Faculty of Technology & Engineering

Chandubhai S. Patel Institute of Technology (CSPIT)

ACADEMIC REGULATIONS & SYLLABUS

(Choice Based Credit System)

Master of Technology Programme

(Computer Engineering)

Academic Year 2020-2021

Education Campus – Changa, (ECC), hitherto a conglomerate of institutes of professional education in Engineering, Pharmacy, Computer Applications, Management, Applied Sciences, Physiotherapy and Nursing, is one of the choicest destinations by students. It has been transformed into **Charotar University of Science and Technology (CHARUSAT)** through an Act by Government of Gujarat. CHARUSAT is permitted to grant degrees under Section-22 of UGC- Govt. of India.

The journey of CHARUSAT started in the year 2000, with only 240 Students, 4 Programmes, one Institute and an investment of about Rs. 3 Crores (INR 30 million). At present there are seven different institutes falling under ambit of six different faculties. The programmes offered by these faculties range from undergraduate (UG) to Ph.D degrees including M.Phil. These faculties, in all offer 23 different programmes. A quick glimpse in as under:

Faculty	Institute	Programmes Offered
Faculty of Technology & Engineering	Charotar Institute of Technology	B. Tech M. Tech (CE/CSE/ICT) Ph. D
	Devang Patel Institute of Technology and Research	B.Tech (CE/IT/CSE)
Faculty of Pharmacy	Ramanbhai Patel College of Pharmacy	B. Pharm M. Pharm Ph. D PGDCT/ PGDPT
Faculty of Management Studies	Indukaka Ipcowala Institute of Management	M.B.A PGDM Ph.D Dual Degree BBA+MBA
Faculty of Computer Applications	Smt. Chandaben Mohanbhai Patel Institute of Computer Applications	M.C.A/MCA (Lateral) M.Sc IT Ph. D

		Dual Degree BCA+MCA
Faculty of Applied Sciences	P.D.Patel Institute of Applied Sciences	M.Sc M.Phil Ph.D Dual Degree B.Sc+M.Sc
Faculty of Medical Sciences	Ashok and Rita Institute of Physiotherapy Manikaka Topawala Institute of Nursing Charotar Institute of Paramedical Sciences	B.PT M.PT Ph.D B.Sc (Nursing) M.Sc GNM Ph.D PGDHA

The development and growth of the institutes have already led to an investment of over Rs.63 Crores (INR 630 Million). The future outlay is planned with an estimate of Rs. 250 Crores (INR 2500 Million).

The University is characterized by state-of-the-art infrastructural facilities, innovative teaching methods and highly learned faculty members. The University Campus sprawls over 100 acres of land and is Wi-Fi enabled. It is also recognized as the Greenest Campus of Gujarat.

CHARUSAT is privileged to have 300 core faculty members, educated and trained in Stanford, IITs, IIMs and leading Indian Universities, and with long exposure to industry. It is also proud of its past students who are employed in prestigious national and multinational corporations.

From one college to the level of a forward-looking University, **CHARUSAT** has the vision of entering the club of premier Universities initially in the country and then globally. **High Moral Values like Honesty, Integrity and Transparency** which have been the foundation of ECC continue to anchor the functioning of **CHARUSAT**. Banking on the world class infrastructure and highly qualified and competent faculty, the University is expected to be catapulted into top 20 Universities in the coming five years. In order to align with the global requirements, the University has collaborated with internationally reputed organizations like Pennsylvania State University – USA, University at Alabama at Birmingham – USA, Northwick Park Institute –UK, ISRO, BARC, etc.

CHARUSAT has designed curricula for all its programmes in line with the current international practices and emerging requirements. Industrial Visits, Study Tours, Expert Lectures and Interactive IT enabled Teaching Practice form an integral part of the unique **CHARUSAT** pedagogy.

The programmes are credit-based and have continuous evaluation as an important feature. The pedagogy is student-centred, augurs well for self-learning and motivation for enquiry and research, and contains innumerable unique features like:

- Participatory and interactive discussion-based classes.
- Sessions by visiting faculty members drawn from leading academic institutions and industry.
- Regular weekly seminars.
- Distinguished lecture series.
- Practical, field-based projects and assignments.
- Summer training in leading organizations under faculty supervision in relevant programmes.
- Industrial tours and visits.
- Extensive use of technology for learning.
- Final Placement through campus interviews.

Exploration in the field of knowledge through research and development and comprehensive industrial linkages will be a hallmark of the University, which will mould the students for global assignments through technology-based knowledge and critical skills.

The evaluation of the student is based on grading system. A student has to pursue his/her programme with diligence for scoring a good Cumulative Grade Point Average (CGPA) and for succeeding in the chosen profession and life.

CHARUSAT welcomes you for a Bright Future

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

Faculty of Technology and Engineering

ACADEMIC REGULATIONS

Master of Technology Programme

(Choice Based Credit System)

Charotar University of Science and Technology (CHARUSAT)
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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
First class:	CGPA≥ 6.0
Second 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 2018 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	
First Year 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
		University Elective-I	0	2	2	2	0	0	30	70	100
			19	**12**	**31**	**25**	**180**	**420**	**180**	**220**	**1000**
First Year 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
	HS705 A	Academic Writing	0	2	2	2	0	0	30	70	100
		University Elective-II	0	2	2	2	0	0	30	70	100
			17	**14**	**31**	**25**	**180**	**420**	**180**	**220**	**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
HS701 A	Advance Critical Thinking and Logic
HS703.01 A	Languages (French/ German)
HS704 A	Academic Speaking

Code	University Elective I (Semester 1)	Code	University Elective II (Semester 2)
MA771	Reliability and Risk Analysis	EE782.01	Energy Audit and Management
EE781.01	Optimization Techniques	CE771.01	Project Management
ME781.01	Occupational Health & Safety	CA 842	Mobile Application Development
CE772.01	Research Methodology	PT796	Fitness & Nutrition
CA730	Internet & Web Designing	NR752	Epidemiology and Community Health
PT795	Health & Physical Activity	OC733	Introduction to Polymer Science
NR751	Women's Health	MB651	Software based Statistical Analysis
RD701	Introduction to Analytical Techniques	PH826	Intellectual Property Rights
RD702	Introduction to Nanoscience & Technology	MA772	Design of Experiments
MB650	Creative Leadership		
PH825	Community Pharmacy Ownership		

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	
S.Y 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
S.Y 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

Credits and Hours:

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

A. Objective of the Course:

- To Understand basic issues, concepts, principles, and mechanisms in information security
- To know the methods of conventional encryption.
- To understand authentication and Hash functions.
- To analyze both early and contemporary threats to network security
- To identify and investigate threats to network security
- To understand how network security is conceptualized and carried out.
- Exposure to commercial as well as research security technologies.

B. 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

C. Detailed Syllabus:

1	**Introduction** Security Goals, Attacks, Services and Mechanisms, Techniques	**02 Hours**	**04%**
2.	**Mathematics of Cryptography** Integer Arithmetic, Modular Arithmetic, Matrices, Linear Congruence	**03 Hours**	**06%**
3.	**Tradition Symmetric Key Ciphers** Introduction, Substitution Ciphers, Transposition Ciphers, Stream and block Ciphers	**03 Hours**	**07%**
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,	**04 Hours**	**09%**

Transport Layer Security

12. **E-commerce Security** **04 Hours** **09%**

Electronic Voting / Polling systems -Standards and Applications

D. Instructional Method and Pedagogy:

- Lectures will be taken in class room with the use of multi-media presentations and black board – mix of both.
- Assignments based on above course content will be given to the students at the end of each chapter. Each assignment contains minimum 5 questions.
- Quizzes and Surprise tests will be conducted for testing the knowledge of students for particular topic.

E. Student Learning Outcomes:

After completing this course, students will be able to:

- Explain common attacks against network assets, the associated threats and vulnerabilities, and what network security personnel do to secure assets.
- Explain how to use cryptography to help protect information and how to choose an appropriate encryption method for an organization.
- Implement security-enhanced computing baselines in an organization.
- Help protect transmission of data by identifying threats to network devices and implementing security for common data transmission, remote access, and wireless network traffic.
- Identify common security threats and vulnerabilities to directory services and DNS, and then apply security methods to help protect them.
- Identify types of security policies to manage operational security, and then use these policies to ensure compliance by users in an organization.
- Preserve business continuity by implementing a security-enhanced disaster recovery strategy, communicating risks to others, and performing secure backup and recovery.

F. 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

Credits and Hours:

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

A. Objective of the Course:

The main objective to give the course

- To understand the basics of data mining
- To understand the basics of data warehousing and business intelligence
- To understand the use of the various data mining tools.

B. 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

C. 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 Imarts - 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** Data mining for business Applications like Balanced Scorecard, Fraud Detection, Clickstream Mining, Market Segmentation, retail industry, telecommunications industry, banking & finance and CRM etc.	**04 Hours**	**08%**
8.	**Advance topics** 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	**04 Hours**	**08%**

D. Instructional Method and Pedagogy:

- Lectures will be taken in class room with the use of multi-media presentations and black board – mix of both.
- Assignments based on above course content will be given to the students at the end of each chapter. Each assignment contains minimum 5 questions.
- Quizzes and Surprise tests will be conducted for testing the knowledge of students for particular topic.

E. Student Learning Outcomes:

By taking this course,

- Students will be able to use mining tool.
- Students are able to perform various data warehouse related exercise.

F. 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

Credits and Hours:

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

A. Objective of the Course:

- To study the Fundamentals behind Mobile Computing
- To study the Integration of Mobile Computing Technology
- To study insight into Wireless Technology
- To study the Protocols related Mobile Network and Mobile Transport Layer

B. 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

C. 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** GSM, Digital enhanced cordless telecommunications(DECT)	**04 Hours**	**09%**
3	**Medium access control** 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	**04 Hours**	**09%**
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%**

D. Instructional Method and Pedagogy:

- Lectures will be taken in class room with the use of multi-media presentations and black board – mix of both.
- Assignments based on above course content will be given to the students at the end of each chapter. Each assignment contains minimum 5 questions.
- Quizzes and Surprise tests will be conducted for testing the knowledge of students for particular topic.

E. Student Learning Outcomes:

By taking this course Mobile computing and Wireless Networking

- Understand the basic concepts Mobile Computing.

