K J Somaiya Institute of Engineering and Information Technology, Sion, Mumbai

An Autonomous Institute under University of Mumbai

Autonomy Syllabus Scheme-I (2021-22)

Bachelor of Technology

in

Electronics Engineering (ETRX)

(Last Year-Semester-VIII)

(With Effect from AY 2021-22)

From the Principal's Desk:

The academic reforms recently recommended by the AICTE and UGC have effectually strengthened the higher education system in India. To adhere to the status quo and enhance the academic standards and quality of engineering education further, it is essential to assimilate innovation and recurrent revision in curriculum, teaching-learning methodology, examination, and assessment system.

In congruence with it, the University of Mumbai has adapted Outcome-Based Education (OBE) system and has revised the engineering curriculum thrice in the last decade as Rev 2012, Rev 2016, and the recent Rev 2019, 'C' scheme focusing on cutting-edge technology courses.

K. J. Somaiya Institute of Engineering and Information Technology, being an autonomous institute possesses more flexibility in adapting newer approaches to reach higher levels of excellence in engineering education. This first syllabus scheme under the autonomy comprises state-of-the-art courses and laboratory sessions on emerging areas of technology. The syllabus is designed with an objective to foster the students for developing innovative solutions to real-world issues of the society and/or industry through the acquired knowledge. The induction program for the students is deliberated as per guidelines of AICTE and shall be executed over the entire First Year.

With an ideology that the root of innovation is 'interest', the curriculum offers a wide range of elective courses - grouped into core and inter-disciplinary domains. At par with international engineering education, the students can choose to study courses concerning areas of their interests.

The curriculum introduces Skill-Based Learning (SBL), Activity-Based Learning (ABL), and Technology-Based Learning (TBL) as eXposure (SAT) courses - that assure X factor in all the students of the institute. The SAT courses shall be practiced across the first three years of engineering, focusing on graduate attributes like work ethics, responsibilities towards society, problem-solving ability, communication skills, motivation for life-long learning, leadership and teamwork, etc. that may not be copiously imbibed through regular engineering courses. The proficiencies acquired herein shall open huge employment and entrepreneurial opportunities for the students.

Students of the institute are already provided exposure to the work culture and trends in industries through live / collaborative projects / product developments, etc. Under autonomy too, through the component of Project-Based Learning included in the syllabus, the students shall develop Mini, Minor, and Major projects in Second, Third, and Last Year respectively concerning healthcare, agriculture, societal / industrial need-based problems, etc. as well as pursue internships at the end of each semester / year - making them industry-ready engineers. The blend of all these learning components in the curriculum shall strengthen the research and innovation ecosystem in the institute — for best benefits of the students.

This first syllabus shall be effective from Academic Year 2021-22 to all four years at once. It comprises 165 credits, follows the AICTE model curriculum, focuses on learner-centric approach as well as continuous evaluation, and shall offer the ideal learning experience for the students of the institute.

In the coming years, the institute shall also offer an Honours degree for students who are desirous of pursuing their special interest areas in industry-relevant tracks like Artificial Intelligence, Internet of Things, Cyber Security, etc. Through joint efforts of all stakeholders, strategic planning, and efficient execution of neoteric educational practices with hi-tech wizardry, we shall strive to become a role model for all autonomous institutes across the nation.

Dr. Suresh Ukarande
Principal and Chairman - Academic Council

Member Secretary, Academic Council's Preamble:

We, Board of Studies in Computer Engineering (CE), Information Technology (IT), Artificial Intelligence and Data Science (AI-DS), Electronics and Telecommunication (ET) and Electronics Engineering (EX) are very happy to present 4 years of undergraduate and 2 years of post-graduation in Artificial Intelligence (AI), Engineering technology syllabus effective from the Academic Year 2021-22 under the autonomy status granted to our institute, K J Somaiya Institute of Engineering and Information Technology (KJSIEIT). We are sure you will find this syllabus interesting, challenging and meeting the needs of Industry 4.0.

UGC states the benefits of granting academic autonomy to higher education institutes as the freedom to modernize curricula, making it globally competent, locally relevant and skill oriented to promote employability'. Thus exercising academic freedom by eligible and capable institutes is the need for developing the intellectual climate of our country and bringing and promoting academic excellence in higher education system. KJSIEIT under its first autonomous syllabus scheme (KJSIEIT-Scheme I) is keen in providing globally required exposure to its learners focusing sound theoretical background supported by practical experiences in the relevant areas of engineering and technology.

