

AC – 5th May, 2018

Item No. – 4.51

UNIVERSITY OF MUMBAI



Revised syllabus (Rev- 2016) from Academic Year 2016 -17

Under

FACULTY OF TECHNOLOGY

Computer Engineering

Second Year with Effect from **AY 2017-18**

Third Year with Effect from **AY 2018-19**

Final Year with Effect from **AY 2019-20**

As per **Choice Based Credit and Grading System**

with effect from the AY 2016–17

Co-ordinator, Faculty of Technology's Preamble:

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited. In line with this Faculty of Technology of University of Mumbai has taken a lead in incorporating philosophy of outcome based education in the process of curriculum development.

Faculty of Technology, University of Mumbai, in one of its meeting unanimously resolved that, each Board of Studies shall prepare some Program Educational Objectives (PEO's) and give freedom to affiliated Institutes to add few (PEO's). It is also resolved that course objectives and course outcomes are to be clearly defined for each course, so that all faculty members in affiliated institutes understand the depth and approach of course to be taught, which will enhance learner's learning process. It was also resolved that, maximum senior faculty from colleges and experts from industry to be involved while revising the curriculum. I am happy to state that, each Board of studies has adhered to the resolutions passed by Faculty of Technology, and developed curriculum accordingly. In addition to outcome based education, semester based credit and grading system is also introduced to ensure quality of engineering education.

Choice based Credit and Grading system enables a much-required shift in focus from teacher-centric to learner-centric education since the workload estimated is based on the investment of time in learning and not in teaching. It also focuses on continuous evaluation which will enhance the quality of education. University of Mumbai has taken a lead in implementing the system through its affiliated Institutes and Faculty of Technology has devised a transparent credit assignment policy and adopted ten points scale to grade learner's performance. Credit assignment for courses is based on 15 weeks teaching learning process, however content of courses is to be taught in 12-13 weeks and remaining 2-3 weeks to be utilized for revision, guest lectures, coverage of content beyond syllabus etc.

Choice based Credit and grading system is implemented from the academic year 2016-17 through optional courses at department and institute level. This will be effective for SE, TE and BE from academic year 2017-18, 2018-19 and 2019-20 respectively.

Dr. S. K. Ukarande

Dean (I/ c), Faculty of Science and Technology,

Member - Academic Council,

University of Mumbai, Mumbai

Chairman's Preamble:

Engineering education in India is expanding and is set to increase manifold. The major challenge in the current scenario is to ensure quality to the stakeholders along with expansion. To meet this challenge, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education and reflects the fact that in achieving recognition, the institution or program of study is committed and open to external review to meet certain minimum specified standards. The major emphasis of this accreditation process is to measure the outcomes of the program that is being accredited. Program outcomes are essentially a range of skills and knowledge that a student will have at the time of graduation from the program. In line with this Faculty of Technology of University of Mumbai has taken a lead in incorporating the philosophy of outcome based education in the process of curriculum development.

As the Chairman, Board of Studies in Computer Engineering of the University of Mumbai, I am happy to state here that, the Program Educational Objectives for Undergraduate Program were finalized in a brainstorming session, which was attended by more than 85 members from different affiliated Institutes of the University. They are either Heads of Departments or their senior representatives from the Department of Computer Engineering. The Program Educational Objectives finalized for the undergraduate program in Computer Engineering are listed below;

1. To prepare the Learner with a sound foundation in the mathematical, scientific and engineering fundamentals.
2. To motivate the Learner in the art of self-learning and to use modern tools for solving real life problems.
3. To equip the Learner with broad education necessary to understand the impact of Computer Science and Engineering in a global and social context.
4. To encourage, motivate and prepare the Learner's for Lifelong- learning.
5. To inculcate professional and ethical attitude, good leadership qualities and commitment to social responsibilities in the Learner's thought process.

In addition to Program Educational Objectives, for each course of the program, objectives and expected outcomes from a learner's point of view are also included in the curriculum to support the philosophy of outcome based education. I strongly believe that even a small step taken in the right direction will definitely help in providing quality education to the major stakeholders.

