	--	02/01	--	30/15	**02**
Marks	--	100	--	100	

Pre-requisite courses:

- French Language Studies- Introduction (Coursera)

Outline of the Course:

Sr. No.	Title of the unit	Minimum number of hours
1.	Introduction to French Language	08
2.	Grammar: Articles, Tense, Forms, Numbers, Verbs, Days, Months, Family	08
3.	Grammar : Adjectives, Adverbs, Interrogative Forms, Directions, Countries, Nationalities, Seasons, Weather, Professions, Verbs	08
4.	Grammar: Prepositions, Conjunctions, Tenses, Colours, Vegetables, Fruits, Shapes, Verbs	06
	Total hours (Theory) :	--
	Total hours (Practical) :	30
	Total hours :	30

Detailed Syllabus:

1.	Introduction to French Language	08 Hours	28%
	Facts and figures about French Language; Basic French Linguistics-* Alphabets * Accents * Liaison * Nasalization French Culture, Differ between French and English; **Grammar-**Subject Pronoun, Verbs: (être, avoir, habiter, regarder, manger … "er" verb), Form of address, Numbers (1 to 20), Nouns and plurals of nouns, The expression: C'est, Il y a; **Presentation:** -1) Self-Introduction-2) Question and answering; **Dialogue**		
2.	Grammar: Articles, Tense, Forms, Numbers, Verbs, Days, Months, Family	08 Hours	28%
	Grammar-Definite articles**,** Indefinite articles**,** Present tense (Positive Forms**,** Negative Forms)**,** Numbers (21 to 100, 100-1000)**,** Days, Months, Family, Verbs: (aller, venir, finir,		

	pouvoir, vouloir … "ir" verb)**; Social Links-**1), My family & relations 2) Appointments 3) Gathering information from someone**; Dialogue**		
3.	Grammar : Adjectives, Adverbs, Interrogative Forms, Directions, Countries, Nationalities, Seasons, Weather, Professions, Verbs	08 Hours	28%
	Grammar- Common Adjectives**,** Comparative Adjectives**,** Common Adverbs**,** Interrogative Forms**,** The expression: "On"**,** Directions, Countries, Nationalities, Seasons, Weather, Professions**,** Verbs: (Prendre, Apprendre, Comprendre, faire ... "re " verb)**; Work , Study and Travel-**1) Job/ Profession 2) Ticket Reservation (At Bus/At Railway/At Airport)**; Dialogue**		
4.	Grammar: Prepositions, Conjunctions, Tenses, Colours, Vegetables, Fruits, Shapes, Verbs	06 Hours	26%
	Grammar-1) Common Prepositions 2) Common Conjunctions 3)Past Tense 4) Future Tense 5) Colors ,Shapes, Animals ,Vegetables, Fruits 6) Verbs: ("er", "ir","re" etc...)**; Food & Shopping-**1) Buy a vegetables and fruits 2) Any Conversation between Customer and Vendor (At Mall/At Restaurant / At Market)**; Dialogue**		

Course Outcome (COs):

At the end of the course, the students will be able to

CO1	Gain basic communication skills in French language with preliminary understanding of grammar
CO2	Develop vocabulary required to speak about him/herself and his/her immediate environment.
CO3	Become capable of interacting in simple ways, to ask simple questions to get necessary information, to reply simple questions.
CO4	Become capable of understanding and using simple instructions in their personal, academic and professional environments.
CO5	Develop skills and intelligences to function in multi-disciplinary and cross-cultural work environment.
CO6	Practice new global trends in communication in multiple perspectives at personal, professional, and social level.

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2

CO1	-	1	-	-	1
CO2	1	1	-	-	1
CO3	1	1	-	-	1
CO4	1	1	-	2	2
CO5	2	-	1	1	2
CO6	1	-	-	-	1

Enter correlation levels 1, 2 or 3 as defined below:

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

If there is no correlation, put "-"

Recommended Study Material:

- **Text book:**
  1. Complete French: All-In-One, McGraw-Hill, Amazon
  2. Best for Grammar: Easy French Step-by-Step, McGraw-Hill, Amazon
- **Reference book:**
  1. Basic French: McGraw-Hill, Amazon
  2. French Grammar for Beginners, Amazon
- **Web material:**
  1. https://alison.com/course/french-language-studies-introduction
  2. https://alison.com/course/basic-french-language-skills-for-everyday-life-revised-2017
  3. http://www.bbc.co.uk/languages/french/
  4. https://www.loecsen.com/en/learn-french
  5. https://www.youtube.com/watch?v=ujDtm0hZyII

M. Tech. (Computer Engineering) Programme

SYLLABI

(Semester – 2)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

CE744: INTERNET OF THINGS(PC-I)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Introduction of IoT	06
2	IoT in depth	10
3	Scalable and Trust based Framework	12
4	Research and Innovation in IoT	11
5	IoT Tools and Data Analytics	06

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

Detailed Syllabus:

1. Introduction of IoT **06 Hours** **10 %**

1.1 Introduction

1.2 Domains of IoT

1.3 M2M Vs. IoT

1.4 European Standards, ISO/IEC JTC 1/WTC 7 Sensor Networks, ETSI, IEEE, IETF, ITU-T

1.5 Internet of Things today and tomorrow

2. IoT in dept **10 Hours** **25 %**

2.1 Internet of Things: layers, languages, protocols, packets, services, performance parameters of a packet network as well as applications such as web, Peer-to-peer, sensor networks, and multimedia.