Besides engineering and technology foundation, Industry 4.0 demands modern, industry-oriented education, up-to-date knowledge of analysis, interpretation, designing, implementation, validation, and documentation of not only computer software and systems but also electronics and communication systems, hardware devices and tools, trained professional, ability to work in teams on multidisciplinary projects, etc. Thus KJSIEITs autonomy Scheme-I syllabus has been designed for the learners to successfully acquaint with the demands of the industry worldwide, life-long experiential learning, professional ethics with universal human values and training for needed skillsets and in line with the objectives of higher and technical education, AICTE, UGC and various accreditation and ranking agencies by keeping an eye on the technological developments, innovations, and industry requirements.

The salient features of KJSIEITs autonomy Scheme-I syllabus are:

1. Total 165 credits ensuring extra time for students' experiential learning through extracurricular activities, innovations, and research.
2. Introduction of Skill Based, Activity Based, Technology based and Project Based learning to showcase learners' creativity, interest and talent by developing additional skillsets, social involvement and contributions through activities, case studies, field visits, internships, creative learning, innovative mini, minor and major project developments, strengthen their profile and increasing the chances of employability.
3. Value addition learning through MOOCs platforms such as IBM-ICE, Coursera, NPTEL, SWAYAM, Spoken Tutorial etc.
4. Emerging areas of technology learning in Artificial Intelligence, Machine learning, Data Science, Internet of things, Cyber Security, Block chain, augmented and Virtual reality.

We would like to place on record our gratefulness to the faculty, alumni, students, industry experts and stakeholders for having helped us in the formulation of this syllabus.

Dr. Sunita R Patil

Member Secretary, Academic Council and Vice Principal, KJSIEIT, Sion

Preface by Board of Studies in Electronics Engineering:

We, the members of Board of Studies of B.Tech in Electronics Engineering are very happy to present a syllabus of Third and Last Year of B. Tech in Electronics Engineering with effect from the Academic Year 2021-22. We are assured that you will discover this syllabus interesting and challenging.

There are nine emerging technology thrust areas declared by AICTE, as an Electronics Engineer he/she should have knowledge about all the emerging technologies which will rules the industries in future so we have touched almost every emerging areas while deciding the courses and contents there in. The syllabus focuses on providing a sound theoretical background as well as good practical exposure to students in the relevant areas. Program Educational Objectives are considered while deciding different courses. It is envisioned to deliver a modern, industry-oriented education in Electronics Engineering. It aims at creating skilled engineers who can successfully acquaint with the demands of the industry worldwide. They obtain skills and experience in up-to-date knowledge to analysis, design, employ, technologies, software and systems.

At the beginning of every course we have added two theory lectures for prerequisites and course outline and at the end one theory lecture added for coverage of course conclusion which includes recap of modules, outcomes, applications, and summarization. We have mapped Course outcomes, PBL outcomes, Skills outcomes, Activity outcomes and TBL outcomes module wise throughout the syllabus. Faculty in this program adopted collaborative, co-operative and online teaching learning techniques during coverage of the course; this will help students to understand each course in depth. The designed syllabus promises to achieve the objectives of affiliating University, AICTE, UGC, and various accreditation agencies by keeping an eye on the technological developments, innovations, and industry requirements.

We would like to show our appreciation to the faculties, students, industry experts and stakeholders assisting us in the design of this syllabus.

Board of Studies in Electronics Engineering are,

Sr. No.	Name	Designation	Sr. No.	Name	Designation
1	Dr. Milind U. Nemade	Head of the Department concerned (Chairman)	9	Prof. Pankaj Deshmukh	Member
2	Dr. Sudhakar Mande	One expert to be nominated by the Vice-Chancellor	10	Prof. Sejal Shah	Member
3	Mr. Saurabh Srivastava	One Representative from Industry /Corporate Sector/ Allied area relating to Placement	11	Prof. Vidya Sagvekar	Member
4	Dr. Vaishali Wadhe	Member	12	Prof. Sheetal Jagtap	Member
5	Prof. Vrinda Ullas	Member	13	Prof. Sarika Mane	Member
6	Prof. Ganesh Wadmare	Member	14	Prof. G.R. Phadke	Member
7	Prof. Mandar Bivalkar	Member	15	Prof. Devanand Bathe	Member
8	Prof. Medha Asurlekar	Member			

Program Structure for Third and Last Year UG Technology with Credit and Examination Scheme
Program Structure for Last Year UG Technology (ET)