- Integration of Existing technology for development of Mobile Computing.
- Student will be able to make program which works on Cellular phones

F. 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	

A. Objective of the Course:

- Design modern SOA and apply SOA-specific methodologies, technologies and standards
- Analyze your organization to map it as a "set of services"
- Understand logical models for your SOA and Convert your SOA design into a buildable specification
- Study Orchestrate services to create new applications

B. 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

C. Detailed Syllabus:

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

Concepts; Service governance, characteristics; Business and technical benefits

2.	**SOA Fundamentals** 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.	**05 Hours**	**11%**
3.	**SOA Planning and Analysis** 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).	**08 Hours**	**18%**
4.	**SOA Design and implementation** 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.	**08 Hours**	**18%**
5.	**Managing SOA Environment** 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.	**05 Hours**	**11%**
6.	**SOA and WS** The WS platform (XML, SOAP, WSDL, UDDI); Service contracts; Service-level data model, security and interaction patterns; Business	**10 Hours**	**23%**

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

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Minimum 5 experiments shall be there in the laboratory related to course contents.
- Research / technical papers in relevant areas must be covered.
- Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.

E. Student Learning Outcomes:

Demonstrate an understanding of software oriented architectures.

- Demonstrate an understanding of the service composition.
- Demonstrate an ability to manage a modern medium scale software development project using SOA principles.
- Demonstrate an understanding of the principles linking business processes, process oriented architectures and service oriented architectures.

- Demonstrate and ability to implement a service oriented application.

F. 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	

A. Objective of the Course:

The main objective to give the course

- To understand basic of Parallel Processing.
- To understand the computer architecture for Parallel Processing.
- To understand the basic Parallel Programming.

B. 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

C. 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		

D. Instructional Method and Pedagogy:

- Lectures will be taken in class room with the use of multi-media presentations and black board – mix of both.
- Assignments based on above course content will be given to the students at the end of each chapter. Each assignment contains minimum 5 questions.
- Quizzes and Surprise tests will be conducted for testing the knowledge of students for particular topic.

E. Student Learning Outcomes:

By taking this course,

- Students will be able to write parallel program.
- Students are able to identify the requirement to make application parallel.

F. 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	

A. Objective of the Course:

- The objective of this course is to introduce students to the fundamentals and techniques of distributed computing and provide them with the basic skills of how to write distributed programs.
- Topics to be covered include: distributed computing, distributed programming, distributed systems, distributed computing paradigms, inter-process communications, group communications.
- Students are expected to develop distributed applications using latest technologies.

B. 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

C. 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**	**10 Hours**	**23%**

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.

3.	**Synchronization**	**10 Hours**	**23%**

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.

4.	**XML and XML Web services**	**03 Hours**	**06%**

Introduction to XML, APIs for XML Processing, XML Web services

5.	**Enterprise Application Integration, Web Services**	**10 Hours**	**23%**

Web services: Concepts, Protocols: SOAP, WSDL, UDDI,

Development of Web services, J2EE and .Net Interoperability

6. **Introduction to Cluster Computing , Grid Computing and Cloud Computing** **04 Hours** **08%**

   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, 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

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Faculty would use coached problem solving method as it is class format in which faculty provide a structured, guided context for students working collaboratively to solve problems.
- Attendance is compulsory in lectures and laboratory which carries 5% component of the overall evaluation.

- Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weight age of 5%.
- Surprise tests/Quizzes will be conducted which carries 5% component of the overall evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Minimum 10 experiments are suggested in the laboratory related to course content.

E. Student Learning Outcomes:

- The course will allow students to apply problem solving (analysis, design, and development) skills to distributed applications
- Student will be able to identify and decompose complex systems into its components parts
- Students will be able to integrate OS and programming language concepts to solve/implement the (distributed) components of the systems
- Students will be able to develop suites of networking protocols for implementing the communicating components
- Students will be able to evaluate or validate their implementations via simulations and/or realistic projects

F. 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

EC767: EMBEDDED SYSTEM DESIGN (CT - I)

Credits and Hours:

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

A. Objective of the Course:

Embedded systems are generally part of complex systems. An embedded system carries out the Computational subtasks of the main system. The computing systems within home appliances and Automobiles are examples of such systems. This course will cover the process of embedded Computing system design under mainly cost, power, performance and several system- specific Restrictions.

B. Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Introduction to Embedded Systems	08
2	Typical Embedded Systems	14
3	RISC microcontrollers	18
4	Embedded product development life cycle	05

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

C. Detailed Syllabus:

This will provide details about topics under each units of the course.

1 Introduction to Embedded Systems **08 Hours 18%**

1.1 History of embedded systems

1.2 Classification of embedded systems

1.3 Major application area of embedded systems

1.4	Purpose of embedded systems		
1.5	Fundamental issues in hardware software co-design		
1.6	Introduction to unified modeling language (UML)		
2	**Typical Embedded Systems**	**14 Hours**	**30%**
2.1	Core of the Embedded Systems		
2.2	Memory		
2.3	Sensors and actuators		
2.4	Communication interface		
2.5	Embedded firmware		
3	**RISC microcontrollers**	**18 Hours**	**40%**
3.1	RISC and CISC architectures		
3.2	AVR architecture and pin functions		
3.3	AVR programming in C		
3.4	I/O interfacing: LED, multiplexed 7-segment, LCD, GLCD, sensors, keypad, relay, buzzer		
3.5	AVR interrupt programming in C		
3.6	AVR serial programming in C		
3.7	Communication protocol: I2C protocol and RTC interfacing, SPI protocol and max7221 interfacing		
4	**Embedded product development life cycle**	**05 Hours**	**12%**
4.1	Product enclosure design tool		
4.2	Product enclosure development techniques		
4.3	Objective of EDLC		
4.4	Different phases of EDLC and approaches		

D. Instructional Method and Pedagogy:

- Multimedia Projector
- OHP
- Chapter wise Assignments
- Quiz
- Chalk + Board
- White Board
- Online Demo

E. Student Learning Outcomes:

After completion of the course students will be able to

- Will learn various peripheral components.
- Use AVR Programming to interface various peripherals.
- Able to visualize the design of an embedded system to unified modeling language.
- Able to analyze and document various development cycle for the embedded system.

F. Recommended Study Material:

❖ **Text Books:**

1. Introduction to Embedded Systems by shibu K V mcgraw hill
2. The AVR microcontroller and Embedded Systems by muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi

❖ **Reference Books:**

1. System Design: A Unified Hardware/Software Introduction by Frank Vahid and Tony D. Givargis, Addison Wesley, 2002.
2. Computers as Components by Wayne Wolf, Morgan Kaufmann, 2001
3. Embedded C programming and the ATMEL AVR by Barnett, cox and o'cull, Thomson

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	

A. Objective of the Course:

The main objective to give the course Operating System Design and Concepts is:

- To provide an in-depth understanding of how UNIX-based operating system works.
- To Understand the concepts of process synchronization and deadlock.
- To Understand various Memory management techniques.
- To be aware of latest trends in Operating Systems.

B. 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

C. 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** Introduction, architecture of Unix operating system, Mode space and context, The process abstraction, kernel data structure, Executing in kernel mode, System administrator	**08 Hours**	**18%**
3.	**Threads and Lightweight Processes** 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	**04 Hours**	**08%**
4.	**The Buffer Cache** Buffer headers, Structure of the buffer pool, Scenario for retrieval of a buffer, Reading and writing disk blocks, Advantages and disadvantages of duffer cache.	**06Hours**	**14%**
5.	**System Calls for the file system** 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	**08 Hours**	**18%**
6.	**Signal and Session Management** 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	**06 Hours**	**14%**
7.	**Interprocess Communications** Universal IPC facilities, System V IPC, Mach IPC, Messages, Ports, Message passing, Port operations, Extensibility Mach 3.0 enhancements, discussion	**06 Hours**	**14%**
8.	**Case Study: Multiprocessor Systems, Distributed Unix Systems** overview, Solutions with master and slave processors, solutions with semaphore, performance limitation, Satellite Processors, The Newcastle connection, transparent distributed file systems	**05 Hours**	**10%**

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Faculty would use coached problem solving method as it is class format in which faculty provide a structured, guided context for students working collaboratively to solve problems.
- Attendance is compulsory in lectures and laboratory which carries 5% component of the overall evaluation.
- Internal exams or Open-book tests will be conducted and average will be considered as a part of 15% overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weight age of 5%.
- Surprise tests/Quizzes will be conducted which carries 5% component of the overall evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Minimum 10 experiments are suggested in the laboratory related to course content.

E. Student Learning Outcomes:

- Students will be able to learn advanced topics in design and implementation of microkernel-based.
- Students will also learn to read and critique research papers.
- Students will be familiar with classic operating systems literature.
- Students will make substantial contributions to the operating systems project

F. 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.

EE771: DIGITAL SIGNAL PROCESSING & ITS APPLICATION (CT - I)

Credits and Hours:

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

A. Objective of the Course:

The educational objectives of this course are:

- To classify signals and systems & their mathematical representation
- To analyze the Discrete Time system and to study the various Digital Signal Processing concepts like Discrete Fourier Transform, design of Digital filters which will be useful in relevant applications.
- To motivate and to make the student able to apply the DSP Concepts in Real Time application.

B. Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Introduction to Signals and Systems	10
2	Realization of Discrete time systems	10
3	Discrete Fourier Transform	10
4	Digital Filter Design	15

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

C. Detailed Syllabus:

1. **Introduction to Signals and Systems** **10 Hours** **22 %**

   Basic elements of Digital Signal Processing System. Advantages of Digital over Analog Signal Processing, Generalized Block diagram of a DSP System,

Continuous-time Vs Discrete time signals, Classification of discrete time Signals, Deterministic and Random Signals, Periodic and Aperiodic signals, Even and odd signals, Exponential and Sinusoidal signals, Causal and Non-Causal signals, Energy and Power Signals, Some Standard signals like Impulse, Step, Ramp and Parabolic. **Basic operations on signals**: Shifting, Scaling, Time reversal or Folding, Addition, Subtraction, Multiplication. **Classification of discrete time Systems**: Static and Dynamic Systems, shift-variant and invariant systems, Linear and Non Linear systems, Causal and Non Causal systems, Stable and Unstable systems, impulse response and convolution sum, analytical evaluation of discrete convolution, properties of convolution

2.	**Realization of Discrete Time Systems**	**10 Hours**	**22 %**

Introduction to Z Transform, properties of Z transform, Numerical for Z transform, **Realization of discrete time systems:** basic building block, types of digital system, **Structures for Realization of IIR Systems and numerical**: Direct Form I, Direct Form II, Cascade form, Parallel form, **Structures for Realization of FIR systems and numerical**: Direct Form, Cascade Form Realization

3.	**Discrete Fourier Transform**	**10 Hours**	**22%**

Concepts of frequency in continuous-time and discrete time signals, Discrete Fourier Series: Exponential form, trigonometric form, relation between exponential and trigonometric form of discrete Fourier series, properties of discrete Fourier transform (DFT), Examples, Relation between DFT and Z transform. Numerical to compute DFT of signal, Computational Advantage of Fast Fourier Transform(FFT) Over DFT, Decimation in time (DIT) & Decimation in Frequency (DIF), Algorithm for implementation of FFT: Derivation, Butterfly Diagram & Related Numerical.

4.	**Digital Filter Design**	**15 Hours**	**34 %**

Advantages and disadvantages of digital filter over analog filters,

Classification of filter: low pass, high pass, band pass and band reject (Band Stop), filter specification and Magnitude Characteristics of Low Pass Filter.

Design of IIR Filters:

Design of IIR filters from analog filters: derivation for impulse invariant & Bilinear transformation method, Analog Butterworth and Chebyshev Filters, Design of digital low pass Butterworth filter and low pass Chebeshev filters, Design of High Pass, Band Pass and Band Reject IIR Filters from Low Pass IIR Filter, Frequency transformation in Analog Domain and Frequency transformation in Digital Domain & Related Numerical

Design of FIR Filters: Advantages and Disadvantages of FIR Filter, design of FIR filters using windows, various windows for FIR filter and summary, frequency sampling techniques, numerical

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, pre-requisite of the course will be discussed.
- Attendance is compulsory in lectures and laboratory.
- Two internal exams will be conducted as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lecturers.

E. Student Learning Outcomes:

Students will become familiar with the basics of DSP in various areas of Electrical engineering. Many real time complex project demands some sort of signal processing. Student will be taught about the basic concepts of signals, systems and signal processing and usage of tools such as Fourier transform and z-transform & thereby they will be able to process signals further for their application.

F. Recommended Study Material:

- **Text Books:**
  1. V. Udayashankara: Real time Digital Signal Processing, Fundamentals, Algorithms and Implementation using TMS Processor, Eastern Economy Edition
  2. A. Anand kumar, Digital Signal Processing, PHI Learning Pvt Ltd.
- **Reference Books:**
  1. John G. Proakis, Dimitris Manolakis: Digital Signal Processing - Principles, Algorithms and Applications, Pearson, ISBN 0-13-394289-9
  2. Steven T. Karris, Signals and Systems with MATLAB Computing and Simulink Modelin, Orchard Publications.
  3. Lecture Series on Digital Signal Processing by Prof.S. C Dutta Roy, Department of Electrical Engineering, IIT Delhi. For More details on NPTEL visit http://nptel.iitm.ac.in

CS767: KNOWLEDGE REPRESENTATION

Credits and Hours:

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

G. Objective of the Course:

- To understand basic issues, concepts, principles, and mechanisms in Knowledge Representation (KR).
- To explore a variety of representation formalisms and the associated algorithms for reasoning, propositions, and move on to first order logic, and then to representations for reasoning about action, change, situations, and about other agents in incomplete information situations.
- Conveying insight in the process of knowledge representation and its role in AI and insight in knowledge representation formalisms, their differences and correspondences. Conveying insight in different types of knowledge and the methodology to express them.
- Developing skills in expressing knowledge and solving computational tasks.
- Getting in touch with current hot research topics and questions about knowledge representation languages and tools: important research topics, important open research questions, experimentation with state-of-the-art inference tools. Exposure to commercial as well as research in KR.

H. Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	**Introduction on the role of Knowledge Representation in AI**	**03 Hours**
2	**Knowledge representation in classical logic**	**04 Hours**
3	**Extending classical logic with definitions**	**04 Hours**

4	**Knowledge representation in probabilistic logics**	**05 Hours**
5	**Introduction to non-logical KR-formalisms**	**05 Hours**
6	**Epistemic modal logic**	**04 Hours**
7	**Reasoning**	**04 Hours**
8	**Semantic Web**	**04 Hours**
9	**Ontology**	**06 Hours**
10	**Description Logic**	**06 Hours**

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

I. Detailed Syllabus:

1	**Introduction on the role of Knowledge Representation in AI**	**03 Hours**	**05%**
	Informal introduction to different types of knowledge and propositional attitudes, possible world analysis of knowledge, the role of knowledge in problem solving, the controversies and trade-offs of KR in AI		
2.	**Knowledge representation in classical logic**	**04 Hours**	**09%**
	Syntax, informal and formal semantics of classical logic, KR methology in classical logic, Propositional Logic, Syntax and Semantics, Proof Systems, Natural Deduction, Tableau Method, Resolution Method		
3.	**Extending classical logic with definitions**	**04 Hours**	**09%**
	First Order Logic (FOL), Syntax and Semantics, Unification, Forward Chaining Introduction to different types of definitions and inductive definitions, syntax and formal semantics of ID-logic. Deductive Retrieval, Backward Chaining, Logic Programming with Prolog. Resolution Refutation in FOL, FOL with Equality, Complexity of Theorem Proving		
4.	**Knowledge representation in probabilistic logics**	**05 Hours**	**11%**
	Introduction to probabilistic logics. Case study of CP-logic: syntax, informal and formal semantics		
5.	**Introduction to non-logical KR-formalisms**	**05 Hours**	**11%**
	Production rules and frame-based systems, Semantic Net		
6.	**Epistemic modal logic**	**04 Hours**	**09%**

	Default Logic, Autoepistemic Logic, Epistemic Logic, Multi Agent Scenarios Reasoning about knowledge, beliefs and intentions of other agents, syntax, formal and informal semantics of modal logic, correspondence theory, application to multi-agents systems		
7.	**Reasoning**	**04 Hours**	**09%**
	Default Reasoning, Circumscription, The Event Calculus Revisited Qualitative and Model Based Reasoning, Abductive Reasoning, Constraint Satisfaction, Reasoning with Actions		
8.	**Semantic Web**	**04 Hours**	**09%**
	Semantic Web Technology Stack, Architecture, XML, RDF, RDFS, OWL, OWL DL/EL, Proof, Reasoners and Logic		
9.	**Ontology**	**06 Hours**	**13%**
	Ontologies and representation of Domain Knowledge, Ontology Engineering, Ontology Learning, Ontology Alignment and Matching, Ontology Merging and Integration, Ontology based Applications, Reasoning in Ontology and Reasoners.		
10.	**Description Logic**	**06 Hours**	**13%**
	Description Logic (DL), Structure Matching, Classification, Extensions of DL, The ALC Language, Inheritance in Taxonomies, DL based Reasoners.		

J. Instructional Method and Pedagogy:

- Lectures will be taken in class room with the use of multi-media presentations and black board – mix of both.
- Assignments based on above course content will be given to the students at the end of each chapter. Each assignment contains minimum 5 questions.
- Quizzes and Surprise tests will be conducted for testing the knowledge of students for particular topic.

Student Learning Outcomes:

After completing this course, students will be able to:

- The course provides an in-depth introduction into the techniques that underlay advanced systems for knowledge representation and automated reasoning. The following topics are covered:
- Students should able to understand concepts of classical logic (recap), modal logics and qualitative temporal, non-monotonic reasoning: default logic, cumulative logic, non-monotonic logic programming, description logics, Semantic web and Ontology.
- Students should able develop skills and knowledge for development of Knowledge based applications and formalism.

K. Recommended Study Material:

❖ **Text Books:**

S. Russell and P. Norvig. Artificial Intelligence 2nd ed. Prentice Hall, 2002.

❖ **Reference Books:**

Brachman and Levesque. Knowledge Representation and Reasoning. Morgan Kauffman, 2004.

Deepak Khemani.A First Course in Artificial Intelligence, McGraw Hill Education (India).

The Description Logic Handbook: Theory, implementation, and applications, Franz Baader, Deborah L. McGuinness, Daniele Nardi and Peter F. Patel-Schneider, Cambridge University Press

ICT767: INFORMATION THEORY & CODING

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	7	4
Marks	100	100	200	

A. Objective of the Course:

Error control coding is an indispensible part of any digital communication system. In this introductory course, we will discuss theory of linear block codes and convolutional codes, their encoding and decoding techniques as well as their applications in real world scenarios. Starting from simple repetition codes, we will discuss among other codes: Hamming codes, Reed Muller codes, low density parity check codes, and turbo codes. We will also study how from simple codes by concatenation we can build more powerful error correcting codes.