3.	**Scalable and Trust based Framework**	**12 Hours**	**30 %**
3.1	Main Concepts and Motivations for the framework		
3.2	Identity Management		
3.3	Context Awareness		
3.4	Policy based framework for Security and Privacy in IoT		
4.	**Research and Innovation in IoT**	**11 Hours**	**20 %**
4.1	IoT Vision and common Definitions		
4.2	IoT Research and Innovation Directions		
4.3	IoT Applications and Use Case Scenarios, IoT Application Areas		
4.4	IoT Smart-X applications including Smart Cities, Smart Mobility, Smart Transport etc.		
4.5	IoT and Future related technologies: Cloud Computing, Semantic Technologies		
4.6	Network and Communication: Networking Technology, Growth of Wireless Networks, Mobile Networks, Iot and IPV6 etc.		
5.	**IoT Tools and Data Analytics**	**06 Hours**	**15 %**
5.1	Tools in IoT, Data Analytics in IoT, IoT Physical Systems		

Course Outcome (COs):

At the end of the course, the students will be able to

CO1	Describe what IoT is and how it works today
CO2	Recognise the factors that contributed to the emergence of IoT
CO3	Use real IoT protocols for communication
CO4	Assess the genesis and impact of IoT applications and architectures in real world
CO5	Illustrate diverse methods of deploying smart objects and connect them to network

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2
CO1	2	1	2	1	1
CO2	3	1	2	-	1
CO3	2	-	2	-	2

CO4	2	1	1	2	2
CO5	2	1	2	1	2

Enter correlation levels 1, 2 or 3 as defined below:

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

If there is no correlation, put "-"

Recommended Study Material:

- **Text Books:**
  1. "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", Ovidiu Vermesan, Peter Friess, River Publishers.
- **Reference Books:**
  1. Internet of Things: A hands on approach by Arhdeep Bahga and Vijay Madisetti.
  2. Research papers from IEEE, Springer etc.
- **Web Materials:**
  1. http://www.vs.inf.ethz.ch/res/show.html?what=iot – For Research Papers
  2. www.ieee.org – For standards and technical research papers

CE745: INTELLIGENT NETWORKS(PC-II)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	4	7	5
Marks	100	100	200	

Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Layering Model and Physical Interface	07
2	Internetworking Routing	10
3	Transport and Application Services	10
4	Software Defined Networking	05
5	Named Data Network	13

Total hours (Theory): 45

Total hours (Lab): 60

Total hours: 105

Detailed Syllabus:

1. Layering Model and Physical Interface **07 Hours 16%**

Protocols and Standards, Standards Organization, Internet Standards, Internet Administration, A Brief History, The OSI Model, Layers in the OSI Model, TCP/IP Protocol suite, Addressing, TCP/IP versions. Local Area Networks (LAN), Point-to-Point WAN, Switched WAN, Connecting Devices, Addressing Mapping, The ARP Protocol, and Messages.

2. Internetworking Routing **10 Hours 22%**

Switching, Network Layer Services, Input Ports, Switching Fabric, Output Ports, Where does queuing Occur, Datagram Format, IPv4 Addressing, IPv6, Link State Routing Algorithm, Distance Vector Routing Algorithm, Hierarchical Routing, RIP,

OSPF, BGP, Broadcast Routing Algorithms, Multicast.

3. Transport and Application Services **10 Hours 22%**

User Datagram, UDP Services, UDP Packages, Process-to-Process Communication, TCP Services, Segment, Options, Checksum, Flow Control, Error Control, TCP Timers, Connection, State Transition Diagram, Congestion Control, TCP Operation, TCP Design, Introduction, DHCP operations.

4. Software Defined Networking **05 Hours 11%**

History and evolution of SDN, Control and Data Plane of SDN, Network Virtualization, Network Function Virtualization

5. Named Data Network **13 Hours 29%**

Introduction to NDN, CDN,CCN,SDN, Named Data Networking, Routing in NDN, Instant Messaging, Interest Forwarding, Performance Measurement of Name-Centric Content Distribution Methods

Course Outcomes (COs):

At the end of the course, the students will be able to

CO1	Get the research direction in the networking field.
CO2	Design, examine and evaluate the different type of network and transport protocol in the network.
CO3	Design own protocol with the help of software defined networking.
CO4	Understand other type of protocol present for the content delivery.

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2
CO1	3	1	2	1	1
CO2	2	1	3	-	1
CO3	1	3	2	-	2
CO4	1	1	2	2	2

Enter correlation levels 1, 2 or 3 as defined below:

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

If there is no correlation, put "-"

Recommended Study Material:

- **Text Books:**
  1. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach.", Fifth Edition; Pearson, ISBN: 978-81-317-9050-0
  2. Behrouz A. Forouzan, "TCP/IP Protocol Suite.", Fourth Reprint, 2003;Tata McGraw Hill ISBN: 0-07-049551-3
- **Reference Books:**
  1. Douglas E. Comer and David L. Stevens, "Internetworking with TCP/IP Volume-2, Design, Implementation and Internals ", Prentice Hall
  2. Douglas E Comer, "Computer Network and internet with internet applications", 4th edition, Pearson Education, ISBN: 81-297-0330-0
  3. Karanjit S. Siyan, "Inside TCP/IP", third edition, New Riders Publishing , ISBN: 1-56205-714-6
  4. Karanjit S. Siyan, "TCP/IP Unleashed", third edition, Pearson Education, ISBN: 81-7808-758-8
  5. Garj R. Wright, W Richard. Stevens, "TCP/IP Illustrated, Volume-2, The Implementation", 2000, Pearson Education
  6. Miller, "Data Networking and Communication", Vikas Publishing house, ISBN: 981-240-058-3
- **Web Materials:**
  1. https://www.coursera.org/course/sdn1

CE746: CLOUD COMPUTING(PC-III)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Fundamental of Virtualization	02
2	Fundamental Concepts and Models	02
3	Cloud-Enabling Technology	04
4	Fundamental Cloud Architectures	08
5	Advanced Cloud Architectures	12
6	Specialized Cloud Architectures	13
7	Build Cloud Application using Cloudstack	04

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

Detailed Syllabus:

1 Fundamental of Virtualization **02 Hours 05%**

Type of Virtualization, Virtualization Technologies, Virtualize your Environment, Managing Virtualization Environment, Storage Virtualization.

2. Fundamental Concepts and Models **02 Hours 05%**

Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models

3. Cloud-Enabling Technology **04 Hours 9%**

Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology, Web Technology, Multitenant Technology, Service Technology.