Semester- VIII-Credit Scheme

Course Code	Course Name	Teaching Scheme (Hrs.) (TH –P–TUT)	Total (Hrs.)	Credit Assigned (TH–P–TUT)	Total Credits	Course Category
1UETC801	Industrial Automation	3–0–0	03	3 – 0 – 0	03	PC
1UETDLC802X	Department Level Elective-5	3–0–0	03	3 – 0 – 0	03	DLE
1UETDLC803X	Department Level Elective-6	3–0–0	03	3 – 0 – 0	03	DLE
1UILC804X	Institute Level Elective-2	3–0–0	03	3 – 0 – 0	03	ILE
1UETL801	Industrial Automation Lab	0–2–0	02	0 – 1 – 0	01	PC
1UETDLL802X	Department Level Elective-5 Lab	0–2–0	02	0 – 1 – 0	01	DLE
1UETDLL803X	Department Level Elective-6 Lab	0–2–0	02	0 – 1 – 0	01	DLE
1UETPR86	Project Based Learning-Major Project Lab-B	0-12#-0	12*	0 – 6 – 0	06	PBL
Total		12-18-0	30	12- 9- 0	21	

#PBL-PR-B (Conference /Journal Publication Filling Patent, Creation of Product & Licencing, Start up, SIH, Participation etc)
*Load of learner, not the faculty

Semester- VIII-Examination Scheme

Course Code	Course Name	Examination Scheme								
		Marks								
		CA			ESE	TW	O	P	P&O	Total
		T1	T2	IA						
1UETC801	Industrial Automation	15	15	10	60	--	--	--	--	100
1UETDLC802X	Department Level Elective-5	15	15	10	60	--	--	--	--	100
1UETDLC803X	Department Level Elective-6	15	15	10	60	--	--	--	--	100
1UILC804X	Institute Level Elective-2	15	15	10	60	--	--	--	--	100
1UETL801	Industrial Automation Lab	--	--	--	--	25	25	--	--	50
1UETDLL802X	Department Level Elective-5 Lab	--	--	--	--	25	25	--	--	50
1UETDLL803X	Department Level Elective-6 Lab	--	--	--	--	25	25	--	--	50
1UETPR86	Project Based Learning-Major Project Lab-B	--	--	--	--	50	--	--	100	150
Total		**60**	**60**	**40**	**240**	**125**	**75**	**--**	**100**	**700**

Major Project A and B: Students can form groups with minimum 2 and not more than 3
Faculty Load: In Semester VII – ½ hour per week per project group
In Semester VIII – 1 hour per week per project group

Department Level Elective-5			
Group A: Data Storage and Technology	**Group B: Electronics Core**	**Group C: Artificial Intelligence and Data Science**	**Group D: Computer Domain**
1UETDLC8021	**1UETDLC8024**	**1UETDLC8023**	**1UETDLC8022**
Microelectromechanical Systems (MEMS)	Virtual Instrumentation	Advanced Power Electronics	Web Design
Department Level Elective-6			
Group A: Data Storage and Technology	**Group B: Electronics Core**	**Group C: Artificial Intelligence and Data Science**	**Group D: Computer Domain**
1UETDLC8034	**1UETDLC8033**	**1UETDLC8032**	**1UETDLC8031**
Integrated Circuit Technology	System On Chip	Industrial Internet of Things	Next Generation Networks
Institute Level Elective-2			
1UILC8041	**1UILC8042**	**1UILC8043**	**1UILC8044**
Project Management	Finance Management	Entrepreneurship Development and Management	Human Resource Management
1UILC8045	**1UILC8046**	**1UILC8047**	**1UILC8048**
Professional Ethics and CSR	Research Methodology	IPR and Patenting	Digital Business Management
1UILC8049			
Environmental Management			

Course Code	Course Name	Credits (TH+P+TUT)
1UETC801	Industrial Automation	(3+0+0)

Prerequisite:	1.Basics of Electrical Engineering 2.Electronics Devices and Circuits-I 3.Linear Control System
Course Objectives:	1. To teach automation architecture of Industrial Automation System. 2. To be familiar with various automation components. 3. To learn about Computer Aided Measurements and Control Systems 4. To disseminate knowledge about use of Robot in Industrial Automation.
Couse Outcomes:	After learning the course, the students will be able to: 1. Explain architecture of Industrial Automation System. 2. Describe various automation components and systems. 3. Learn Computer Aided Measurements and Control System. 4. Apply programmable logic controllers for industrial automation. 5. Explain Distributed Control System. 6. Use of robot for Industrial Automation.

Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs./ Module
I. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction	---	02	02
1. Introduction to Industrial Automation	1.1 Introduction to Automation overview, Requirement of automation systems, Architecture of Industrial Automation system.	CO1	03	06
	1.2 Introduction of PLC and supervisory control and data acquisition (SCADA). block diagram, Industrial bus systems: modbus & profibus.		03	
2.Automation components	2.1 Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement.	CO2	03	06
	2.2 Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT. Introduction of DC and AC servo drives for motion control.		03	
3. Computer aided measurement and control systems	3.1 Role of computers in measurement and control.	CO3	02	08
	3.2 Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, process related interfaces, Communication and networking.		03	
	3.3 Industrial communication systems, Data transfer techniques, Computer aided process control software, Computer based data acquisition system, Internet of things (IoT) for plant automation.		03	
4. Programmable Logic Controllers	4.1Programmable controllers, programmable logic controllers, Analog digital input and output modules	CO4	02	08
	4.2 PLC programming, Ladder diagram, Sequential flow chart.		02	

	4.3 PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation.		02	
	4.4 Application of PLC to process control industries.		02	
5.Distributed Control System	5.1 Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks,	CO5	04	08
	5.2 DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.		04	
6. Overview of Industrial automation using robots	Basic construction and configuration of robot Pick and place robot, Welding robot.	CO6	03	03
II. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
Total hours				42

Books:

Text Books	1. Industrial Instrumentation and Control by S.K. Singh Mc-Graw Hill Publications, Third Edition, 2017 2. Process Control Instrumentation Technology by C.D. Johnson PHI Publications, Seventh Edition, 2019
Reference Books	1. Industrial Control Handbook by E. A. Parr, Newnem, Publication, 1998. 2. Introduction to Programmable Logic Controllers by Dunning, Thomson Publication, Third Edition 2005 3. SCADA- Supervisory Control and Data Acquisition by Stuart A. Boyer, ISA Publications 4. Industrial Robotics-Technology, Programming and Applications by Michell P. Grover, Tata McGraw-Hill Edition

Useful Links:

1. https://nptel.ac.in/content/storage2/courses/108105063/pdf/L01(SM)(IA&C)%20((EE)NPTEL).pdf
2. https://www.youtube.com/watch?v=oxMdDsud5vg&list=PLE8F9BF5CB1201D23
3. https://www.youtube.com/watch?v=EgtQs6Pclxs

Assessment:

Continuous Assessment for 40 marks:

1. Test 1 – 15 marks
2. Test 2 – 15 marks
3. Internal assessment - 10 marks

Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty

End Semester Examination will be of 60 marks for 3 hours duration.

Term work:

1. Term work should consist of a Minimum of 8 experiments.
2. Journal must include at least 2 assignments on content of theory and practical of the course "Industrial Automation".
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work.
4. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks.

Course Code	Course Name	Credits (TH+P+TUT)
1UETDLC8021	Micro Electro Mechanical System	(3+0+0)

Prerequisite:	1.Basic VLSI Design 2.Mixed Signal VLSI Design 3.Electronic Instrumentation and Measurement
Course Objectives:	1. To provide knowledge of MEMS processing steps and processing modules 2. To provide knowledge of MEMS Materials with respect to applications. 3. To demonstrate the use of semiconductor-based processing modules used in the fabrication of variety of sensors and actuators (e.g., pressure sensors, accelerometers, etc.) at the micro-scale. 4. To provide an understanding of basic design and operation of MEMS sensors, actuators and structures.
Couse Outcomes:	1. Identify types of real-world MEMS sensors/actuators and its use in various MEMs applications. 2. Describe various MEMS materials and selection of materials based on applications. 3. Describe working principle, construction of MEMS Sensors, Actuators and Structures. 4. Explain MEMs fabrication processes and selection of fabrication processes based on applications. 5. Explain working principle, constructions and fabrication steps of MEMs devices, 6. Describe MEMS device characterization and importance of measurements of various parameters in device behavior & MEMs reliability.

Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs./ Module
I. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction	---	02	02
1.Introduction to MEMS	1.1 Introduction to MEMS, Comparison with Micro Electronics Technology	CO1	01	03
	1.2 Real world examples (Air-Bag, DMD, Pressure Sensors), MEMS Challenges, MEMS Sensors in Internet of Things (IoT), Bio-medical applications		02	
2. MEMS Materials and Their Properties	2.1 Materials (eg. Si, SiO2, SiN, SiC, Cr, Au, Al, Ti, SU8, PMMA, Pt)	CO2	05	08
	2.2 Important properties: Young modulus, Poisson's ratio, density, piezoresistive coefficients, TCR, Thermal Conductivity, Material Structure.		03	
3.MEMS Sensors, Actuators and Structures	3.1 MEMS Sensing (Capacitive, Piezo electric Piezo resistive)	CO3	03	06
	3.2 Micro Actuation Techniques, Micro Grippers, Micro Gears, Micro Motors, Micro Valves, Micro Pumps.		03	
4. MEMS Fab Processes	4.1 MEMS Processes & Process parameters: Bulk & Surface Micromachining, High Aspect Ratio Micro	CO4	04	10