B. Outline of the Course:

Sr No.	Title of the unit	Minimum number of hours
1.	Information Theory	06
2.	Linear Block Codes	10
3.	Coding Over AWGN channels	10
4.	LDPC codes	10
5.	Convolutional codes	06
6.	Applications of linear codes	03

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

C. Detailed Syllabus:

1.	**Information Theory**	**06 Hours**	**13**
1.1	Measure of Information, Source Encoding	**02**	
1.2	Error free communication over a Noisy channel	**02**	
1.3	Channel capacity of discrete memoryless channel, channel capacity of a continuous channel	**02**	
2	**Linear Block Codes**	**10 Hours**	**22**
2.1	Introduction to Error Control Coding	1 Hr	
2.2	Introduction to Linear block codes, Generator matrix and parity check matrix	2 Hr	
2.3	Syndrome, Error Correction and Error Detection	2 Hr	
2.4	Decoding of Linear block codes	1 Hr	
2.5	Distance Properties of Linear block codes	1 Hr	
2.6	Some Simple Linear block codes, Reed Muller Codes	2 Hr	
2.7	Bound on the Size of Code	1 Hr	
3	**Coding Over AWGN channels**	**10 Hours**	**22**
3	AWGN channels, Coding gain, Encoding and decoding in AWGN channels.	2 Hrs	
3.1	Bitwise MAP Decoder, Likelihood ratios, LLRs.	3 Hr	
3.2	ML and Map decoding for Repetition codes, Probability of decoding error, Channel Capacity, Capacity for various schemes, Eb/No, Coding Gain.	2 Hr	
3.3	Coding gain performances of previously studied codes, Proof of capacity and random codes, Low-Density Parity check (LDPC) codes, Regular LDPC codes, Gallager construction of LDPC codes.	3 Hr	
4	**LDPC codes**	10 Hours	**22**
4.1	Introduction to Low Density Parity Check Codes (LDPC) Code, Socket Construction of Regular LDPC codes, Tanner Graphs, Neighborhoods and Cycles in Graph	4 Hrs	

4.2	Decoding of Low Density Parity Check Codes	6 Hrs	
5	**Convolutional codes**	**06 Hours**	**13**
5.1	Convolutional codes- Feedforward Convolutional Encoder, Trellis Representation.	2 Hrs	
5.2	Viterbi Decoder for convolutional codes.	2 Hrs	
5.3	Viterbi Decoder (contd.), Recursive convolutional encoders.	2 Hrs	
6	**Applications of linear codes**	**3 Hours**	**8**
6.1	Application of Linear Block Code - Deep space communications, modems and wireless communications, compact discs, satellite communications and wireless communications.	02	
6.2	Comparison of coded and un-coded system	01	

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory which carries 5 Marks weightage.
- Two internal exams will be conducted and average of the same will be converted to equivalent of 15 Marks as a part of internal theory evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weightage of 5 Marks as a part of internal theory evaluation.
- Surprise tests/Quizzes/Seminar will be conducted which carries 5 Marks as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Student Learning Outcome:

After completion of the course students will be able to

- Understand the importance of information theory
- Able to implement linear codes and convolutional codes
- Apply the knowledge in signal processing applications

F. Recommended Study Material:

Text Books:

1. Error Control Coding (2 nd edition) by Shu Lin and Daniel Costello, Pearson

Reference Books:

2. Modern coding theory by Rudiger Urbanke and Thomas Richardson, Cambridge.
3. Modern Digital and Analog Communication Systems By B.P. Lathi Oxford publication

Reference Links/ e-content:

1. http://www.leizhang.tk/publications%20and%20codes.html
2. http://www4.comp.polyu.edu.hk/~cslzhang/papers.htm

HS701: ADVANCED CRITICAL THINKING & LOGIC (HSS ELECTIVE-I)

I. Credits and Schemes:

Sem	Course Code	Course Name	Credits	Teaching Scheme	Evaluation Scheme				
				Contact Hours/Week	Theory		Practical		Total
					Internal	External	Internal	External	
I	HS701	Advance Critical Thinking and Logic	02	02	30	70	--	--	100

II. Course Objectives

To facilitate learners to:

- critically and logically read, listen, and write
- develop intellectual and personal discipline
- recognize both the need and complexity of good reasoning, logic and critical thinking
- provide intellectual tools for more rigorous self-reflection and critical assessment of other people's arguments
- develop a sense of fairness and respect for opposing positions
- develop advance thinking skills that are applicable to a variety of academic subjects and learners' lives as citizens, consumers, leaders, and moral agents
- improve ability to argue fairly, and to handle bias, emotion, and propaganda
- develop scientific approach of thinking
- develop questioning competencies for logical and critical thinking

III. Course Outline

Module No.	Title/Topic	Classroom Contact Hours
1	**Introduction to Critical Thinking & Logic** • *Concept and Meaning of Thinking & Mind* • *Concept and Meaning of Critical Thinking* • *Concept and Meaning of Logic* • *History of Critical Thinking and Logic*	02
2	**Study of Theories and Critical Thinkers & Logicians** • *Socrates, Aristotle and Contemporary Theorists* • *Asian Critical Thinking Theories*	08

3	**Socratic Questioning** • *Background of Socratic Questioning* • *Importance of Socratic Questioning for Critical Thinking* • *Methods of Socratic Questing & Critical Thinking*	06
4	**Scientific Approach & Critical Thinking** • *Meaning and Concept of Science Approach & Critical thinking* • *Relationship of Critical Thinking to the Scientific Method*	04
5	**Logic and Arguments** • *Nature and Concept of Logic and Arguments* • *Application of Arguments for Logical Thinking*	06
6	**Contemporary Issues, Critical Thinking & Logic** • *Critical Thinking, Society and Moral Reasoning* • *Case Study*	04
	Total	30

IV. **Instruction Methods and Pedagogy**

The course is based on pragmatic learning. Teaching will be facilitated by Reading Material, Discussion, Task-based learning, projects, assignments and various interpersonal activities like case studies, critical reading, group work, independent and collaborative research, presentations, etc.

V. **Evaluation:**

The students will be evaluated continuously in the form of internal as well as external examinations. The evaluation (Theory) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation in the form of University examination.

Internal Evaluation

The students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
3	Assignment / Project Work / Quiz	3	--	25
4	Attendance and Class Participation			05
			Total	**30**

External Evaluation

The University Theory examination will be of 70 marks and will test the reasoning, logic and critical thinking skills of the students by asking them theoretical as well as application based questions. The examination will avoid, as far as possible, grammatical errors and will focus on applications. There will be at least one question on case analysis relevant to the components of the course.

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Theory Paper	01	70	70
			Total	70

VI. Learning Outcomes

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

- demonstrate the ability to use the elements of thought in developing their thinking process to effectively solve problems and make decisions.
- consistently apply the critical thinking standards to their thinking process to engage in the process of application, analysis, synthesis, and evaluation in order to make informed and effective decisions.
- become independent thinker.
- develop system thinking.
- develop moral reasoning.
- apply good reasoning to issues in professional and personal contexts.
- evaluate evidence and make appropriate inferences from that evidence.
- determine what evidence is necessary and know how to find that evidence, if possible.
- construct and defend arguments in support of or in opposition to particular propositions.

VII. Reference Books / Reading

- Critical Thinking : Introduction, by Alec Fisher, Cambridge
- Introduction to Logic by Harry J Gensler, Routledge
- http://www.skepdic.com/essays/haskins.pdf
- https://www.palgrave.com/PDFs/1403996857.Pdf
- www.criticalthinking.org
- philosophy.hku.hk/think/critical/ct.php

HS703.01 A: LANGUAGES (FRENCH) (HSS ELECTIVE-I)

I. Credits and Schemes:

Sem	Course Code	Course Name	Credits	Teaching Scheme	Evaluation Scheme				
				Contact Hours/Week	Theory		Practical		Total
					Internal	External	Internal	External	
I	HS703.01	LANGUAGES (French)	02	02	--	--	30	70	100

II. Course Outline

Module No.	Title/Topic	Classroom Contact Hours
1	**Introduction to French Language** **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**	08
2	**Grammar :** • Definite articles • Indefinite articles • Present tense o Positive Froms o Negative Forms • Numbers (21 to 100 , 100-1000) • Days ,Months ,Familly • Verbs: (aller,venir,finir,pouvoir,vouloir ..... "ir " verb) **Social Links:** 1) My family & relations 2) Appointments 3) Gathering information from someone	08

	Dialogue	
3	**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**	**08**
4	**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**	**06**
	Total	**30**

III. Instruction Methods and Pedagogy

The course is based on pragmatic learning. Teaching will be facilitated by Reading Material, Discussion, Task-based learning, assignments and various interpersonal activities like group/pair work, independent and collaborative work, presentations, etc.

IV. Evaluation:

The students will be evaluated continuously in the form of their consistent performance. There is no theoretical evaluation. There is just practical evaluation. The evaluation (practical) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation.

The students' performance in the course will be evaluated on a continuous basis through the following components:

Internal Evaluation:

Sl. No.	Component	Number	Marks per incident	Total Marks
1	Assignment / Presentation/ Task	5	5	25
2	Attendance and Class Participation			05
			Total	**30**

External Evaluation

The University Practical Examination will be for 70 marks and will test the LSRW skills in the French Language.

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Term Work, Viva and Practical (LSRW)	-	70	70
			Total	**70**

Note: The reference/ reading material will be provided in consultation with the expert.

HS703.01 A: LANGUAGES (GERMAN) (HSS ELECTIVE-I)

I. Credits and Schemes:

Sem	Course Code	Course Name	Credits	Teaching Scheme	Evaluation Scheme				
				Contact Hours/Week	Theory		Practical		Total
					Internal	External	Internal	External	
I	HS703.01	LANGUAGES (German)	02	02	--	--	30	70	100

II. Course Objectives

The Course is aimed at

- developing the language skills in listening, speaking, reading & writing in German language
- Introducing the learners to the lifestyle in Germany & the German Culture

III. Course Outline

Module No.	Title/Topic	Classroom Contact Hours
1	**Introduction to German Language** **Facts and figures about German Language** **Basic German Linguistics** * Alphabets * Accents * Liaison * Nasalization German Culture, Differ between German and English **Grammar :** • Sentence: statement, question, (question for completion and decision) command. • Coordination of clauses. • Placing of the verb in the sentence: first, second and last place. • Word order in a main clause. • Verbs: danken, arbeiten and many more **Presentation** **Everyday activities** • Personal and social life • The world around us • The world of work • The international world **Dialogue**	08
2	**Grammar** • Details of time, manner and place (casual).	08

	• Verb: infinitive, imperative, indicative – *Präsens*, *Perfekt*, *Präteritum* of auxiliary and modal verbs, modal verbs (meaning, indicative *Präsens* & *Präteritum*, **möchten**). • Verbs with prefixes – separable and inseparable. • Nouns: Gender, plural, Nominative, Accusative, Dative. • Verbs: fliegen, lieben and many more **Presentation** **Social Links:** • Everyday activities • Home life and school • Food, health and fitness **Dialogue**	
3	**Grammar** • Articles: Definite and Indefinite. • Adjectives: predicative use. • Pronouns: personal, interrogative, possessive and demonstrative pronouns (in Accusative & Dative), man, jemand, niemand the impersonal pronouns es , etwas , nichts • Prepositions: with Accusative; with Dative • Conjunctions: **und, aber, oder, sondern, denn, dann** **Presentation** **Work , Study and Travel** • The world of work • Continuing education • Careers and employment • Language and communication in the work place • The international world • Tourism at home and abroad • Life in other countries and communities • World events and issues **Dialogue**	**08**
4	**Grammar :** • Numerals: cardinal and ordinal numbers. • Modal particles: **aber, auch, denn, doch, mal, nur** • Negation: **nicht, kein, nie** • Special adverbs: **gern / lieber / am liebsten** • Common Prepositions • Common Conjunctions • Past Tense	**06**

	• Future Tense • Colors ,Shapes, Animals ,Vegetables, Fruits **Presentation** **Everyday activities** Home life and school Food, health and fitness **Dialogue**	
	Total	**30**

IV. **Instruction Methods and Pedagogy**

The course is based on pragmatic learning. Teaching will be facilitated by Reading Material, Discussion, Task-based learning, assignments and various interpersonal activities like group/pair work, independent and collaborative work, presentations, etc.