Dr. Subhash K. Shinde

**Chairman, Board of Studies in Computer Engineering,
University of Mumbai, Mumbai.**

Program Structure B.E. Computer Engineering, (Rev. 2016) w.e.f. AY 2019-20

B. E. Computer Engineering (Semester-VIII)

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract	Tut	Theory	TW/Pract	Tut	Total
CSC801	Human Machine Interaction	4	-	-	4	-	-	4
CSC802	Distributed Computing	4	-	-	4	-	-	4
CSDLO 801X	Department Level Optional Course -IV	4	-	-	4	-	-	4
ILO801X	Institute Level Optional Course-II	3	-	-	3	-	-	3
CSL801	Human Machine Interaction Lab	-	2	-	-	1	-	1
CSL802	Distributed Computing Lab	-	2	-	-	1	-	1
CSL803	Cloud Computing Lab	-	4	-	-	2	-	2
CSL804	Computational Lab-II	-	2	-	-	1	-	1
CSP805	Major Project-II	-	12	-	-	6	-	6
Total		15	22	-	15	11	-	26

Course Code	Course Name	Examination Scheme								
		Theory					TW	Oral	Oral & Pract	Total
		Internal Assessment			End Sem. Exam	Exam Duration (in				
		Test 1	Test 2	Avg.						
CSC801	Human Machine Interaction	20	20	20	80	3	-	-	-	100
CSC802	Distributed Computing	20	20	20	80	3	-	-	-	100
CSDLO 801X	Department Level Optional Course -IV	20	20	20	80	3	-	-	-	100
ILO801X	Institute Level Optional Course-II	20	20	20	80	3	-	-	-	100
CSC801	Human Machine Interaction Lab						25	25	-	50
CSL802	Distributed Computing Lab	-	-	-	-	-	25	25		50
CSL803	Cloud Computing Lab	-	-	-	-	-	50	--	25	75
CSL804	Computational Lab-II	-	-	-	-	-	50	--	25	75
CSP805	Major Project-II						50	--	50	100
Total		80	80	80	320	--	200	50	100	750

Sem.	Department Level Optional Course (DLOC)	Institute Level Optional Course (ILOC)
V	CSDLO5011: Multimedia System CSDLO5012: Advance Operating System CSDLO5013: Advance Algorithm	-----
VI	CSDLO6021: Machine Learning CSDLO6022: Advance Database System CSDLO6023: Enterprise Resource Planning CSDLO6024: Advance Computer Network	-----
VII	CSDLO7031: Advance System Security & Digital Forensics CSDLO7032: Big Data & Analytics CSDLO7033: Robotics	ILO7011. Product Lifecycle Management ILO7012. Reliability Engineering ILO7013. Management Information System ILO7014. Design of Experiments ILO7015. Operation Research ILO7016. Cyber Security and Laws ILO7017. Disaster Management & Mitigation Measures ILO7018. Energy Audit and Management ILO7019. Development Engineering
VIII	DLO8011: High Performance Computing DLO8012: Natural Language Processing DLO8013: Adhoc Wireless Network	ILO8021. Project Management ILO8022. Finance Management ILO8023. Entrepreneurship Development and Management ILO8024. Human Resource Management ILO8025. Professional Ethics and CSR ILO8026. Research Methodology ILO8027. IPR and Patenting ILO8028. Digital Business Management ILO8029. Environmental Management

Course Code	Course Name	Credits
CSC801	Human Machine Interaction	4

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

1. Learn the foundation of human machine interaction.
2. Understand the importance of human psychology in designing good interfaces.
3. Be aware of mobile interaction design and its usage in day – to – day activities.
4. Understand various design technologies to meet user requirements.
5. Encourage to indulge into research in Machine Interaction Design.

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

1. Identify User Interface (UI) design principles.
2. Analysis of effective user friendly interfaces.
3. Apply Interactive Design process in real world applications.
4. Evaluate UI design and justify.
5. Create application for social and technical task.