	4.2 Machining (LIGA, Laser), X-Ray Lithography, Photolithography, PVD techniques, Wet, Dry, Plasma		03	
	4.3 Etching, DRIE, Etch Stop Techniques. Die, Wire & Wafer Bonding, Dicing, Packaging.		03	
5.MEMS Devices	Architecture, working and basic behaviour of Cantilevers, Micro heaters, Accelerometers, Pressure Sensor types, Micromirrors in DMD, Inkjet printer-head. Steps involved in Fabricating above devices.	CO5	08	08
6. MEMS Device Characterization	6.1 Piezo-resistance, TCR, Stiffness, Adhesion, Vibration, Resonant frequency, & importance of these measurements in studying device behaviour	CO6	03	04
	6.2 MEMS Failure Mechanisms and Reliability.		01	
II. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
				42

Books:

Text Books	1.MEMS and MICROSYSTEMS Design and Manufacture by Tai Ran Hsu, McGraw Hill Education
Reference Books	1. An Introduction to Micro-electromechanical Systems Engineering; 2nd Ed - by N. Maluf, K Williams; Publisher: Artech House Inc 2.Micro machined Transducers Sourcebook - by G. Kovacs; Publisher: McGraw-Hill 3.Practical MEMS - by Ville Kaajakari; Publisher: Small Gear Publishing 4.Micro-system Design - by S. Senturia; Publisher: Springer 5.Analysis and Design Principles of MEMS Devices – Minhang Bao; Publisher: Elsevier Science 6.Fundamentals of Micro-fabrication – by M. Madou; Publisher: CRC Press; 2 editions 7.Micro machined Transducers Sourcebook - by G. Kovacs; Publisher: McGraw-Hill

Useful Links:

1.https://nptel.ac.in/courses/117/105/117105082/

2.https://www.mems-exchange.org/MEMS/

Assessment:

Continuous Assessment for 40 marks:

1. Test 1 – 15 marks
2. Test 2 – 15 marks
3. Internal assessment - 10 marks

Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty

End Semester Examination will be of 60 marks for 3 hours duration.

Term work:

1. Term work should consist of a Minimum of 8 experiments.
2. Journal must include at least 2 assignments on content of theory and practical of the course "Micro Electro Mechanical System".
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work.
4. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks.

Course Code	Course Name	Credits (TH+P+TUT)
1UETDLC8022	Web Designing	(3+0+0)

Prerequisite:	1. Data Structures 2. Basics of Programming Languages
Course Objectives:	1. To design and create web pages using HTML5 and CSS3. 2. To Create web pages and provide client side validation. 3. To create dynamic web pages using server side scripting. 4. To use MVC framework for web application development.
Course Outcomes:	1. Understand the core concepts and features of Web Technology 2. Design static web pages using HTML5 and CSS3 3. Apply the concept of client side validation and design dynamic web pages using JavaScript and JQuery. 4. Evaluate client and server side technologies and create Interactive web pages using PHP, AJAX with database connectivity using MySQL. 5. Understand the basics of XML, DTD and XSL and develop web pages using XML / XSLT. 6. Analyze end user requirements and Create web application using appropriate web technologies and web development framework

Module No. & Name	Sub Topics	CO mapped	Hrs./ Subtopic	Total Hrs. /Module
I. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction	---	02	02
1. Introduction to WWW	1.1 Internet Standards – Introduction to WWW – WWW Architecture – SMTP – POP3 – File Transfer Protocol	CO1	02	04
	1.2 Overview of HTTP, HTTP request – response — Generation of dynamic web pages- W3C Validator, How web works - Setting up the environment (LAMP/XAMP/WAMP server)		02	
2. Client Side Programming	2.1 Markup Language (HTML): Introduction to HTML and HTML5 - Formatting and Fonts –Commenting Code – Anchors – Backgrounds – Images – Hyperlinks	CO2	02	08
	2.2 Lists – Tables – Frames - HTML Forms and controls.		02	
	2.3 Cascading Style Sheet (CSS): The need for CSS, Introduction to CSS 3 – Basic syntax and structure ,CSS Properties-Inline Styles – Embedding Style Sheets		02	
	2.4 Linking External Style Sheets – Backgrounds –Box Model(Introduction , Border Properties, Padding Properties, Margin Properties), Manipulating text - Margins and Padding - Positioning using CSS., Creating page Layout and Site Designs		02	
3. Introduction to JAVA Script	3.1 Introduction - Core features - Data types and Variables - Operators, 6 Expressions, and Statements, Functions - Objects - Array, Date and Math related Objects	CO3	02	08
	3.2 Document Object Model - Event Handling Controlling Windows & Frames and Documents Form handling and validations.		02	
	3.3 Advanced JavaScript - Browser Management and		02	