V. **Evaluation:**

The students will be evaluated continuously in the form of their consistent performance. There will be no theoretical evaluation. The evaluation is schemed as 30 marks for internal evaluation and 70 marks for external evaluation.

The students' performance in the course will be evaluated on a continuous basis through the following components:

Internal Evaluation:

Sl. No.	Component	Number	Marks per incident	Total Marks
1	Assignment / Presentation / Tasks	5	5	25
2	Attendance and Class Participation			05
			Total	**30**

External Evaluation

The University Practical Examination will be for 70 marks and will test the LSRW skills in the German Language.

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Viva / Practical Exam	-	70	70
			Total	**70**

VI. **Learning Outcome(s):**

- Can understand and use familiar, everyday expressions and very simple sentences, which relate to the satisfying of concrete needs.
- Can introduce him/ herself and others as well as ask others about themselves – e.g. where they live, who they know and what they own – and can respond to questions of this nature.
- Can communicate in a simple manner if the person they are speaking to speaks slowly and clearly and is willing to help.

- Can understand sentences and commonly used expressions associated with topics directly related to his/her direct circumstances (e.g. personal information or information about his/her family, shopping, work, immediate surroundings).
- Can make him/herself understood in simple, routine situations dealing with a simple and direct exchange of information on familiar and common topics. Can describe his/her background and education, immediate surroundings and other things associated with immediate needs in a simple way.

Note: The reference/ reading material will be provided in consultation with the expert.

HS704 A: ACADEMIC SPEAKING (HSS ELECTIVE-I)

I. Credits and Schemes:

Sem	Course Code	Course Name	Credits	Teaching Scheme	Evaluation Scheme				
				Contact Hours/Week	Theory		Practical		Total
					Internal	External	Internal	External	
II	HS704	Academic Speaking	02	02	--	--	30	70	100

II. Course Objectives

To facilitate learners to:

- explore the concepts of advance communication
- understand the concept academic language
- understand the concept and applications of academic speaking
- learn the nuances of formal/academic speaking
- explore and implement accurate pronunciation, stress and intonation patterns in English
- understand oral interactions, including impromptu speaking, job interviews, research presentations, and group discussion

III. Course Outline

Module No.	Title/Topic	Classroom Contact Hours
1	**Foundations of Advance Communication** • *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	04
2	**Art of Conversation** • *Describing people, places and things* • *Expressing opinions* • *Making suggesting* • *Persuading someone* • *Interpreting and Summarizing*	06
3	***Science of Power Speaking*** • *Phonemes*	06

	• *Word Stress* • *Pronunciation* • *Intonation* • *Pause* • *Register* • *Fluency* • *Prosody* • *Lexical Range*	
4	***Academic Speaking Application – Part I*** • *Art of Oratory* • *Formal Presentation* • *Speech Analysis – Decoding Best Speeches*	**08**
5	**Academic Speaking Application – Part II** • *Job Interview* • *Group Discussion* • *Meeting*	**06**
	Total	**30**

IV. **Instruction Methods and Pedagogy**

The course is based on practical learning. Teaching will be facilitated by reading material, discussion, task-based learning, projects, assignments and various interpersonal activities like case studies, group work, independent and collaborative research, presentations etc.

V. **Evaluation**

The students will be evaluated continuously in the form of their consistent performance throughout the semester. There is no theoretical evaluation. There is just practical evaluation. The evaluation (practical) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation.

Internal Evaluation

The students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	I-Talk	1	10	25
2	Situational Speaking	1	05	
3	Case Study - Speech Analysis	2	10	
4	Attendance and Class Participation	-		05
			Total	**30**

External Evaluation

The University Practical Examination will be for 70 marks and will test the advance communication skills and academic speaking.

Sl. No.	Component	Number	Marks per incidence	Total Marks

1	Viva / Practical	-	70	70
			Total	**70**

VI. Learning Outcomes

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

- understand and demonstrate advance communication skills and academic speaking.
- demonstrate linguistic competence
- demonstrate performing ability at group discussion and personal interview.
- demonstrate the formal presentation skills.
- demonstrate ability to communicate in diverse situations

VII. Reference Books

- Headway Academic Skills - Level 1: Listening, Speaking and Study Skills Student's Book Paperback

VIII. Reading

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

M. Tech. (Computer Engineering) Programme

SYLLABI

(Semester – 2)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

CE744: INTERNET OF THINGS

Credits and Hours:

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

A. Objective of the Course:

The main objectives for offering the course Internet of Things (IoT) are:

- Have built a couple of applications that will communicate with IoT hardware and software
- Have researched a specific IoT domain and provided insight on current work
- Be able to explain how IoT, cloud computing and big data analytics can work together
- Be able to evaluate an IoT offering in terms of IoT levels and Protocols

B. 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

C. 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		

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.

- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Student Learning Outcomes:

Upon completion of this course, students will be able to do the following:

- Understand the basic concepts Internet of Things
- Integration of Existing technology for development of IoT Applications
- Student will be able to make program which works on Sensors

F. 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

Credits and Hours:

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

A. Objective of the Course:

The main objective to give the course

- To understand uses of intelligent scenario of routing protocols.
- To learn current research area in to Intelligent Network
- To utilize the concepts of Intelligent Network to develop future applications.

B. 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

C. 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** 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.	**10 Hours**	**22%**
3.	**Transport and Application Services** 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.	**10 Hours**	**22%**
4.	**Software Defined Networking** History and evolution of SDN, Control and Data Plane of SDN, Network Virtualization, Network Function Virtualization	**05 Hours**	**11%**
5.	**Named Data Network** Introduction to NDN, CDN,CCN,SDN, Named Data Networking, Routing in NDN, Instant Messaging, Interest Forwarding, Performance Measurement of Name-Centric Content Distribution Methods	**13 Hours**	**29%**

D. Instructional Method and Pedagogy:

- Lectures will be taken in class room with the use of multi-media presentations and black board – mix of both.
- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Minimum 5 experiments shall be there in the laboratory related to course contents.
- Research / technical papers in relevant areas must be covered.
- Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.

E. Student Learning Outcomes:

By taking this course,

- To understand, design and implement Routing Protocol.
- Student will learn how congestion control can be applied to future network
- Students will know various addressing standards of internet
- Students will know various routing algorithm

F. 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

Credits and Hours:

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

A. Objective of the Course:

- Identify key elements of the cloud computing
- Understand and appreciate the need for cloud computing, and identify their use in industrial applications
- Apply the knowledge of the cloud application development platform for the development of e-business systems such as e-government, e-banking, e-logistics, e-learning and e-health.
- To analyse the current issues in cloud computing

B. 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

C. Detailed Syllabus:

1	**Fundamental of Virtualization** Type of Virtualization, Virtualization Technologies, Virtualize your Environment, Managing Virtualization Environment, Storage Virtualization.	**02 Hours**	**05%**
2.	**Fundamental Concepts and Models** Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models	**02 Hours**	**05%**
3.	**Cloud-Enabling Technology** Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology, Web Technology, Multitenant Technology, Service Technology.	**04 Hours**	**9%**
4.	**Fundamental Cloud Architectures** 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	**08 Hours**	**17%**
5.	**Advanced Cloud Architectures** 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	**12 Hours**	**26%**
6.	**Specialized Cloud Architectures** 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	**13 Hours**	**28%**

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.

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Faculty would use coached problem solving method as it is class format in which faculty provide a structured, guided context for students working collaboratively to solve problems.
- Attendance is compulsory in lectures and laboratory which carries 5% component of the overall evaluation.
- Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weight age of 5%.
- Surprise tests/Quizzes will be conducted which carries 5% component of the overall evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Minimum 10 experiments are suggested in the laboratory related to course content.

E. Student Learning Outcomes:

By taking this course Cloud Computing

- be able to evaluate a set of business requirements to determine suitability for a cloud computing delivery model.
- be able to identify and design an ICT Risk Management strategy for a cloud computing delivery plan to meet business requirements.
- be able to critically analyze business requirements to plan a migration to a cloud

model.

- be able to compare and critique Service Level Agreements (SLA) that meet the business requirements for a cloud computing plan.

F. 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	

A. Objective of the Course:

The main objective to give the course Advanced Compiler Construction is:

- To understand, the foundation of compiler and mathematical models of computation.
- To understand, what compiler could do and what it couldn't.
- To check the correctness of the compiler and measure the speed (runtime and compile time)
- To see the degree of optimization.
- To check error reporting and analysis (feedback) to user.
- To check the debugging facility provided by the compiler.

B. 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

C. Detailed Syllabus:

1.	**Language Translation Overview** 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	**02 Hours**	**05 %**
2.	**Lexical Analysis** 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	**06 Hours**	**14 %**
3.	**Syntax Analysis** 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.	**10 Hours**	**23 %**
4.	**Syntax-Directed Translation** 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.	**04 Hours**	**08 %**
5.	**Memory Allocation , Organization And Memory Management** 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,	**06 Hours**	**14 %**

Garbage Collection.

6.	**Intermediate Code Generation** Intermediate Languages, Declarations, Assignment Statements, Boolean Expressions, Case Statements, Back patching, Procedure Calls, Types of Intermediate Forms of the Program.	**04 Hours**	**08 %**
7.	**Code Optimization** 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.	**04 Hours**	**08 %**
8.	**Code Generation** 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.	**04 Hours**	**08 %**
9.	**Symbol Table Management** 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.	**05 Hours**	**12%**

D. Instructional Method and Pedagogy:

- Lectures will be taken in class room with the use of multi-media presentations and black board – mix of both.
- Assignments based on above course content will be given to the students at the end of each chapter. Each assignment contains minimum 5 questions.
- Quizzes and Surprise tests will be conducted for testing the knowledge of students for particular topic.