Pre-requisites: Web Technologies; Software Engineering; Experience in designing interfaces for applications and web sites. Basic knowledge of designing tools and languages like HTML, Java, etc

Module No.	Topics	Hrs.
1.0	FOUNDATIONS OF HMI: The Human: History of User Interface Designing, I/O channels, Hardware, Software and Operating environments, The Psychopathology of everyday Things, Psychology of everyday actions, Reasoning and problem solving . The computer: Devices, Memory, processing and networks. Interaction: Models, frameworks, Ergonomics, styles, elements, interactivity, Paradigms.	8
2.0	DESIGN & SOFTWARE PROCESS: Mistakes performed while designing a computer system, Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds .Interactive Design basics, process, scenarios, navigation, Iteration and prototyping. HMI in software process: software life cycle, usability engineering, Prototyping in practice, design rationale. Design rules: principles, standards, guidelines, rules. Recognize the goals, Goal directed design process. Evaluation Techniques: Universal Design.	10
3.0	GRAPHICAL USER INTERFACE: The graphical User Interface: Popularity of graphics, the concept of direct manipulation, graphical systems, Characteristics. Web user Interface: Interface popularity, characteristics. The merging of graphical Business systems and the Web. Principles of user interface design.	8

4.0	SCREEN DESIGNING: Design goals , Screen planning and purpose, organizing screen elements, ordering of screen data and content , screen navigation and flow, Visually pleasing composition, amount of information, focus and emphasis, presentation information simply and meaningfully, information retrieval on web, statistical graphics, Technological consideration in interface design.	10
5.0	INTERFACE DESIGN FOR MOBILE DEVICES: Mobile Ecosystem: Platforms, Application frameworks: Types of Mobile Applications: Widgets, Applications, Games, Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	8
6.0	INTERACTION STYLES AND COMMUNICATION: Windows:Characteristics, Components, Presentation styles, Types of Windows, Management, operations. Text messages: Words, Sentences, messages and text words, Text for web pages. Icons, Multimedia and colors	8
	Total	52

Text Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, 3rd Edition, Pearson Education, 2004.
2. Wilbert O. Galitz, “The Essential Guide to User Interface Design”, Wiley publication.
3. Alan Cooper, Robert Reimann, David Cronin, “About Face3: Essentials of Interaction design”, Wiley publication.
4. Jeff Johnson, “Designing with the mind in mind”, Morgan Kaufmann Publication.
5. Donald A. Normann, “ Design of everyday things”, Basic Books; Reprint edition 2002.
6. Brian Fling, “Mobile Design and Development”, First Edition , O’Reilly Media Inc., 2009.

Reference Books:

1. Rogers Sharp Preece, ”Interaction Design: Beyond Human Computer Interaction”, Wiley.
2. Guy A. Boy “The Handbook of Human Machine Interaction”, Ashgate publishing Ltd.
3. Kalbande, Kanade, Iyer, “Galitz’s Human Machine Interaction”, Wiley Publications.

Assessment:

Internal Assessment:

Assessment consists of two class tests of 20 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 40% syllabus is completed. Duration of each test shall be one hour.

End Semester Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3. Question No.1 will be compulsory and based on entire syllabus.
4. Remaining question (Q.2 to Q.6) will be selected from all the modules.

Course Code	Course Name	Credits
CSC802	Distributed Computing	04

Course objectives:

1. To provide students with contemporary knowledge in distributed systems
2. To equip students with skills to analyze and design distributed applications.
3. To provide master skills to measure the performance of distributed synchronization algorithms

Course outcomes: On successful completion of course learner will be able to:

1. Demonstrate knowledge of the basic elements and concepts related to distributed system technologies;
2. Illustrate the middleware technologies that support distributed applications such as RPC, RMI and Object based middleware.
3. Analyze the various techniques used for clock synchronization and mutual exclusion
4. Demonstrate the concepts of Resource and Process management and synchronization algorithms
5. Demonstrate the concepts of Consistency and Replication Management
6. Apply the knowledge of Distributed File System to analyze various file systems like NFS, AFS and the experience in building large-scale distributed applications.