	Media Management – Classes – Constructors – Object-Oriented Techniques in JavaScript			
	3.4 Object constructor and Prototyping - Sub classes and Super classes – JSON - jQuery and AJAX., Rich Internet Application with AJAX, JQuery Framework		02	
4. Server Side Programming	4.1 Introduction - Programming basics - Print/echo - Variables and constants – Strings and Arrays	CO4	02	09
	4.2 Operators, Control structures and looping structures – Functions – Reading Data in Web Pages		02	
	4.3 Embedding PHP within HTML - Establishing connectivity with MySQL database, cookies, sessions and Authentication		03	
	4.4 AJAX with PHP - AJAX with Databases		02	
5. XML	5.1 Dynamic page generation (adding interactivity, styles, using HTML, DHTML, XHTML, CSS, Java Script), XML –DTD(Document Type Definition) - XML Schema	CO5	03	06
	5.2 XML –DTD(Document Type Definition) - XML Schema - Document Object Model - Presenting XML - Using XML Parsers: DOM and SAX,XSL-eXtensible Style sheet Language		03	
6. Web Development Framework	6.1 Introduction to Composer - MVC Architecture	CO6	02	04
	6.2 Web Application Development using web development framework :-Introduction to Laravel, Development of Web pages using Laravel, Example web applications – Interactive websites, web based information systems , blogs, social networking sites etc.		02	
II. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
Total hours				42

Books:

Text Books	1. Ralph Moseley , M.T. Savliya , Developing Web Applications‖, Willy India, Second Edition, ISBN: 978-81-265-3867-6 2. Web Technology Black Book, Dremtech Press, First Edition, 978-7722-997 3. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition 4. Professional Rich Internet Applications: AJAX and Beyond, Dana Moore, Raymond Budd, Edward Benson, Wiley publications.
Reference Books	1. Harvey & Paul Deitel& Associates, Harvey Deitel and Abbey Deitel, Internet and World Wide Web - How To Program, Fifth Edition, Pearson Education, 2011. 2. Achyut S Godbole and Atul Kahate, Web Technologies‖, Second Edition, Tata McGraw Hill, 2012. 3. Thomas A Powell, Fritz Schneider, JavaScript: The Complete Reference‖, Third Edition, Tata McGraw Hill, 2013. 4. David Flanagan, JavaScript: The Definitive Guide, Sixth Edition‖, O'Reilly Media, 2011 5. Steven Holzner, The Complete Reference - PHP‖, Tata McGraw Hill, 2008 6. Mike Mcgrath, PHP & MySQL in easy Steps‖, Tata McGraw Hill, 2012.

Useful Links:

1. www.nptelvideos.in
2. www.w3schools.com
3. http://spoken-tutorial.org

Assessment:

Continuous Assessment for 40 marks:

1. Test 1 – 15 marks
2. Test 2 – 15 marks
3. Internal assessment - 10 marks

Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty

End Semester Examination will be of 60 marks for 3 hours duration.

Term work:

1. Term work should consist of a Minimum of 8 experiments.
2. Journal must include at least 2 assignments on content of theory and practical of the course "Web Designing".
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work.
4. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks.

Course Code	Course Name	Credits (TH+P+TUT)
1UETDLC8023	Advanced Power Electronics	(3+0+0)

Prerequisite:	1.Subjects taught in previous semesters, Power Electronics, Linear Control System, BEE
Course Objectives:	1. To enhance and expand the ideas of students for more complex power electronic Systems. 2. To teach the analytical methods in power electronic systems. 3. To expose the students to various applications of power electronics in various Electronics equipment and drives.
Couse Outcomes:	After successful completion of the course students will be able to: 1. Simulate three phase controlled rectifier circuits. 2. Simulate three phase inverter circuits. 3. Design mathematical model for DC-DC converter. 4. Demonstrate various speed control methods of DC drives. 5. Demonstrate speed control of AC drives in an energy efficient manner using power electronics. 6. Demonstrate various applications of power electronics

Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs./ Module
I. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction	---	02	02
1. Three-phase Rectifiers	Three-phase half-wave and full-wave controlled rectifiers with R and RL load	CO1	03	03
2. Three-phase inverters and control	2.1 Three phase bridge inverters (120^0 and 180^0 conduction mode) with R and RL load	CO2	04	06
	2.2 PWM for 3-phase voltage source inverters		02	
3. DC-DC Converters	3.1 Average model, linearized and transfer function models, state-space average models of basic buck, boost and buck-boost converters	CO3	06	08
	3.2 Feedback control of these converters (PI and PID).		02	
4.Power Electronic Applications in DC Drives	4.1 Introduction to DC motors, speed control of DC motor, drives with semi converters, full converters and dual converters	CO4	02	08
	4.2 Chopper-based drive		03	
	4.3 Electric braking of DC motors		03	
5. Power Electronic Applications in AC Drives	5.1 Introduction to three-phase induction motor	CO5	02	10
	5.2 Speed control methods for three-phase induction motor : i) Stator voltage ii) Variable frequency iii) Rotor resistance iv) V/f control v) Slip power recovery schemes		08	
6. Power	6.1 Induction heating, dielectric heating, solid state relays	CO6	02	04

Electronic Applications	6.2 Energy conversion interface in renewable energy system		02	
II. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
Total hours				42

Books:

Text Books	1. M. H. Rashid, "Power Electronics", Prentice-Hall of India 2. L. Umanand, " Power Electronics Essentials and Applications", Wiley india Pvt. Ltd 3. Ned Mohan, "Power Electronics", Undeland, Robbins, John Wiley Publication 4. P. S. Bhimbra, "Power Electronics", Khanna Publishers, 2012
Reference Books	1.M.D. Singh and K. B. Khanchandani, "Power Electronics",Tata McGraw Hill 2.J. P. Agrawal, Power Electronics Systems: Theory and Design, Pearson 3.Education, 2002.P. C. Sen, "Modern Power Electronics",Wheeler Publication

Useful Links:

1.https://nptel.ac.in/courses/108/108/108108077/

2.https://onlinecourses.nptel.ac.in/noc19_ee65/preview

Assessment:

Continuous Assessment for 40 marks:

1. Test 1 – 15 marks
2. Test 2 – 15 marks
3. Internal assessment - 10 marks

Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty

End Semester Examination will be of 60 marks for 3 hours duration.

Term work:

1. Term work should consist of a Minimum of 8 experiments.
2. Journal must include at least 2 assignments on content of theory and practical of the course "Advanced Power Electronics".
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work.
4. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks.

Course Code	Course Name	Credits (TH+P+TUT)
1UETDLC8024	Virtual Instrumentation	(3+0+0)

Prerequisite:	1.Instrumentation System Design, 2. Biomedical Instrumentation
Course Objectives:	1. To understand virtual instrumentation (VI) & to realize its architecture 2. To familiarize with VI software & learn programming in VI 3. To study various instruments interfacing & data acquisition methods 4. To understand various analysis tools & develop programs for different measurement applications
Couse Outcomes:	The end of the course, students should gain the ability to :- 1.Describe the concepts of virtual instrumentation 2.Select the proper data acquisition hardware 3.Configure the data acquisition hardware using LabVIEW 4 . Use LabVIEW to interface related hardware like transducers 5 . Design virtual instruments for practical applications

Module No. & Name	Sub Topics	CO mapped	Hrs./ Subtopic	Total Hrs. /Module
I. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction	---	02	02
1.Introduction to Virtual Instrumentation (VI)	1.1. Historical perspective Need for VI Advantages of VI Definition of VI Block diagram & architecture of VI	CO1	02	04
	1.2 Data flow techniques Graphical programming in data flow Comparison with conventional programming		02	
2.Programming Techniques	2.1 VI & sub-VI Loops & charts Arrays Clusters Graphs Case & sequence structures	CO2	03	06
	2.2 Formula nodes Local & global variables String & files inputs		03	
3. Application Development Software (LabVIEW)	3.1 Creating virtual instrument in LabVIEW Implementing dataflow programming in LabVIEW VI	CO3	03	09
	3.2 Sub-VI & modular code creation in LabVIEW Arrays & file I/O in LabVIEW Textual math integration in LabVIEW		03	
	3.3 Interfacing external instruments to PC using LabVIEW		02	08
4. Data Acquisition Basics	4.1 Digital I/O Counters & timers PC hardware structure Timing Interrupts DMA Software & hardware installation	CO4	03	
	4.2 IEEE GPIB 488 concepts Embedded system buses PCI EISA CPCI		03	
5. Common Instrument	5.1 Current loop RS 232C / RS 485 Interface basics USB PCMCIA VXI SCXI PXI	CO5	03	06

Interfaces	5.2 Networking basics for office & industrial application VISA & IVI Image acquisition & process Motion control Digital multimeter (DMM) Waveform generator		03	
6. Using Analysis Tools & Application of VI	6.1 Fourier transform Power spectrum Correlation method Windowing & filtering Pressure control system	CO5	03	06
	6.2 Flow control system Level control system Temperature control system Motion control employing stepper motor PID controller toolbox		03	
II. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
Total hours				42