4. Fundamental Cloud Architectures **08 Hours** **17%**

Workload Distribution Architecture, Resource Pooling Architecture ,Dynamic Scalability Architecture, Elastic Resource Capacity Architecture, Service Load Balancing Architecture, Cloud Bursting Architecture, Elastic Disk Provisioning Architecture, Redundant Storage Architecture

5. Advanced Cloud Architectures **12 Hours** **26%**

Hypervisor Clustering Architecture ,Load Balanced Virtual Server Instances Architecture, Non-Disruptive Service Relocation Architecture, Zero Downtime Architecture ,Cloud Balancing Architecture ,Resource Reservation Architecture, Dynamic Failure Detection and Recovery Architecture, Bare-Metal Provisioning Architecture, Rapid Provisioning Architecture, Storage Workload Management Architecture

6. Specialized Cloud Architectures **13 Hours** **28%**

Direct I/O Access Architecture, Direct LUN Access Architecture, Dynamic Data Normalization Architecture, Elastic Network Capacity Architecture, Cross-Storage Device Vertical Tiering Architecture, Intra-Storage Device Vertical Data Tiering Architecture , Load Balanced Virtual Switches Architecture, Multipath Resource Access Architecture, Persistent Virtual Network Configuration Architecture, Redundant Physical Connection for Virtual Servers Architecture, Storage Maintenance Window Architecture

7. Build Cloud Application using Cloudstack. **04 Hours** **10%**

Apache CloudStack Architecture, Apache CloudStack Configuration.

Course Outcome (COs):

At the end of the course, the students will be able to

CO1	Assess and examine advantages and disadvantages of virtualization technology.
CO2	Compose services in a distributed computing environment to achieve tasks relevant to a knowledge-based business or public service
CO3	Evaluate a set of business requirements to determine suitability for a cloud

	computing delivery model.
CO4	Explore the various cloud computing architectures and paradigms.
CO5	Deployment of cloud and identify security implications in cloud computing.
CO6	collaboratively research and write a research paper, and present the research online.

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2
CO1	-	1	1	1	-
CO2	2	1	-	-	2
CO3	1	1	2	-	-
CO4	2	-	3	2	-
CO5	1	-	3	1	-
CO6	-	2	-	1	2

Enter correlation levels 1, 2 or 3 as defined below:

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

If there is no correlation, put "-".

Recommended Study Material:

- **Text Books:**
  1. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, "Cloud Computing Concepts, Technology & Architecture", Prentice Hall
  2. Navin Sabharwal, Ravi Shankar "Apache CloudStack Cloud Computing" PACKT Publishing
- **Reference Books:**
  1. Ravi Shankar, Navin Sabharwa "Cloud Computing First Steps: Cloud Computing for Beginners" CreateSpace Independent Publishing Platform
  2. Rajkumar Buyya, James Broberg, Andrzej Goscinski "Cloud Computing: Principles and Paradigms" Wiley
  3. Judith Hurwitz, Robin Bloor "Cloud Computing For Dummies" , for Dummies

CE764: ADVANCED COMPILER DESIGN (PE - II)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Language Translation Overview	02
2	Lexical Analysis	06
3	Syntax Analysis	10
4	Syntax-Directed Translation	04
5	Memory Allocation , Organization And Memory Management	06
6	Intermediate Code Generation	04
7	Code Optimization	04
8	Code Generation	04
9	Symbol Table Management	05

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

Detailed Syllabus:

1. Language Translation Overview **02 Hours 05 %**

Overview of system software used during translation –language processors, linker, loader. Types of language processors –assembler, interpreter, compiler. Difference between interpreter, assembler and compiler. Overview and use of linker and loader, model of compilation, The Phases of a Compiler, The Grouping of Phases, Compiler-Construction Tools

2. Lexical Analysis **06 Hours 14 %**

The Role of the Lexical Analyser, regular expression, regular languages, Input Buffering, Specification of Lexemes, Tokens and pattern. Recognition of Tokens, A Language for Specifying Lexical Analysers, Finite Automata, From a Regular Expression to an NFA, Design of a Lexical Analyser Generator, Optimization of DFA-Based Pattern Matchers

3.	**Syntax Analysis**	**10 Hours**	**23 %**

The Role of the Parser, Context-Free Grammars, Writing a Grammar, Top-Down Parsing, Bottom-Up Parsing, Operator-Precedence Parsing, LR Parsers, Using Ambiguous Grammars, Parser Generators.

4.	**Syntax-Directed Translation**	**04 Hours**	**08 %**

Syntax-Directed Definitions, Construction of Syntax Trees, Bottom-Up Evaluation of S-Attributed Definitions, L-Attributed Definitions, Top Down Translation, Bottom-Up Evaluation of Inherited Attributes, Recursive Evaluators, Analysis of Syntax-Directed Definitions , Type Systems, Specification of a Simple Type Checker, Equivalence of Type Expressions, Type Conversions, Overloading of Functions and Operators.

5.	**Memory Allocation , Organization And Memory Management**	**06 Hours**	**14 %**

Source Language Issues, Storage Organization, Storage-Allocation Strategies, and Access to Non local Names, Parameter Passing, and Language Facilities for Dynamic Storage Allocation, Dynamic Storage Allocation Techniques. Activation Tree, Activation Record, Parameter Passing, Symbol Table, Static, Dynamic And Heap Storage Allocation, Garbage Collection.

6.	**Intermediate Code Generation**	**04 Hours**	**08 %**

Intermediate Languages, Declarations, Assignment Statements, Boolean Expressions, Case Statements, Back patching, Procedure Calls, Types of Intermediate Forms of the Program.

7.	**Code Optimization**	**04 Hours**	**08 %**

The Principal Sources of Optimization, Optimization of Basic Blocks, Loops in Flow Graphs, Introduction to Global Data-Flow Analysis, Iterative Solution of Data-Flow Equations, Linear optimization (peep

hole) Techniques, parse optimization Techniques and structured optimization techniques. Code-Improving Transformations, Dealing with Aliases, Data-Flow Analysis of Structured Flow Graphs, Efficient Data-Flow Algorithms, A Tool for Data-Flow Analysis, Estimation of Types, Symbolic Debugging of Optimized Code.

8. Code Generation **04 Hours 08 %**

Issues in the Design of a Code Generator, The Target Machine, Run-Time Storage Management, Basic Blocks and Flow Graphs, Next-Use Information, A Simple Code Generator, Register Allocation and Assignment, The DAG Representation of Basic Blocks, Peephole Optimization, Generating Code from DAGs, Dynamic Programming Code-Generation Algorithm, Code-Generator Generators.

9. Symbol Table Management **05 Hours 12%**

General concepts, Symbol Table as a data structure, Various operations performed on Symbol Table, Symbol table organizations for blocked structured language and non-blocked structured language.

Course Outcome (COs):

At the end of the course, the students will be able to

CO1	Specify and analyse the lexical, syntactic and semantic structures of advanced language features.
CO2	Separate the lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation.
CO3	Write a scanner, parser, and semantic analyser without the aid of automatic generators.
CO4	Turn fully processed source code for a novel language into machine code for a novel computer.
CO5	Describe techniques for intermediate code and machine code optimisation.
CO6	Design the structures and support required for compiling advanced language features.