Prerequisite: Java Programming, Operating Systems, Computer Networks

Module No.	Unit No.	Topics	Hrs.
1.0	Introduction to Distributed Systems		06
	1.1	Characterization of Distributed Systems: Issues, Goals, and Types of distributed systems, Distributed System Models, Hardware concepts, Software Concept.	
	1.2	Middleware: Models of Middleware, Services offered by middleware, Client Server model.	
2.0	Communication		10
	2.1	Layered Protocols, Interprocess communication (IPC): MPI, Remote Procedure Call (RPC), Remote Object Invocation, Remote Method Invocation (RMI)	
	2.2	Message Oriented Communication, Stream Oriented Communication, Group Communication	
3.0	Synchronization		10
	3.1	Clock Synchronization, Logical Clocks, Election Algorithms, Mutual Exclusion, Distributed Mutual Exclusion-Classification of mutual Exclusion Algorithm, Requirements of Mutual Exclusion Algorithms, Performance measure.	
	3.2	Non Token based Algorithms: Lamport Algorithm, Ricart-Agrawala's Algorithm, Maekawa's Algorithm	
	3.3	Token Based Algorithms: Suzuki-Kasami's Broadcast Algorithms, Singhal's Heuristic Algorithm, Raymond's Tree based Algorithm, Comparative Performance Analysis.	
4.0	Resource and Process Management		06
	4.1	Desirable Features of global Scheduling algorithm, Task assignment approach, Load balancing approach, load sharing approach	
	4.2	Introduction to process management, process migration, Threads,	

		Virtualization, Clients, Servers, Code Migration	
5.0	Consistency, Replication and Fault Tolerance		08
	5.1	Introduction to replication and consistency, Data-Centric and Client-Centric Consistency Models, Replica Management	
	5.2	Fault Tolerance: Introduction, Process resilience, Reliable client-server and group communication, Recovery	
6.0	Distributed File Systems and Name Services		12
	6.1	Introduction and features of DFS, File models, File Accessing models, File-Caching Schemes, File Replication, Case Study: Distributed File Systems (DSF), Network File System (NFS), Andrew File System (AFS)	
	6.2	Introduction to Name services and Domain Name System, Directory Services, Case Study: The Global Name Service, The X.500 Directory Service	
	6.3	Designing Distributed Systems: Google Case Study	
		Total	52

Assessment:

Internal Assessment:

Assessment consists of two class tests of 20 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 40% syllabus is completed. Duration of each test shall be one hour.

End Semester Theory Examination:

- Question paper will comprise of 6 questions, each carrying 20 marks.
- The students need to solve total 4 questions.
- Question No.1 will be compulsory and based on entire syllabus.
- Remaining question (Q.2 to Q.6) will be selected from all the modules.

Text Books:

- Andrew S. Tanenbaum and Maarten Van Steen, "Distributed Systems: Principles and Paradigms, 2nd edition, Pearson Education.
- George Coulouris, Jean Dollimore, Tim Kindberg, , "Distributed Systems: Concepts and Design", 4th Edition, Pearson Education, 2005.

Reference Books:

- A. S. Tanenbaum and M. V. Steen, "Distributed Systems: Principles and Paradigms", Second Edition, Prentice Hall, 2006.
- M. L. Liu, "Distributed Computing Principles and Applications", Pearson Addison Wesley, 2004.

Course Code	Course Name	Credits
DLO8012	Natural Language Processing	4

Course objectives:

1. To understand natural language processing and to learn how to apply basic algorithms in this field.
2. To get acquainted with the basic concepts and algorithmic description of the main language levels: morphology, syntax, semantics, and pragmatics.
3. To design and implement applications based on natural language processing
4. To implement various language Models.
5. To design systems that uses NLP techniques

Course outcomes: On successful completion of course learner should:

1. Have a broad understanding of the field of natural language processing.
2. Have a sense of the capabilities and limitations of current natural language technologies,
3. Be able to model linguistic phenomena with formal grammars.
4. Be able to Design, implement and test algorithms for NLP problems
5. Understand the mathematical and linguistic foundations underlying approaches to the various areas in NLP
6. Be able to apply NLP techniques to design real world NLP applications such as machine translation, text categorization, text summarization, information extraction...etc.