E. Student Learning Outcomes:

By taking this course Advanced Compiler Construction:

- Students will be able to use Lex and YACC tool.
- Students are able to perform lexical analysis and various parsing technique.

F. 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	

A. Objective of the Course:

The intent of this course is to present a broad introduction to Machine Learning, the study of computing systems that improve their performance with experience; including discussions of each of the major approaches. The primary focus of the course will be on understanding the underlying algorithms used in various learning systems.

At the end of the course the student will understand:

- Concept Learning and the General-to-Specific Ordering
- Decision Tree Learning
- Artificial Neural Networks
- Bayesian Learning
- Computational Learning Theory
- Instance-Based Learning
- Unsupervised learning

B. 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

C. 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** 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.	**05 Hours**	**11%**
7	**Artificial Neural Networks** 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.	**04 Hours**	**09%**
8	**Support Vector Machines** Maximum margin linear separators. Quadratic programming solution to finding maximum margin separators. Kernels for learning non-linear functions.	**04 Hours**	**09%**
9	**Bayesian Learning** 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.	**02 Hours**	**04%**
10	**Instance-Based Learning** Constructing explicit generalizations versus comparing to past specific examples. K-Nearest-neighbor algorithm. Case-based learning.	**02 Hours**	**04%**
11	**Introduction to G A, N N and Fuzzy logic** 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	**04 Hours**	**09%**

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.

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Minimum 5 experiments shall be there in the laboratory related to course contents.
- Research / technical papers in relevant areas must be covered.
- Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.

E. Student Learning Outcomes:

- Student will know how prediction from data can do.
- The course introduces an approach to thinking about machine learning.
- The students will be able to describe why a particular model is appropriate in a given situations, formulate the model and use it appropriately

F. 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	

A. Objective of the Course:

- To introduce basic concepts of algorithms
- To introduce mathematical aspects and analysis of algorithms
- To introduce various algorithmic techniques
- To introduce algorithm design methods
- To create analytical skills, to enable the students to design algorithms for various applications, and to analyse the algorithms.

B. 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

C. 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** Probability, Analyzing Quick Sort. QuickSelect – median selection in linear time. QuickSort and Treaps with High Probability, Treaps.	**10 Hours**	**22%**
3.	**Graph Algorithms** 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.	**08 Hours**	**18%**
4.	**String Matching** Introduction, The naïve string matching algorithm. The Rabin-Karp algorithm, Knuth-Morris-Pratt Algorithm, Boyer-Moore Algorithm.	**07 Hours**	**16%**
5.	**Approximation Algorithms** Greedy algorithms and approximation algorithms, Travelling Salesman Person, Approximation Algorithms for Set Cover and Clustering.	**08 Hours**	**18%**
6.	**Computational Complexity** Introduction, Complexity classes, More NP-Complete problems Max-Clique, Independent Set, Vertex Cover, Graph Coloring, Hamiltonian Cycle and Travelling Salesman Problem	**08 Hours**	**18%**

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.

- Faculty would use coached problem solving method as it is class format in which faculty provide a structured, guided context for students working collaboratively to solve problems.
- Attendance is compulsory in lectures and laboratory which carries 5% component of the overall evaluation.
- Internal exam will be conducted and will be considered as a part of 15% overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weight age of 5%.
- Surprise tests/Quizzes will be conducted which carries 5% component of the overall evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Minimum 10 experiments are suggested in the laboratory related to course content.

E. Student Learning Outcomes:

Upon completion of this course, students will be able to do the following:

- The students will learn Basic concepts of algorithms, mathematical aspects and analysis of algorithms, sorting and searching algorithms, various algorithmic techniques, algorithm design methods
- Enable the students to design algorithms for various applications, and to analyse the algorithms.

F. 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

EC768: DIGITAL IMAGE & SPEECH PROCESSING (CT - II)

Credits and Hours:

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

A. Objective of the Course:

The goal of this course is to provide the student with a working knowledge of Identify the quality characteristics of medical images that can be changed by digital processing , Describe the general relationship between image contrast and pixel values & Describe how the process of blurred (un-sharp) mask subtraction can increase the visibility of detail in images. Prerequisite knowledge for this subject is audio & video engineering .

B. Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Digital Image Processing: Introduction	1
2	Digital Image Fundamentals	3
3	Image Enhancement in Spatial Domain	5
4	Image Enhancement in Frequency Domain	4
5	Image Restoration	5
6	Color Image Processing	4
7	Digital Speech Signal Processing: Introduction	3
8	Digital Models for Speech Signal	5
9	Time Domain Models for Speech Processing	5
10	Digital Representation of The Speech Waveforms	4
11	Short Time Fourier Analysis	3
12	Linear Predictive Coding of Speech	3

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

C. Detailed Syllabus:

This will provide details about topics under each units of the course.

1.	**Digital Image Processing: Introduction**	**01 Hour**	**02 %**
1.1	Fundamental steps in Digital Image Processing		
1.2	Components of Image Processing System.		
2.	**Digital Image Fundamentals**	**03 Hours**	**06 %**
2.1	Image sensing and Acquisition		
2.2	Image Sampling and Quantization		
2.3	Basic relationship between pixel, Linear and Non Linear operation		
3.	**Image Enhancement in Spatial Domain**	**05 Hours**	**11%**
3.1	Basic Gray Level Transformations, Hostogram Processing		
3.2	Enhancement using Arithmatic /Logic operations		
3.3	Basics of Spatial filtering, Smoothing Spatial Filters		
3.4	Sharpening Spatial Filters		
4.	**Image Enhancement in Frequency Domain**	**04 Hours**	**10%**
4.1	Introduction Fourier Transform and Frequency Domain		
4.2	Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters		
4.3	Homomorphic Filtering		
5.	**Image Restoration**	**05 Hours**	**11 %**
5.1	Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering		
5.2	Periodic Noise Reduction by Frequency Domain Filtering		
5.3	Linear, Position-Invariant Degradations , Estimating the Degradation Function		
5.4	Inverse Filtering ,Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering,		
5.5	Geometric Mean Filter, Geometric Transformations		
6.	**Color Image Processing**	**04 Hours**	**10 %**
6.1	Color Models, Pseudo Color Processing		
6.2	Basics of Full-Color Image Processing, Color Transformations		
7.	**Digital Speech Signal Processing: Introduction**	**03 Hours**	**06 %**

7.1	Speech Signal, Signal Processing		
7.2	Digital Speech Processing		
7.3	Transform Representation of Signals and Systems		
7.4	Fundamentals of Digital Filters, Sampling		
8	**Digital Models for Speech Signal**	**05 Hours**	**11 %**
8.1	Process of Speech Production		
8.2	Acoustic Theory of Speech Production		
8.3	Digital Model for Speech Signals		
9	**Time Domain Models for Speech Processing**	**05 Hours**	**11 %**
9.1	Short Time Energy and Average Magnitude, Short Time Ave. Zero Crossing Rate		
9.2	Pitch Period Estimation using Parallel processing Approach, Short Time Autocorrelation Function		
9.3	Pitch Period Estimation using Autocorrelation Function, Median Smoothing and Speech Processing		
10	**Digital Representation of The Speech Waveforms**	**04 Hours**	**10 %**
10.1	Sampling Speech Signals, Statistical Model for Speech		
10.2	Instantaneous Quantization, Adaptive Quantization		
10.3	Differential Quantization, delta Modulation, DPCM, comparison of Systems		
10.4	Direct Digital Code Conversion		
11	**Short Time Fourier Analysis**	**03 Hours**	**06 %**
11.1	Definitions and Properties		
11.2	Design of Digital Filter Bank		
11.3	Spectrographic Displays		
11.4	Pitch Detection, Analysis-by-Synthesis		
12	**Linear Predictive Coding of Speech**	**03 Hours**	**06 %**
12.1	Basic Principles of Linear Predictive Analysis,		
12.2	Solution to LPC equations, Comparisons between methods of solutions		
12.3	Prediction Error Signal, Applications of LPC Parameters		

D. Instructional Method and Pedagogy:

- Multimedia Projector

- OHP
- Audio Visual Presentations
- Chalk + Board
- White Board
- Online Demo
- Charts

E. Student Learning Outcomes:

- Enhance the images for various medical & satellite applications
- Able to restore the images for forensic purpose
- To perform pseudo color image processing
- Implement digital model of speech signal
- predict the error of speech signal & learn LPC coder

F. Recommended Study Material:

❖ **Reference Books:**

1. Digital Image Processing, Rafael Gonzalez, Richard Woods,2nd ed., Pearson Education
2. Digital Processing of Speech Signals, L.R. Rabiner, R.W. Schafer, Pearson Education
3. Fundamentals of Digital Image Processing, A.K. Jain ,Prentice Hall of India

❖ **Web Materials:**

1. www.qi.tnw.tudelft.nl/Courses/FIP/noframes/fip.html
2. www.cs.dartmouth.edu/farid/tutorials/fip.pdf
3. www.imageprocessingplace.com/root_files…/tutorials.htm
4. speech.tifr.res.in/tutorials/fundamentalOfASR_picone96.pdf
5. en.wikipedia.org/wiki/Speech_recognition

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	

A. Objective of the Course:

The course aims to provide and understanding management issues process during software project management. It provides holistic views of different aspect of development process necessary for the management of the project which includes various activities, resources, quality, cost and system configuration etc. Software Quality and its management has become an extremely important aspect of software development and maintenance. Various models have been proposed about quality assurance of software products and processes. This course will enable the student to understand the issues related to design and development of good quality software, data gathering, and interpretation and learn the relevant techniques and quality models. Students will study the various topics relevant to Software Quality and Testing. This course also provides Quality Assurance details. It focuses on types of testing and test case generation for testing the software. It introduces the testing tool to test the system. Student will also learn defect prevention and software maintenance.