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2
CO1	1	1	1	1	-
CO2	1	2	3	-	2
CO3	1	1	-	-	-
CO4	1	1	3	2	-

CO5	1	2	-	1	-
CO6	1	2	2	1	2

Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
If there is no correlation, put "-"

Recommended Study Material:

- **Text Books:**
  1. Alfred Aho, Ravi Sethi, Jeffrey D Ullman, "Compilers Principles, Techniques and Tools", Pearson Education Asia.
  2. Tremblay and Sorenson, Compiler Writing, BS Publication
- **Reference Books:**
  1. Rich, Craig A. *Advanced Compiler Design--CS 441 Lecture Notes*, Spring 001(Available at Bronco Copy 'n Mail in the University Union).
  2. Allen I. Holub "Compiler Design in C", Prentice Hall of India.
  3. C. N. Fischer and R. J. LeBlanc, "Crafting a compiler with C", Benjamin Cummings.
  4. J.P. Bennet, "Introduction to Compiler Techniques", Second Edition, Tata McGraw-Hill.
  5. Henk Alblas and Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI.
  6. Kenneth C. Louden, "Compiler Construction: Principles and Practice", Thompson Learning.
  7. Compiler Construction by Kenneth. C. Louden, Vikas Pub.
- **Web Materials:**
  1. http://compilers.iecc.com/crenshaw
  2. http://www.compilerconnection.com
  3. http://dinosaur.compilertools.net
  4. http://pltplp.net/lex-yacc

CE765: MACHINE LEARNING (PE - II)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Introduction	02
2	Inductive Classification	04
3	Ensemble Learning	05
4	Experimental Evaluation of Learning Algorithms	04
5	Computational Learning Theory	05
6	Rule Learning: Propositional and First-Order	05
7	Artificial Neural Networks	04
8	Support Vector Machines	04
9	Bayesian Learning	02
10	Instance-Based Learning	02
11	Introduction to G A, N N and Fuzzy logic	04
12	Hybrid System	04

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

Detailed Syllabus:

1 Introduction **02 Hours 07%**

Definition of learning systems. Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation.

2 Inductive Classification **04 Hours 09%**

The concept learning task. Concept learning as search through a hypothesis space. General-to-specific ordering of hypotheses. Finding

	maximally specific hypotheses. Version spaces and the candidate elimination algorithm. Learning conjunctive concepts. The importance of inductive bias		
3	**Ensemble Learning**	**05 Hours**	**11%**
	Using committees of multiple hypotheses. Bagging, boosting, and DECORATE. Active learning with ensembles.		
4	**Experimental Evaluation of Learning Algorithms**	**04 Hours**	**09%**
	Measuring the accuracy of learned hypotheses. Comparing learning algorithms: cross-validation, learning curves, and statistical hypothesis testing.		
5	**Computational Learning Theory**	**05 Hours**	**11%**
	Models of learnability: learning in the limit; probably approximately correct (PAC) learning. Sample complexity: quantifying the number of examples needed to PAC learn. Computational complexity of training. Sample complexity for finite hypothesis spaces. PAC results for learning conjunctions, kDNF, and kCNF. Sample complexity for infinite hypothesis spaces, Vapnik-Chervonenkis dimension.		
6	**Rule Learning: Propositional and First-Order**	**05 Hours**	**11%**
	Translating decision trees into rules. Heuristic rule induction using separate and conquer and information gain. First-order Horn-clause induction (Inductive Logic Programming) and Foil. Learning recursive rules. Inverse resolution, Golem, and Progol.		
7	**Artificial Neural Networks**	**04 Hours**	**09%**
	Neurons and biological motivation. Linear threshold units. Perceptions: representational limitation and gradient descent training. Multilayer networks and back propagation. Hidden layers and constructing intermediate, distributed representations. Over fitting, learning network structure, recurrent networks.		
8	**Support Vector Machines**	**04 Hours**	**09%**
	Maximum margin linear separators. Quadratic programming solution to finding maximum margin separators. Kernels for learning non-		

linear functions.

9 Bayesian Learning **02 Hours 04%**

Probability theory and Bayes rule. Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training. Logistic regression. Bayes nets and Markov nets for representing dependencies.

10 Instance-Based Learning **02 Hours 04%**

Constructing explicit generalizations versus comparing to past specific examples. K-Nearest-neighbor algorithm. Case-based learning.

11 Introduction to G A, N N and Fuzzy logic **04 Hours 09%**

Introduction to Genetic Algorithms - Definition of GA - Description of Terminology/Vocabulary of GA - Importance and Goal of Traditional Optimization Methods - Classification of Search Techniques - Introduction to Hill climbing - Simulated annealing – Decision Tree - Difference between Genetic Algorithms and Traditional Methods -

Fuzzy logic - Introduction – Definition and Terminology - Set Theoretic Operations-MF Formulation and Parameterization-Extension Principal and Fuzzy Relations-Fuzzy Rules-Fuzzy Reasoning - Mamdani Fuzzy Model, Neural Network- Basic Concept of Neural Network - Human Brain, Model of An Artificial Neuron-Neural Network Architecture - Characteristic of Neural Network

12 Hybrid Systems **04 Hours 07%**

Introduction to Hybrid System – Types of Hybrid Systems – Neuro Fuzzy Hybrids – Neuro Genetic Hybrid – Fuzzy Genetic Hybrids – Neuro Fuzzy Modelling – Application.

Course Outcome (COs):

At the end of the course, the students will be able to

CO1	Apply basic concepts of Machine Learning and Understanding of standard learning algorithms.
CO2	Analyse mathematical modelling of various Machine Learning algorithms.
CO3	Understanding challenges of machine learning like data characteristics, model

	selection, and model complexity
CO4	Identify strengths and weaknesses of machine learning techniques suitable for a given problem domain and data set.
CO5	Design and implement of various machine learning algorithms in a range of real-world applications.
CO6	Evaluate and interpret the results of learning algorithms.