Prerequisite: Data structure & Algorithms, Theory of computer science, Probability Theory.

Module No.	Unit No.	Topics	Hrs.
1	Introduction	History of NLP, Generic NLP system, levels of NLP , Knowledge in language processing , Ambiguity in Natural language , stages in NLP, challenges of NLP ,Applications of NLP	4
2	Word Level Analysis	Morphology analysis –survey of English Morphology, Inflectional morphology & Derivational morphology, Lemmatization, Regular expression, finite automata, finite state transducers (FST) ,Morphological parsing with FST , Lexicon free FST Porter stemmer. N –Grams- N-gram language model, N-gram for spelling correction.	10
3	Syntax analysis	Part-Of-Speech tagging(POS)- Tag set for English (Penn Treebank) , Rule based POS tagging, Stochastic POS tagging, Issues –Multiple tags & words, Unknown words. Introduction to CFG, Sequence labeling: Hidden Markov Model (HMM), Maximum Entropy, and Conditional Random Field (CRF).	10
4	Semantic Analysis	Lexical Semantics, Attachment for fragment of English- sentences, noun phrases, Verb phrases, prepositional phrases, Relations among lexemes & their senses –Homonymy, Polysemy, Synonymy, Hyponymy, WordNet, Robust Word Sense Disambiguation (WSD) ,Dictionary based approach	10

5	Pragmatics	Discourse –reference resolution, reference phenomenon , syntactic & semantic constraints on co reference	8
6	Applications (preferably for Indian regional languages)	Machine translation, Information retrieval, Question answers system, categorization, summarization, sentiment analysis, Named Entity Recognition.	10

Text Books:

1. Daniel Jurafsky, James H. Martin “Speech and Language Processing” Second Edition, Prentice Hall, 2008.
2. Christopher D.Manning and Hinrich Schutze, “ Foundations of Statistical Natural Language Processing “, MIT Press, 1999.

Reference Books:

1. Siddiqui and Tiwary U.S., Natural Language Processing and Information Retrieval, Oxford University Press (2008).
2. Daniel M Bikel and Imed Zitouni “ Multilingual natural language processing applications” Pearson, 2013
3. Alexander Clark (Editor), Chris Fox (Editor), Shalom Lappin (Editor) “ The Handbook of Computational Linguistics and Natural Language Processing “ ISBN: 978-1-118-
4. Steven Bird, Ewan Klein, Natural Language Processing with Python, O’Reilly
5. Brian Neil Levine, An Introduction to R Programming
6. Niel J le Roux, Sugnet Lubbe, A step by step tutorial : An introduction into R application and programming

Assessment:

Internal Assessment:

Assessment consists of two class tests of 20 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 40% syllabus is completed. Duration of each test shall be one hour.

End Semester Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3. Question No.1 will be compulsory and based on entire syllabus.
4. Remaining question (Q.2 to Q.6) will be selected from all the modules.

Laboratory Work/Case study/Experiments:

Description: The Laboratory Work (Experiments) for this course is required to be performed and to be evaluated in CSL803: Computational Lab-II

The objective of Natural Language Processing lab is to introduce the students with the basics of NLP which will empower them for developing advanced NLP tools and solving practical problems in this field.

Reference for Experiments: <http://cse24-iiith.virtual-labs.ac.in/#>

Reference for NPTEL: <http://www.cse.iitb.ac.in/~cs626-449>

Sample Experiments: possible tools / language: R tool/ Python programming Language

Note: Although it is not mandatory, the experiments can be conducted with reference to any Indian regional language.

1. Preprocessing of text (Tokenization, Filtration, Script Validation, Stop Word Removal, Stemming)
2. Morphological Analysis
3. N-gram model
4. POS tagging
5. Chunking
6. Named Entity Recognition
7. Case Study/ Mini Project based on Application mentioned in Module 6.

Course Code	Course Name	Credits
ILO8023	Entrepreneurship Development and Management	03

Objectives:

1. To acquaint with entrepreneurship and management of business
2. Understand Indian environment for entrepreneurship
3. Idea of EDP, MSME

Outcomes: Learner will be able to...