B. 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

C. Detailed Syllabus:

1.	**Introduction to Software Project Management System** Overview of Project Planning, Project Estimation, Project Scheduling, Organization and Team Structure, Risk Analysis and Management, Resource Allocation	**06 Hours**	**13 %**
2.	**Project Tracking and Configuration Management** 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	**08 Hours**	**17 %**
3.	**Introduction to Software Quality Assurance** 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	**05 Hours**	**11 %**
4.	**Software quality Assurance (SQA) Management and Software Quality Metrics** 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,	**08 Hours**	**17 %**

complexity metrics and their relationship with testing and quality, metrics for object-oriented software analysis.

5.	**Software Quality Engineering, Inspection and Defect prevention** Defining Quality Requirements, Complexity Metrics and models, Project Tracking and Oversight, Data Quality Control, Software Inspection, Reliability Models, Reliability Growth Models	**06 Hours**	**13 %**
6.	**Software Testing and Maintenance** 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	**08 Hours**	**17 %**
7.	**Software** Testing Tools Test case Generation Methodology, Study of various Testing Tools (Win Runner, Load Runner), Automatic Testing Tool.	**04 Hours**	**12 %**

D. Instructional Method and Pedagogy:

- Lectures will be taken in class room with the use of multi-media presentations and black board – mix of both.
- Assignments based on above course content will be given to the students at the end of each chapter. Each assignment contains minimum 5 questions.
- Quizzes and Surprise tests will be conducted for testing the knowledge of students for particular topic.

E. Student Learning Outcomes:

Upon successful completion of this course, students will be able to understand software project management process and different aspect of development process necessary for the management of the project which includes various activities, resources, quality, cost

and system configuration etc. Student will learn the issues related to design and development of good quality software, data gathering, and interpretation and learn the relevant techniques and quality models. Students will study the various topics relevant to Software Quality and Testing. It focuses on types of testing and test case generation for testing the software. It introduces the testing tool to test the system. Student will also learn defect prevention and software maintenance.

F. 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

EE772: RESTRUCTRING AND DEREGULATION OF POWER SYSTEM (CT - II)

Credits and Hours:

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

A. Objective of the Course:

- The organization of the electric sector in the world has been changing dramatically to allow for competition among generators and to create market condition in the sector, seen as necessary conditions for increasing the efficiency of electric energy production and distribution, offering a lower price, higher quality and secure product.
- This course is aimed at providing a basic understanding to different types of power system restructuring process of the world.
- The course also addresses the very important issues arising after the restructuring of the power system and their remedies.

B. Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Introduction to Deregulation in Power System	02
2	Power System Restructuring Model	03
3	Available Transfer Capability (ATC)	10
4	Congestion Management	10
5	Transmission Pricing	05
6	Ancillary Services	10
7	Optimal Bidding in Restructured Power System	05

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

C. Detailed Syllabus:

1.	**Introduction to Deregulation in Power System** Concepts of regulation and deregulation, Characteristic of regulated power system, Need to restructured the power system, Overview of a deregulated industry, Disaggregation of traditionally vertically integrated utility, Structure of deregulated power system, Different entities in deregulated power system, Responsibilities of independent system operator, Trading arrangements: Pool, Bilateral, Multilateral, Power Exchange, Energy auction and market clearing prices	**02 Hours**	**4.44%**
2.	**Power System Restructuring Model** Classification of market models, Models based on energy trading, Models based on contractual agreements, Models based on ISO, Market operations, Day-Ahead and Hour-ahead markets, Elastic and Inelastic market, Market power, Vertical and horizontal market power, Measuring market power	**03 Hours**	**6.66%**
3.	**Available Transfer Capability (ATC)** Definition of ATC, Criteria for ATC evaluation, Methods of ATC calculation, Power transfer distribution factor (PTDF) and Line outage distribution factor (LODF), Optimal power flow (OPF), Continuation power flow (CPF), Open Access Same-Time Information System (OASIS), Structure of OASIS, Functionality of OASIS, Posting of information on OASIS, Information requirement of OASIS	**10 Hours**	**22.22%**
4.	**Congestion Management** Definition and effects of congestion in restructured power system, General methodologies for congestion management, Transaction curtailment, Transmission capacity reservation, System re-dispatch, Overall congestion management process, Methods for congestion management, Available transfer capability (ATC), Price area congestion management, Optimal power flow (OPF), Formulation of intra-zonal and inter-zonal problem for congestion management, Market based dynamic	**10 Hours**	**22.22%**

	congestion management		
5.	**Transmission Pricing** Cost component of transmission system, Pricing of transmission service, Transmission pricing methods	**05 Hours**	**11.11%**
6.	**Ancillary services** Ancillary services in restructured power system, Global overview of ancillary service management, Reactive power as an ancillary services, Reactive power placement analysis, Nodal pricing of reactive power, Costing and pricing of third party reactive power support, Synchronous generator as an ancillary service provider, Frequency regulation as an ancillary service, Spinning reserve service, Black start capability service	**10 Hours**	**22.22%**
7.	**Optimal Bidding in Restructured Power System** Game theory – an overview, Framing of bidding problem in game theory, Example, Optimization based approach for making bidding, Optimization based market simulator, Market prices with GENCOs behavior, Markov decision process	**05 Hours**	**11.11%**

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, pre-requisite of the subject will be discussed.
- Lecturers will be conducted with aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory, which carries 10 marks in overall evaluation.
- Two internal exams will be conducted and average of the same will be converted to equivalent of 15 Marks as a part of internal theory evaluation.
- Assignments based on course content will be given to the students for each unit and will be evaluated at regular interval. It carries a weightage of 5 marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lecturers.

E. Student Learning Outcomes:

At the end of course, the students will acquire the knowledge regarding the benefits of restructured power system, its problems and remedial measures.

F. Recommended Study Material:

❖ **Text Books:**

1. L. L. Lai, Power System Restructuring and Deregulation, John Wiley & Sons, UK, 2001.
2. M. Shahidehpour and M. Alomoush, Restructured Electrical Power Systems, Operation, Trading, and Volatility, Marcel Dekker, 2001.
3. K. Bhattacharya, M. H. J. Bollen and J. E. Daalder, Operation of Restructured Power Systems, Kluwer Academic Publishers, 2001.
4. Yong-Hua Song and Xi-Fan Wang (Eds), Operation of Market-oriented Power Systems, Springer, 2003.

CS768: Data Science & Analytics

Credit and Hours:

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

A. Objective of the Course:

The main objectives to give the course Data Science & Analytics are:

- To understand the basics of Data Science & Analytics.
- To develop in depth understanding of the key technologies in data analytics and business analytics: data mining, visualization techniques and predictive modelling.
- To apply principles of Data analytics to the analysis of business problems.
- To use data analytic software to solve real-world problems.
- To apply algorithms to build machine intelligence.

B. Outline of the course:

Sr No.	Title of the unit	Minimum number of hours
1.	Fundamentals of Data Science	06
2.	Introduction to Data Analytics	06
3.	**Data Representation and Visualization**	05
4.	Big Data Technology : NO SQL	10
5.	Mining Social-Network Graphs & Recommendation System	09
6.	Data Analytics Trends and Research Frontiers	09

Total hours (Theory): 45 Hrs.

Total hours (Lab): 30 Hrs.

Total hours: 75 Hrs.

C. Detailed Syllabus:

1.	**Introduction to Data Science & Analytics**	02 hours	13.33 %
Defining Data Science, Data science in business, Use cases for data science, Role of Data Scientist, Defining Data Analytics, importance of data analytics, **data science methodology**, **analytic approach**, Classification of Analytics, Top Challenges Facing in Big Data, Kind of Technologies to meet the Challenges Posed by Big Data			
2	Data Pre-processing & Statistical Methods for Decision Making	08 Hours	13.33 %
Data cleaning, data integration, data reduction, data transformation and data discretization, Probability Theory, Statistical Inference, Sampling Theory, Hypothesis Testing, Regression Analysis			
3.	**Data Representation and Visualization**	05 Hours	11.11 %
Exploring Data, Finding Relationships among Variables, Basic Visualization Tools: Graphing Data bar, pie charts, heat maps, barcharts, histograms, scatter plots, word clouds, Correlation and Covariance			
4	**Big Data Technology : NO SQL**	10 Hours	22.23 %
Not only SQL (NoSQL): Usage, Types of NoSQL, Advantages of NoSQL. Use of NoSQL in Industry, NoSQL Vendors, SQL versus NoSQL, Graph database Neo4j. Introduction to MongoDB key features, Core Server tools, Creating and Querying through Indexes, Document-Oriented, principles of schema design, Constructing queries on Databases, collections and Documents , MongoDB Query Language			
5.	**Mining Social-Network Graphs & Recommendation System**	09 hours	20.00 %
Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis, Web-based networks, Applications of Social Network Analysis. A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering, Dimensionality Reduction, The NetFlix Challenge			
6.	**Data Analytics Trends and Research Frontiers**	09 hours	20.00 %
Mining Complex Data Types, Mining Sequence Data: Time-Series, Symbolic Sequences, and Biological Sequences, Mining Graphs and Networks, Mining Spatial Data, Mining Spatiotemporal Data and Moving Objects, Mining Multimedia Data, Mining Web Data, Mining Stream Data			

D. Instructional Method and Pedagogy:

- Lectures will be taken in class room with the use of multi-media presentations and black board – mix of both.
- Assignments based on above course content will be given to the students at the end of each chapter..

- Quizzes and Surprise tests will be conducted for testing the knowledge of students for particular topic.

E. Student Learning Outcome:

By taking this course students will be able to,

- Integrate components of data analytics to produce knowledge-based solutions for real-world challenges
- Generate hypothesis and determine ways to conduct an analysis based on the interactivity and integration of data systems
- Students will be able to formulate visualization and discovery strategies
- Apply analytical techniques to prepare data for analysis

F. Recommended Study Material:

❖ **Text Books:**

1. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press

❖ **Reference Books:**

1. M. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education.
2. J. Han, M. Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann
3. Tom White, Hadoop: The Definitive Guide, Third Edition, O'reilly Media
4. Zikopoulos, Paul, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, Tata McGraw Hill Publications

ICT768: REAL TIME SYSTEM PROGRAMING

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	7	4
Marks	100	100	200	

A. Objective of the Course:

The Objective of the Course is Leverage to basics of real-time operating systems and to give the participant knowledge and skills necessary to develop software for embedded computer systems using a real-time operating system.