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2
CO1	1	1	-	1	-
CO2	1	2	-	-	1
CO3	2	1	2	1	-
CO4	2	1	3	2	-
CO5	1	-	3	1	-
CO6	-	2	2	1	2

Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
If there is no correlation, put "-"

Recommended Study Material:

- **Text Books:**
  1. Machine Learning, Tom Mitchell, McGraw Hill, 1997. ISBN 0070428077
  2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, 2004

- **Reference Books:**
  1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
  2. Richard O. Duda, Peter E. Hart & David G. Stork, "Pattern Classification. Second Edition", Wiley & Sons, 2001.
  3. Trevor Hastie, Robert Tibshirani and Jerome Friedman, "The elements of statistical learning", Springer, 2001.
  4. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", MIT Press, 1998.

CE766: ADVANCED DATA STRUCTURES & ALGORITHMS (PE - II)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Analysis of Algorithm	04
2	Randomized Algorithms	10
3	Graph Algorithms	08
4	String Matching	07
5	Approximation Algorithms	08
6	Computational Complexity	08

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

Detailed Syllabus:

1. Analysis of Algorithms **04 Hours 08%**

The efficiency of algorithm, average and worst case analysis, elementary operation.

Asymptotic Notation, Analyzing control statement, Analyzing Algorithm using Barometer.

Amortized analysis, solving recurrence Equation, Sorting Algorithm, Binary Tree Search.

2. Randomized Algorithms **10 Hours 22%**

Probability, Analyzing Quick Sort.

QuickSelect – median selection in linear time.

QuickSort and Treaps with High Probability, Treaps.

3. Graph Algorithms **08 Hours 18%**

Breadth First Search (BFS), Depth First Search (DFS).

Topological Sort Strongly Connected Components, Euler Tour.

Generic Minimum Spanning Tree, Kruskal's Algorithm, Prim's Algorithm, Single Source Shortest Path, Dijkstra's Algorithm, Bellman-Ford Algorithm.

4. String Matching **07 Hours 16%**

Introduction, The naïve string matching algorithm.

The Rabin-Karp algorithm, Knuth-Morris-Pratt Algorithm, Boyer-Moore Algorithm.

5. Approximation Algorithms **08 Hours 18%**

Greedy algorithms and approximation algorithms, Travelling Salesman Person, Approximation Algorithms for Set Cover and Clustering.

6. Computational Complexity **08 Hours 18%**

Introduction, Complexity classes, More NP-Complete problems

Max-Clique, Independent Set, Vertex Cover, Graph Coloring, Hamiltonian Cycle and Travelling Salesman Problem

Course Outcome (COs):

At the end of the course, the students will be able to

CO1	Design and analyse programming problem statements.
CO2	Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem.
CO3	Understand the necessary mathematical abstraction to solve problems.
CO4	Come up with analysis of efficiency and proofs of correctness.
CO5	Comprehend and select algorithm design approaches in a problem specific manner.

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2
CO1	1	2	-	1	-
CO2	1	1	-	-	2
CO3	1	1	2	-	-
CO4	2	2	3	2	-

CO5	1	2	3	1	-

Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
If there is no correlation, put "-"

Recommended Study Material:

- **Text Books:**
  1. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein
  2. Fundamental of Algorithms by Gills Brassard, Paul Bratley, Publication : Prentice Hall of India
  3. Algorithm Design by Kleinberg and Tardos, Low Priced Ed. by Pearson.
- **Reference Books:**
  1. Algorithm Design - Foundations, Analysis & Internet Examples by Michael T. Goodrich and Roberto Tamassia
  2. Data Structures and Algorithms in Java by Michael T. Goodrich and Roberto Tamassia
  3. Data Structures and Algorithms in C++ by Michael T. Goodrich, Roberto Tamassia and David M. Mount
  4. Fundamental of Computer Algorithms by Ellis Horowitz, Sartaz sahni and sanguthevar Rajasekarm
- **Web Materials:**
  1. http://www.cse.iitd.ernet.in/~naveen/courses/CSL630/sariel.pdf
  2. http://www.cse.iitd.ernet.in/~naveen/courses/CSL630/jeff.pdf

CE768: SOFTWARE PROJECT MANAGEMENT & QUALITY ASSURANCE (CT - II)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Introduction to Software Project Management System	06
2	Project Tracking and Configuration Management	08
3	Introduction to Software Quality Assurance	05
4	Software quality Assurance (SQA) Management and Software Quality Metrics	08
5	Software Quality Engineering and Inspection and Defect prevention	06
6	Software Testing and Maintenance	08
7	Software Testing Tools	04

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

Detailed Syllabus:

1. **Introduction to Software Project Management System** **06 Hours 13 %**

   Overview of Project Planning, Project Estimation, Project Scheduling, Organization and Team Structure, Risk Analysis and Management, Resource Allocation

2. **Project Tracking and Configuration Management** **08 Hours 17 %**

   Measurement of Physical and Financial progress, Earned value analysis, Status reports and Milestone reports, SCM activities, Standards for Configuration Audit Functions, Personnel in SCM

Activities, Change control, Source code Control System (SCCS), Software Configuration Management: Some Pitfalls

3.	**Introduction to Software Quality Assurance**	**05 Hours**	**11 %**

Quality Control, Assurance, Movements, SQA-Software Quality Assurance Activities, Approaches To SQA, Reliability, ISO 9000 And 9001, CMM Levels, Quality Audit, Concepts of Quality Improvement, Concepts of Process Maturity, Improving Process Maturity, IDEAL^{SM} Model for Process Improvement

4.	**Software quality Assurance (SQA) Management and Software Quality Metrics**	**08 Hours**	**17 %**

Overview of SQA planning, techniques and contents of a SQA plan , establishing quality goals - Quality Function Deployment-Goal/Question/Measure Paradigm, total quality Management, cost of quality, quality assurance management, quality standards, factors affecting SQA effort, Management review process - technical review process -software assertion process - walkthrough process - audit process - verification & validation, Measuring quality, measurement criteria, product and process quality metrics, metrics for configuration management and software maintenance, example of metrics programs, complexity metrics and their relationship with testing and quality, metrics for object-oriented software analysis.