1. Understand the concept of business plan and ownerships
2. Interpret key regulations and legal aspects of entrepreneurship in India
3. Understand government policies for entrepreneurs

Module	Detailed Contents	Hrs
01	Overview Of Entrepreneurship: Definitions, Roles and Functions/Values of Entrepreneurship, History of Entrepreneurship Development, Role of Entrepreneurship in the National Economy, Functions of an Entrepreneur, Entrepreneurship and Forms of Business Ownership Role of Money and Capital Markets in Entrepreneurial Development: Contribution of Government Agencies in Sourcing information for Entrepreneurship	04
02	Business Plans And Importance Of Capital To Entrepreneurship: Preliminary and Marketing Plans, Management and Personnel, Start-up Costs and Financing as well as Projected Financial Statements, Legal Section, Insurance, Suppliers and Risks, Assumptions and Conclusion, Capital and its Importance to the Entrepreneur Entrepreneurship And Business Development: Starting a New Business, Buying an Existing Business, New Product Development, Business Growth and the Entrepreneur Law and its Relevance to Business Operations	09
03	Women's Entrepreneurship Development, Social entrepreneurship-role and need, EDP cell, role of sustainability and sustainable development for SMEs, case studies, exercises	05
04	Indian Environment for Entrepreneurship: key regulations and legal aspects , MSME Act 2006 and its implications, schemes and policies of the Ministry of MSME, role and responsibilities of various government organisations, departments, banks etc., Role of State governments in terms of infrastructure developments and support etc., Public private partnerships, National Skill development Mission, Credit Guarantee Fund, PMEGP, discussions, group exercises etc	08
05	Effective Management of Business: Issues and problems faced by micro and small enterprises and effective management of M and S enterprises (risk management, credit availability, technology innovation, supply chain management, linkage with large industries), exercises, e-Marketing	08
06	Achieving Success In The Small Business: Stages of the small business life cycle, four types of firm-level growth strategies, Options – harvesting or closing small business Critical Success factors of small business	05

Assessment:

Internal Assessment for 20 marks:

Consisting Two Compulsory Class Tests

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions, each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved.**

REFERENCES:

1. Poornima Charantimath, Entrepreneurship development- Small Business Enterprise, Pearson
2. Education Robert D Hisrich, Michael P Peters, Dean A Shapherd, Entrepreneurship, latest edition, The McGrawHill Company
3. Dr TN Chhabra, Entrepreneurship Development, Sun India Publications, New Delhi
4. Dr CN Prasad, Small and Medium Enterprises in Global Perspective, New century Publications, New Delhi
5. Vasant Desai, Entrepreneurial development and management, Himalaya Publishing House
6. Maddhurima Lall, Shikah Sahai, Entrepreneurship, Excel Books
7. Rashmi Bansal, STAY hungry STAY foolish, CHIE, IIM Ahmedabad
8. Law and Practice relating to Micro, Small and Medium enterprises, Taxmann Publication Ltd.
9. Kurakto, Entrepreneurship- Principles and Practices, Thomson Publication
10. Laghu Udyog Samachar
11. www.msme.gov.in
12. www.dcmesme.gov.in
13. www.msmetraining.gov.in

Lab Code	Lab Name	Credits
CSL801	Human Machine Interactions Lab	1

Lab Outcome:

- 1: To design user centric interfaces.
- 2: To design innovative and user friendly interfaces.
- 3: To apply HMI in their day-to-day activities.
- 4: To criticize existing interface designs, and improve them.
- 5: To Design application for social Task.
- 6: To Design application for Technical Tasks

Description:

Human Machine Interaction provides the study of user interface and benefit of good design. The design process gives an idea about how people interact with computer and the problems that they fall, so understanding the human characteristics is important as this lays the base for a good interface. It enables the students to apply his/her design skills to develop an appropriate Mobile App or Website. Students also learn the different types of icon, color and its representation with social and ethical concerns. Students can also learn the different software tools used to assemble and build user interface along with the different types of interaction devices and finally try to measure the usability of the application by learning HMI principles.