B. Outline of the Course:

Sr No.	Title of the unit	Minimum number of hours
1.	Fundamentals of Real-Time Systems	6
2.	Inter Process Communication & Real Time Task Scheduling	12
3.	Real Time OS & scheduling	10
4.	Handling resource sharing	10
5.	Case studies	07

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

D. Detailed Syllabus:

1.	**Introduction of Embedded Linux**	**6 Hours**	**13%**
1.1	Concepts and misconceptions	**01**	
1.2	Multidisciplinary Design Challenges	**01**	
1.3	Birth and Evolution of Real-time systems	**01**	
1.4	Hardware for Real-Time Systems	**01**	
1.5	Characteristics of Real Time systems	02	
2.	**Inter Process Communication &Programming using Raspberry Pi**	**12 Hours**	**27%**

2.1	Getting started with Raspberry Pi	02	
2.2	GPIO programming	02	
2.3	Signal handling	02	
2.4	Shared Memory Communication	03	
2.5	Message-Based Communication	03	
3	**Real Time OS & scheduling**	**10 Hours**	**22%**
3.1	Features of RTOS	02	
3.2	Types of Operating systems	02	
3.3	Clock driven and Event driven scheduling	02	
3.4	Non preemptive scheduling	02	
3.5	preemptive scheduling	**01**	
3.6	Rate-Monotonic Scheduling	01	
4	**Handling resource sharing**	**10 Hours**	**22%**
4.1	Priority Inheritance	**01**	
4.2	priority ceiling	02	
4.3	Issues in resource sharing protocols	02	
4.4	Time-loading	02	
4.5	Memory Loading	**02**	
4.6	Power Optimization Strategies for tasks	01	
5	**Case studies**	**07 Hours**	**16%**
5.1	An embedded system for an adaptive cruise control system in a car	04	
5.2	An embedded system for smart card	03	

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory which carries 5 Marks weightage.

- Two internal exams will be conducted and average of the same will be converted to equivalent of 15 Marks as a part of internal theory evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weightage of 5 Marks as a part of internal theory evaluation.
- Surprise tests/Quizzes/Seminar will be conducted which carries 5 Marks as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Student Learning Outcome:

After completion of the course students will be able to

- Understand Theoretical background and practical knowledge of real-time operating systems.
- Understand multitasking techniques in real-time systems.
- Understand the impact of real time operating systems on application area.
- Write programs using FreeRTOS code.

F. Recommended Study Material:

- Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design," 2/e, Kindle Publishers, 2005.
- Embedded Systems - Architecture, Programming and Design", Raj Kamal, McGraw-Hill, Inc.
- Tanenbaum,"Modern Operating Systems," 3/e, Pearson Edition, 2007.
- Jean J Labrosse,"Embedded Systems Building Blocks Complete and Ready-to-use Modules in C," 2/e, 1999.
- C.M.Krishna and G.Shin, "Real Time Systems," McGraw-Hill International Edition, 1997.
- Philips A. Laplante, "Real-Time System Design and Analysis," Wiley-IEEE Press, 3rd Edition, 2004.
- Rajib Mall, "Real Time System, Theory and Practice" Pearson Edition
- Introduction to Embedded Systems by Shibu K V

HS705 A: ACADEMIC WRITING

I. Credits and Schemes:

Sem	Course Code	Course Name	Credits	Teaching Scheme	Evaluation Scheme				
				Contact Hours/Week	Theory		Practical		Tota
					Internal	External	Internal	External	
II	HS705	Academic Writing	02	02	--	--	30	70	100

II. Course Objectives

To facilitate learners to:

- explore and demonstrate professional communication skills
- understand the concept and applications of academic writing
- learn the academic writing style, strategy and approach
- explore and implement accurate and effective writing in English in academic setting
- hone their academic writing skills in general

III. Course Outline

Module No.	Title / Topic	Classroom Contact Hours
1	**Academic Writing and Research Process** • *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*	**05**
2	**Anatomy of Academic Writing** • *Academic Vocabulary* • *Simple and Complex Sentences* • *Organizing Paragraphs* • *The Writing Process* • *Adopting Academic Writing Style*	**05**
3	**Key Academic Skills** • Note – taking • Note – making • Paraphrasing • Summarizing	**05**
4	**Accuracy in Academic Writing** • *Lexical Range*	**05**

	• *Academic Language and Structures* • *Elements of Writing* • *Proof Reading, Editing, and Rewriting*	
5	**Using and Citing Sources of Ideas** • *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*	**05**
6	**Contemporary Practices in Academic Writing** • Analytical Essays • Graph / Table / Process Interpretation and Description • Writing Reports • Writing Research / Concept Papers	**05**
Total		**30**

IV. **Instruction Methods and Pedagogy**

The course is based on practical learning. Teaching will be facilitated by reading material, discussion, task-based learning, projects, assignments and various interpersonal activities like writing, group work, independent and collaborative research, etc.

V. **Evaluation**

The students will be evaluated continuously in the form of their consistent performance throughout the semester. There is no theoretical evaluation. There is just practical evaluation. The evaluation (practical) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation.

Internal Evaluation

The students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Paragraph Writing	1	3	03
2	Note-taking / Note-making	1	3	03
3	Paraphrasing / Summarizing	1	4	04
4	Essay Writing	1	5	05
5	Concept Paper Writing	1	10	10
5	Attendance and Class Participation			05
			Total	**30**

External Evaluation

The University Practical Examination will be for 70 marks and will test the professional communication skills and academic writing skills of the students.

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Viva / Practical /Quiz/ Project / Academic Writing	-	70	70
			Total	**70**

VI. Learning Outcomes

At the end of the course, learners:

- will have sound understanding of the concept and applications of academic writing
- will have acquired enough knowledge of academic writing style, strategy and approach
- will be able to demonstrate error free and effective academic writing
- will be able to demonstrate ability to work on project/report/paper writing

VII. Reference Books / Reading

Essential Reading for Concepts

- Academic Writing for International Students, Routledge
- Academic Writing: A Guide for Management Students and Researchers. Monipally, M. M. & Pawar, B. S. Sage. 2010. New Delhi

Essential Reading for Activity and Teacher Resource

- ***Effective Academic Writing Level - 1,2,3,4 (Second Edition) By:*** Alice Savage, Patricia Mayer, Masoud Shafiei, Rhonda Liss, & Jason Davis; *Publisher: Oxford*

Additional Reading

- Writing Your Thesis (2nd Edition) by Paul Oliver, Sage
- Development Communication In Practice by Vilanilam V J, Sage
- Intercultural Communication by Mingsheng Li, Patel Fay, Sage
- 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	

A. Objective of the Course:

The main objectives to give the subject Mathematical Methods for Computing & Research Methodology are:

- To provide additional mathematical skill useful for the research project work
- To develop and test one's ability to learn independently
- To provide exposure in the field of Research Methodology
- To provide a deep understanding of the area of mathematical methods for computer science.
- To provide an innovative ability to solve practical/utility problems of computer science

B. 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

C. Detailed Syllabus:

1	**Interpolation and Integration** Newton's forward interpolation formula, Newton's backward interpolation formula, Lagrange's interpolation formula, Numerical integration: Composite rules (Trapezoidal rule, Simpson's rules).	**06 Hours**	**07 %**
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**	**03 Hours**	**05 %**

	What is a Research Problem? - Selecting the Problem-Necessity of Defining the Problem Technique Involved in Defining a Problem-An Illustration-Conclusion		
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 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	**03 Hours**	**05 %**
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	**03 Hours**	**05 %**

	Asymmetry (Skewness)-Measures of Relationship-Simple Regression Analysis-Multiple Correlation and Regression-Partial Correlation-Association in Case of Attributes		
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 the Approach Based on Bayesian Statistics	**03 Hours**	**05 %**
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 χ2 Test-Steps Involved in Applying Chi-square Test-Alternative Formula-Yates' Correction-Conversion ofχ2into Phi Coefficient-Conversion ofχ2into Coefficient by Contingency-Important Characteristics ofχ2Test-Caution in Using χ2 Test	**03 Hours**	**05 %**
14	**Analysis of Variance and Covariance**	**03 Hours**	**05 %**

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

D. Instructional Method and Pedagogy:

- Lectures will be taken in class room with the use of multi-media presentations and black board – mix of both.
- Assignments based on above course content will be given to the students at the end of each chapter. Each assignment contains minimum 5 questions.
- Quizzes and Surprise tests will be conducted for testing the knowledge of students for particular topic.

- Students will select related topic based on subjects they learnt and other literatures like books, periodicals, journals and various internet resources.
- Students can select the topic based on the research areas of available supervisor/guide.

E. Student Learning Outcome:

- 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 explore the new ideas & the possible areas to work ahead.
- Student will learn the various research methodologies useful for doing project work.
- Student will learn to investigate the chosen topic in depth. This implies collecting and reviewing literature and understanding and interpreting the most up-to-date concepts and theories of your chosen academic field and/or project topic.
- Student will learn to apply the concepts and theories learnt in previous years of study and work placements.

F. 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	

A. Objective of the Course:

- To develop and test one's ability to learn independently.
- To apply the concepts and theories learnt in previous years of study and work placements.
- To test one's ability to complete a substantial piece of work to a laid-down standard and within a given time period.
- To Identifying a topic and developing a research question or set of questions within an academically sound framework connected to specialization.
- To investigate the chosen topic in depth. This implies collecting and reviewing literature (e.g. books, papers, journals, websites, proceedings etc.) and understanding and interpreting the most up-to-date concepts and theories of your chosen academic field and/or thesis topic.
- To provide you with a blueprint for a successful project/dissertation.
- To demonstrate the blueprint and way to implementation and writing a successful dissertation before the project phase II starts.

B. 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.

C. 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.

D. 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	18	18
Marks	-	1000	1000	

A. Objective of the Course:

- To provide an innovative ability to solve practical/utility problems.
- To provide a capacity to learn continually and interact with multidisciplinary groups.
- To interpret the research material of project – I in a critical manner and to proceed with an analysis/simulation/experimentation and critical review.
- To discover and provide a framework within which research is conducted so that student's answers are fact based and backed-up by solid information.
- To craft an extensive and comprehensive piece of written work so as to convey research in the most efficient and effective way and therefore confirm to the reader that the thesis is, as a minimum, of a worthy standard and quality.

B. 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.

C. 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.

D. 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.