5.	**Software Quality Engineering, Inspection and Defect prevention**	**06 Hours**	**13 %**

Defining Quality Requirements, Complexity Metrics and models, Project Tracking and Oversight, Data Quality Control, Software Inspection, Reliability Models, Reliability Growth Models

6.	**Software Testing and Maintenance**	**08 Hours**	**17 %**

Foundations of Testing, Test Planning, Test Design and Implementation, Testing Network Management Systems, Web Based Testing, Testing Object-Oriented systems, Test Execution and Measurement, Management Issues for Software Quality, Software Testing Types: Unit, Integration, & System, Benchmarking and Certification, Control flow & loop testing, Data-flow testing, Transaction-flow testing, Domain testing, Coverage vs. usage based

testing, Software Reuse, Software Aging, Product Enhancement, Reverse Engineering, Re-engineering Method, Architectural Simplification

7. Software Testing Tools **04 Hours 12 %**

Test case Generation Methodology, Study of various Testing Tools (Win Runner, Load Runner), Automatic Testing Tool.

Course Outcome (COs):

At the end of the course, the students will be able to

CO1	Understand basics about software project management principles, methods and practices and Learn SRS (Software Requirement Specification) document and SPMP (Software Project Management Plan) document.
CO2	To apply software measurement and metrics using LOC, Function point, COCOMO etc. and learn various scheduling and tracking techniques like (Gantt chart, PERT, CPM).
CO3	To recognize how to ensure the quality of software product, different quality standards and use of SQA activities with standards of ISO 9000 and SEI-CMM.
CO4	Formulate problem by following Software Testing Life Cycle. Apply various testing techniques and test plan in. Design Manual Test cases for Software Project. Use automation testing tool students will be able test the software.
CO5	Analyse software risk and understand the concepts of Software Configuration Management, software maintenance, reengineering, reverse engineering, and Software Testing Tools.

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2
CO1	2	1	1	1	-
CO2	3	2	2	-	2
CO3	3	2	3	-	-
CO4	3	2	2	2	-
CO5	3	1	2	1	-

Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
If there is no correlation, put "-

Recommended Study Material:

- **Text Books:**
  1. Pankaj Jalote, “Software Project Management in Practice”, 2002, Pearson, Education Asia.
  2. Roger S. Pressman, “Software Engineering: A practical Approach”, Fifth Editoin 2001, McGraw-Hill.
  3. Bob Hughes and Mike Cotterell, “Software Project Management”, Third Edition 2002, McGraw-Hill.
- **Reference Books:**
  1. Rapid Testing” by Robert Culbertson, Chris Brown and Gary Cobb; Prentice-Hall, 2002.ISBN 0-13-091294-8
  2. Metrics and Models in Software Quality by Stephen Kan, Addison-Wesley.
  3. Software Engineering By Ian Sommerville Addison Wesley
  4. Fundamentals of Software Engineering By Rajib Mall, Prentice Hall of India
  5. The Capability Maturity Model: Guidelines for Improving the Software Process by Mark Paulik, Addison-Wesley.
  6. "Black-Box Testing: Techniques for Functional Testing of Software and Systems", by Boris Beizer, John Wiley & Sons, Inc., 1995. ISBN# 0-471-12094

HS106.02 A: ACADEMIC WRITING

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	--	**30/15**	--	30/15	**2**
Marks	--	100	--	**100**	

Pre-requisite courses:

- An Intermediate Guide to Writing in English for University Study https://www.futurelearn.com/courses/english-for-study-intermediate/4/todo/62943

Outline of the Course:

Sr. No.	Title of the unit	Minimum number of hours
1.	Academic Writing and Research Process	05
2.	Anatomy of Academic Writing	05
3.	Key Academic Skills	05
4.	Accuracy in Academic Writing	05
5.	Using and Citing Sources of Ideas	05
6.	Contemporary Practices in Academic Writing	05
	Total hours (Practical):	30
	Total hours (Lab) :	--
	Total hours :	**30**

Detailed Syllabus:

1.	Academic Writing and Research Process	5 Hours	
	Introduction to Academic Writing, Academic Writing as a Part of Research, Types of Academic Writing, Features of Academic Writing, Importance of Good Academic Writing in various Academic Works		
2.	Anatomy of Academic Writing	5 Hours	
	Academic Vocabulary, Simple and Complex Sentences, Organizing Paragraphs, The Writing Process, Adopting		

	Academic Writing Style		
3.	Key Academic Skills	5 Hours	
	Note – taking, Note – making, Paraphrasing, Summarizing		
4.	Accuracy in Academic Writing	5 Hours	
	Lexical Range, Academic Language and Structures, Elements of Writing, Proof Reading, Editing, and Rewriting		
5.	Using and Citing Sources of Ideas	5 Hours	
	Academic Texts and their Types, Intellectual Honesty in Academic Writing, Avoiding Plagiarism – Idea Theft, Degrees of Plagiarism, Types of Borrowing, Anatomy of Citations, Common Citation Styles		
6.	Contemporary Practices in Academic Writing	5 Hours	
	Analytical Essays, Graph / Table / Process Interpretation and Description, Writing Reports and Abstract, Writing Research / Concept Papers		

Course Outcome (COs):

At the end of the course, the students

CO1	Will have sound understanding of the concept and applications of academic writing
CO2	Will have acquired enough knowledge of academic writing style, strategy and approach
CO3	Will be able to demonstrate error free and effective academic writing
CO4	Will be able to demonstrate ability to work on project/report/paper writing
CO5	Will have the sound understanding of the Research and Research Methodology
CO6	Will be effectively communicating.

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2
CO1	-	1	-	1	-
CO2	1	1	-	-	1
CO3	-	2	1	1	-
CO4	-	2	-	2	-
CO5	-	2	-	1	2
CO6	1	2	-	1	2

Enter correlation levels 1, 2 or 3 as defined below:

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

If there is no correlation, put "-"

Recommended Study Material:

- **Text book:**
    1. Academic Writing for International Students, Routledge
    2. Academic Writing: A Guide for Management Students and Researchers. Monipally, M.M. &Pawar, B.S. Sage. 2010. New Delhi
    3. Effective Academic Writing Level - 1,2,3,4 (Second Edition) By: Alice Savage, Patricia Mayer, Masoud Shafiei, Rhonda Liss, & Jason Davis; Publisher: Oxford

- **Reference book:**
    1. Writing Your Thesis (2nd Edition) by Paul Oliver, Sage
    2. Development Communication In Practice by Vilanilam V J, Sage
    3. Intercultural Communication by Mingsheng Li, Patel Fay, Sage

- **Web material:**
    1. www.owl.perdue.edu

M. Tech. (Computer Engineering) Programme

SYLLABI

(Semester – 3)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

CE811: PROJECT PRELIMINARIES

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	4	0	4	4
Marks	100	100	200	

Outline of the course:

Sr No.	Title of the unit	Minimum number of hours
1	Interpolation and Integration	06
2	Numerical solution of ordinary differential equation	06
3	Matrix Algebra	06
4	Research Methodology : An Introduction	03
5	Defining the Research Problem	03
6	Research Design	03
7	Sampling Design	03
8	Measurement and Scaling Techniques	03
9	Methods and Data Collection	03
10	Processing and Analysis of Data	03
11	Sampling Fundamentals	03
12	Testing of Hypotheses – I (Parametric or Standard Tests of Hypotheses)	03
13	Chi-Square Test	03
14	Analysis of Variance and Covariance	03
15	Testing of Hypotheses – II (Nonparametric or Distribution – free Tests)	03
16	Multivariate Analysis Techniques	03
17	Interpretation and Report Writing	03

Total hours (Theory): 60 Hrs

Total hours (Lab) : 00 Hrs

Total hours : 60 Hrs

Detailed Syllabus:

1 Interpolation and Integration 06 Hours 07 %

	Newton's forward interpolation formula, Newton's backward interpolation formula, Lagrange's interpolation formula, Numerical integration: Composite rules (Trapezoidal rule, Simpson's rules).		
2	**Numerical solution of ordinary differential equation** Taylor series, Picard's, Euler's methods, Runge- Kutta method 4^{th} order.	**06 Hours**	**10 %**
3	**Matrix Algebra** Cofactor expansion of n×n determinant, Eigen values of matrices, Cayley - Hamilton theorem, special matrices viz., Symmetric, Skew-symmetric, Hermitian, skew Hermitian, Orthogonal and Unitary matrices.	**06 Hours**	**10 %**
4	**Research Methodology : An Introduction** Meaning of Research: Objectives of Research - Motivation in Research-Types of Research-Research Approaches-Significance of Research-Research Methods versus Methodology-Research and Scientific Method-Importance of Knowing How Research is Done-Research Process-Criteria of Good Research-Problems Encountered by Researchers in India	**03 Hours**	**05 %**
5	**Defining the Research Problem** What is a Research Problem? - Selecting the Problem-Necessity of Defining the Problem Technique Involved in Defining a Problem-An Illustration-Conclusion	**03 Hours**	**05 %**
6	**Research Design** Meaning of Research Design-Need for Research Design-Features of a Good Design-Important Concepts Relating to Research Design-Different Research Designs-Basic Principles of Experimental Designs-	**03 Hours**	**05 %**
7	**Sampling Design** Census and Sample Survey-Implications of a Sample Design-Steps in Sampling Design-Criteria of Selecting a Sampling	**03 Hours**	**05 %**

	Procedure-Characteristics of a Good Sample Design-Different Types of Sample Designs-How to Select a Random Sample?-random Sample from an Infinite Universe-Complex Random Sampling Designs		
8	**Measurement and Scaling Techniques** Measurement in Research-Measurement Scales-Sources of Error in Measurement-Tests of Sound Measurement-Technique of Developing Measurement Tools Scaling -Meaning of Scaling-Scale Classification Bases-Important Scaling Techniques-Scale Construction Techniques-	**03 Hours**	**05 %**
9	**Methods and Data Collection** Collection of Primary Data-Observation Method-Interview Method -Collection of Data through Questionnaires-Collection of Data through Schedules-Difference between Questionnaires and Schedules-Some Other Methods of Data Collection1-Collection of Secondary Data	**03 Hours**	**05 %**
10	**Processing and Analysis of Data** Processing Operations-Some Problems in Processing-Elements/Types of Analysis-Statistics in Research-Measures of Central Tendency-Measures of Dispersion-Measures of Asymmetry (Skewness)-Measures of Relationship-Simple Regression Analysis-Multiple Correlation and Regression-Partial Correlation-Association in Case of Attributes	**03 Hours**	**05 %**
11	**Sampling Fundamentals** Need for Sampling-Some Fundamental Definitions-Important Sampling Distributions-Central Limit Theorem-Sampling Theory-Sandler'sA-test-Concept of Standard Error-Estimation-Estimating the Population Mean μ - Estimating Population Proportion-Sample Size and its Determination- Determination of Sample Size through the Approach-Based on Precision Rate and Confidence Level-Determination of Sample Size through	**03 Hours**	**05 %**

the Approach Based on Bayesian Statistics

12	**Testing of Hypotheses – I (Parametric or Standard Tests of Hypotheses)** What is a Hypothesis?- Basic Concepts Concerning Testing of Hypotheses-Procedure for Hypothesis Testing-Flow Diagram for Hypothesis Testing- Measuring the Power of a Hypothesis Test-Tests of Hypotheses-Important Parametric Tests-Hypothesis Testing of Means-Hypothesis Testing for Differences between Means-Hypothesis Testing for Comparing Two Related Samples-Hypothesis Testing of Proportions-Hypothesis Testing for Difference between Proportions-Hypothesis Testing for Comparing a Variance to Some Hypothesized Population Variance	**03 Hours**	**05 %**
13	**Chi-Square Test** Chi-square as a Test for Comparing Variance-Chi-square as a Non-parametric Test-Conditions for the Application of $\chi 2$ Test-Steps Involved in Applying Chi-square Test-Alternative Formula-Yates' Correction-Conversion of$\chi 2$into Phi Coefficient-Conversion of$\chi 2$into Coefficient by Contingency-Important Characteristics of$\chi 2$Test-Caution in Using $\chi 2$ Test	**03 Hours**	**05 %**
14	**Analysis of Variance and Covariance** Analysis of Variance (ANOVA)- What is ANOVA?-The Basic Principle of ANOVA-ANOVA Technique-Setting up Analysis of Variance Table-Short-cut Method for One-way ANOVA-Coding Method-Two-way ANOVA-	**03 Hours**	**05 %**
15	**Testing of Hypotheses – II (Nonparametric or Distribution – free Tests)** Important Nonparametric or Distribution-free Test-Relationship between Spearman'sr's and Kendall's W - Characteristics of Distribution-free or Non-parametric Tests	**03 Hours**	**05 %**
16	**Multivariate Analysis Techniques**	**03 Hours**	**05 %**