Suggested List of Experiments:

Sr. No.	Title of Experiments
1	Problem representation for Designing User Interface
2	Design a Mobile app/ Website that can teach mathematics to children of 4-5 years age in schools in Rural /Urban Sector
3	Design a Mobile App/Website that can help people to sell their handmade products in metro cities
4	ATM machine/KIOSK screen design for rural people.
5	Design a Mobile App/Website to get an experience for passengers whose flight /train is delayed.
6	Design an UI application for Institute event management.
7	Design of User interface for the system using various interaction styles.
8	Statistical Graphics and its use in visualization
9	Design appropriate icons pertaining to a given domain .(Eg. Greeting cards)

10	Design a personal website for an Artisan
11	Design a interface for Home appliances
12	Design an interactive data access using Graphics (QR, BAR Code, Image etc) and generating a print form
13	Redesign of a user interface (Suggest and implement changes in Existing User Interface
14	Design a navigator for a student new in your Institute.
15	Design a navigator for a person new in tourist city/ village
16	Design UI for Motor paralysis for disabled people.
17	KIOSK design for hospital/school/educational campus/National Institute.
18	To calculate screen complexity of existing Graphical User Interface and redesign the interface to minimize the screen complexity.

Guidelines:

1. Students are expected to use advanced tools and Technologies towards execution of lab work.
2. Students can work individually or only 2-3 Students can form a team if they wish to work in Group.
3. Case Study and assignments may be linked with CSC801 Syllabus.

Term Work:

Laboratory work will be based on above syllabus with minimum 10(Ten) experiments in line with the above Lab outcomes to be incorporated with 13(Thirteen) lab session of 2 (two) hours each. The problem statement can be decided by the instructor in line with the above list of experiments

The distribution of 25 marks for term work shall be as follows:

Lab Performance	15
Mini Project	05
Attendance (Theory & Practical)	05

Oral exam will be based on the above and CSC801:‘HMI Theory’ Syllabus.

Lab Code	Lab Name	Credits
CSL802	Distributed Computing Lab	01

Lab Outcome:

1. Develop, test and debug RPC/RMI based client-server programs.
2. Implement the main underlying components of distributed systems (such as IPC, name resolution, file systems etc.)
3. Implement various techniques of synchronization.
4. Design and implement application programs on distributed systems.

Suggested List of Experiments:

Sr. No.	Title of Experiments
1	Client/server using RPC/RMI.
2	Implementation of multi tread application
3	Inter-process communication
4	Group Communication
5	Load Balancing Algorithm.
6	Name Resolution protocol.
7	Election Algorithm.
8	Clock Synchronization algorithms.
9	Mutual Exclusion Algorithm.
10	Deadlock management in Distributed systems
11	Distributed File System
12	CORBA

Term Work:

Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

Laboratory work (experiments): (15) Marks.
Assignments: (05) Marks.
Attendance (Theory + Practical)..... (05) Marks
TOTAL: (25) Marks.

Oral exam will be based on the above and CSC802 syllabus.

Lab Code	Course Name	Credits
CSL803	Cloud Computing Lab	2

Lab Objectives: The course will help the learners to get familiar with

1. Key concepts of virtualization.
2. Various deployment models such as private, public, hybrid and community.
3. Various service models such as IaaS and PaaS.
4. Security and Privacy issues in cloud.

Lab Outcomes: On completion of the course learners will be able to

1. Adapt different types of virtualization and increase resource utilization.
2. Build a private cloud using open source technologies.
3. Analyze security issues on cloud.
4. Develop real world web applications and deploy on commercial cloud.
5. Demonstrate various service models.