Growth of Multivariate Techniques-Characteristics and Applications-Classification of Multivariate Techniques-Variables in Multivariate Analysis- Important Multivariate Techniques-Important Methods of Factor Analysis- Rotation in Factor Analysis-R-type and Q-type Factor Analyses-Path Analysis

17 Interpretation and Report Writing **03 Hours** **05 %**

Meaning of Interpretation-Why Interpretation?-Technique of Interpretation:- Precaution in Interpretation-Significance of Report Writing-Different Steps in Writing Report-Layout of the Research Report -Types of Reports-Oral Presentation-Mechanics of Writing Research Report-Precautions for Writing Research Reports

Course Outcome (COs):

At the end of the course, the students will be able to

CO1	Understand importance of sampling and different types of sampling
CO2	Understand systematic Analysis of data and synthesize research findings
CO3	Report research findings in written and verbal forms
CO4	An understand ethical issues associated with practitioner research

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2
CO1	1	-	-	1	1
CO2	3	3	3	1	1
CO3	3	3	3	1	-
CO4	2	2	3	-	-

Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
If there is no correlation, put "-"

Recommended Study Material:

❖ **Text Books:**

1. Research Method (Methods & Techniques) – Second Revised Edition
2. Erwin Kreyszig: Advanced Engineering Mathematics, 8/e, Jhon Wiley & Sons, 1999
3. Wylie & Barrett: Advanced Engineering Mathematics, Mc graw Hill pub
4. Greenberg M D: Advanced Engineering Mathematics, 2/e, Pearson Education By C.R.Khotari

CE812: PROJECT PHASE - I

Credit Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	-	32	32	18
Marks	-	500	500	

Outline of the Course:

- The Project shall be related to the major field of his/her PG specialization work.
- The Project should be one of the major pieces of evidence that students are familiar with or that student wants to be familiar with. It should reflect your specialist subject by means of deep and sustained study.
- The project will be finalized by the department level Post Graduate Committee on recommendation of the supervisor(s).
- The project work shall be carried out by each candidate independently during the third and fourth semester under the guidance of one of the faculty members of the Department. If the project work is of inter-disciplinary nature, a co-guide shall be taken from the same or any other relevant Department.
- If a project work has to be carried out in any industry / factory / organization, outside the campus, the permission to that effect and the name of co-guide at any of these organizations shall be intimated to the Post Graduate Committee at the beginning of third semester.
- Project I includes literature review, required theoretical input, study and comparison of various approaches for the proposed dissertation work.

Course Outcome (COs):

At the end of the course, the students will be able to

CO1	Analyse data and synthesize research findings
CO2	Demonstrate an understanding of the ethical issues associated with practitioner research
CO3	Demonstrate capacity to lead and manage change through collaboration with others

CO4	Demonstrate capacity to improve student achievement, engagement and retention

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2
CO1	1	-	-	-	1
CO2	3	3	3	-	-
CO3	3	3	3	1	-
CO4	2	2	3	-	1

Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
If there is no correlation, put "-"

Instructional Methods and Pedagogy:

- Student has to submit a project/dissertation proposal indicating the tentative title and broad outline of the proposed work and the name(s) of the supervisor(s) along-with their concurrence in writing within 30 days from the starting of the third semester.
- Utmost care should be taken in selection of research topic so that repetition of research work is avoided.
- Project - I will be evaluated at least once during the semester and at the end of the semester as a part of continuous evaluation.
- After successful completion of Project I only students are allowed to go register for Project – II.

Student Learning Outcomes / Objectives:

- Students will select a topic that is appropriate for his/her degree specialization.
- At the end of the course the student's gets exposure to construct and justify research questions related to the topic.
- Each student will be in a position to design a research investigation that incorporates appropriate theoretical approaches, conceptual models, and a review of the existing literature.
- Students will learn to structure a discussion in a coherent and convincing way by

synthesizing the material in the context of the research questions.

- Students will be having sufficient collection of the literature/experimental data for the implantation/experimentation in project - II.

M. Tech. (Computer Engineering) Programme

SYLLABI

(Semester – 4)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

CE815: PROJECT PHASE - II

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	-	36	36	18
Marks	-	1000	1000	

Outline of the Course:

- Student should carry out the investigation by identifying sources of evidence, accessing those using accepted and rigorous academic methods, and analysing and interpreting the material gathered by simulation/experimentation.
- A project - II is student's own work & will need to keep up the effort, and the interest, over several months and through several stages.
- Student need to think carefully about the time necessary to carry-out and complete your project work and the relative writing up.
- The project should present an orderly and critical exposition of the existing knowledge of the subject and will embody results of original investigations demonstrating the capacity of the candidate to do independent research work.
- While writing the thesis/dissertation, the candidate will layout clearly the work done by him independently and the sources from which he has obtained other information contained in his/her Dissertation.

Course Outcome (COs):

At the end of the course, the students will be able to

CO1	Carry out a substantial research-based project
CO2	Analyse data and synthesize research findings
CO3	Report research findings in written and verbal forms
CO4	Use research findings to advance education theory and practice

Course Articulation Matrix:

	PO1	PO2	PO3	PSO1	PSO2

CO1	3	-	-	-	1
CO2	2	1	1	-	1
CO3	3	3	3	1	1
CO4	2	2	3	-	-

Instructional Methods and Pedagogy:

- Project - II will be evaluated at least once during the semester and at the end of the semester as a part of continuous evaluation.
- Before submission of Phase II project/dissertation report, it is expected from a student to publish at least one research paper in National/International conference. Further, for such publications, Department Post Graduate Committee will identify and approve the national/international conferences.
- The dissertation shall be submitted for 'dissertation – evaluation' ordinarily at the end of IV Semester and 'dissertation – open defence' shall be held soon after the submission of the dissertation.

Student Learning Outcomes / Objectives:

- At the end of the course the student's gets exposure to design a research investigation that incorporates appropriate theoretical approaches, conceptual models, and a review of the existing literature.
- Students will learn to structure a discussion in a coherent and convincing way by summarizing the key arguments and providing suitable and coherent findings.
- Student will be able to draw valid conclusions, relating them to the research topic.
- Students will write a comprehensive review of the literature, including a review of other dissertation research related to their study.
- Students develop a design of their study with a discussion of the methodology to be used including selection of a sample, instrumentation and its testing, sources of data and the data collection process.
- Students describe how their data will be treated and analysed and the significance and limitations of their study.