Module	Detailed Contents	Hours
01	Title: Study of NIST model of cloud computing. Objective: Understand deployment models, service models, advantages of cloud computing.	2
02	Title: Virtualization. Objective: Understand different types of virtualizations, Host and bare metal hypervisors and implement horizontal scalability. Technology: XEN/ Vmwares EXSi	2
03	Title: Infrastructure as a Service. Objective: Implement IaaS using your resources. Technology: Open Stack / Eucalyptus	2
04	Title: Identity Management in Cloud Concept: Simulate identity management in your private cloud. Technology: Open Stack	2
05	Title: Storage as a Service Objective: Explore Storage as a Service for remote file access using web interface. Technology: ownCloud	2
06	Title: Cloud Security Objective: Understand security of web server and data directory. Technology: ownCloud	2
07	Title: Platform as a Service Objective: Deploy web applications on commercial cloud. Technology: Google appEngine/ Windows Azure	2
08	Title: Amazon Web Service Objective: To create and access VM instances and demonstrate various	2

	components such as EC2, S3, Simple DB, DynamoDB. Technology: AWS	
09	Title: Software as a Service Objective: Understand on demand application delivery and Virtual desktop infrastructure. Technology: Ulteo	2
10	Title: Case Study on Fog Computing Objective: To have a basic understanding of implementation/applications of fog computing.	2
11	Title: Mini Project Objective: Using the concepts studied throughout the semester students shall be able to <ol style="list-style-type: none"> 1. Create their private cloud for the institute using the available resources. 2. Apply security concepts to secure a private cloud. 3. Implement efficient load balancing. 4. Compare various virtualization technologies with given resource. 5. Create cloud applications such as messenger, photo editing website, your own social media etc. Note: Evaluators must check if students have used appropriate cloud computing tools for their projects.	6

Digital Material

www.openstack.org

Text Books:

1. Enterprise Cloud Computing by Gautam Shroff, Cambridge, 2010
2. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley - India, 2010 ,
3. Getting Started with OwnCloud by Aditya Patawar , Packt Publishing Ltd, 2013

Term Work:

- Term work should consist of at least 6 experiments and a mini project.
- Journal must include at least 2 assignments.
- The final certification and acceptance of term work indicates that performance in laboratory work is satisfactory and minimum passing marks may be given in term work.
- The distribution of marks for term work shall be as follows:
- Laboratory work (experiments): (15) Marks.
- Mini project..... (15) Marks.
- Mini Project Presentation & Report..... (10) Marks
- Assignments..... (05) Marks
- Attendance(05) Marks
- **TOTAL:(50) Marks.**

Practical and Oral examination will be based on Laboratory work, mini project and above syllabus.

Lab Code	Course Name	Credits
CSL804	Computational Lab II	1

Lab Outcome: After successful completion of this course student will be able to:

1. Acquire practical knowledge within the chosen area of technology for project development.
2. Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.

Description:

Design and implementation of any case study/ applications /experiments / mini project based on departmental level optional courses using modern tools.

Term work:

The distribution of marks for **term work** shall be as follows:

Lab Experimental Work & mini project	:	25
Report/ Documentation/Presentation	:	20
Attendance (Theory & Practical)	:	05

Practical & Oral examination is to be conducted based on departmental level optional courses by pair of internal and external examiners appointed by the University of Mumbai.

Course Code	Title	Credit
CSP805	Major Project- II	6

Objective: The primary objective is to meet the milestones formed in the overall project plan decided in Project - I. The idea presented in Project -I should be implemented in Project -II with results, conclusion and future work. The project will culminate in the production of a thesis by each individual student.

Guidelines:

Project Report Format:

At the end of semester a student need to prepare a project report should be prepared as per the guidelines issued by the University of Mumbai. Along with project report a CD containing: project documentation, Implementation code, required utilities, Software's and user Manuals need to be attached.

Term Work:

Student has to submit weekly progress report to the internal guide and where as internal guide has to keep track on the progress of the project and also has to maintain attendance report. This progress report can be used for awarding term work marks. In case of industry projects, visit by internal guide will be preferred to get the status of project.

Distribution of marks for term work shall be as follows:

- a) Weekly Attendance on Project Day
- b) Project work contributions as per objective
- c) Project Report (Hard Bound)
- d) Term End Presentation (Internal)

The final certification and acceptance of TW ensures the satisfactory performance on the above aspects.

Oral & Practical :

Oral & Practical examination of Project- II should be conducted by Internal and External examiners approved by University of Mumbai. Students have to give presentation and demonstration on the Project-II.