Books:

Text Books	1. Gupta ," Virtual Instrumentation Using Lab view" 2nd Edition, Tata McGraw-Hill Education, 2010
Reference Books	1. Dr. Sumathi S. & Surekha P, LabVIEW Based Advanced Instrumentation System, PHI, 2nd edition (2007) 2. Gary Johnson, LabVIEW Graphical Programming, McGraw Hill, 2nd edition (2006) 3. Lisa K. Wells & Jeffrey Travis, LabVIEW for Everyone, PHI, 3rd edition (2009) 4. Robert H. Bishop, Learning with LabVIEW 7 Express, Pearson Education, 1st edition (2005) 2nd edition (2010) 5. Jovitha Jerome, Virtual Instrumentation using LabVIEW, PHI, 2nd edition (2010) 7. Sokoloff; "Basic concepts of Labview 4", Prentice Hall Inc., New Jersey 1998. 8. Gupta.S., Gupta.J.P., "PC interfacing for Data Acquisition & Process Control", Second Edition, Instrument Society of America, 1994.

Useful Links:

https://nptel.ac.in/courses/108/105/108105064/

Assessment:

Continuous Assessment for 40 marks:

1. Test 1 – 15 marks
2. Test 2 – 15 marks
3. Internal assessment - 10 marks

Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty

End Semester Examination will be of 60 marks for 3 hours duration.

Term work:

1. Term work should consist of a Minimum of 8 experiments.
2. Journal must include at least 2 assignments on content of theory and practical of the course "Virtual Instrumentation".
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work.
4. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks.

Course Code	Course Name	Credits (TH+P+TUT)
1UETDLC8031	Next Generation Networks	(3+0+0)

Prerequisite:	1. Computer Communication Networks 2. Advanced Networking Technologies
Course Objectives:	1. To provide exposure to the new technologies and services. 2. To Explore SDN networks. 3. To demonstrate MPLS VPNs for NGN
Couse Outcomes:	Course Outcomes: After the course completion student will be able to 1. Explain the building blocks of NGN architecture 2. Describe the software Defined Networks. 3. Comprehend IP network Technologies for local, mobile and global networks. 4. Describe the MPLS VPNs for remote access 5. Compare different technologies for wireline and wireless networks. 6. Explore applications of NGN and Future Evolution.

Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs./ Module
I. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction	---	02	02
1. Communicating in the New Era	1.1 New Era of Networking Technological Winners: IP everywhere, Optical Anywhere, Wireless through the air	CO1	02	06
	1.2 Building Blocks for Next Generation Networks: IP Networks, Multiservice Networks, VPNs, Optical Networks, wireline Networks, Wireless networks		02	
	1.3 Next Generation Network Services: Network Infrastructure Convergence, Services Convergence, From Technology Push to Service Pull		02	
2.Software Defined Network	Evolving network requirements-The SDN Approach: Requirements, SDN Architecture, Characteristics of Software-Defined Networking, Network Function Virtualisation , SDN and NFV- Related Standards: Standards-Developing Organizations, Industry Consortia, Open Development Initiatives. Networking, Network Function Virtualisation, SDN and NFV- Related Standards: Standards-Developing Organizations, Industry Consortia, Open Development Initiatives.	CO2	06	06
3. MPLS Networks	3.1 Multiprotocol Label Switching Networks: Frame-Based MPLS: Frame-Based MPLS Components and Terminology, Frame-Based MPLS Functionality	CO3	03	06
	3.2 MPLS Services: MPLS Benefits for Service Providers MPLS Example Benefits for Large Enterprises MPLS Layer 3 VPNs, MPLS Layer 2 VPNs, Layer 2 Any Transport over MPLS		03	
4. IP Networks	4.1 IP: Past, Present and Future, IP network convergence, Wide area technologies and topologies: VPNs, Carrier Ethernet and types, SD-WAN, Secure Access Service Edge (SASE)	CO4	04	12
	4.2 Mobile IP networks: Wi-Fi 6 (802.11ax), SD-access		02	

	4.3 Mobility Networks: SIP, IP RAN Transport (Segment Routing for 5G)/ O-RAN (RF Side), IP and MPLS at the Core of Mobility Networks, Integrating Complementary WLAN 802.11 Technology (VoWiFi), Packet-Based VoIP and IMS (VoLTE), Global IP Networks: Public and Private clouds, Data Center, Future Internet(With IoT)		06	
5. Wireline and Wireless networks	5.1 Wireline Networks: Broadband-FTTX (Optical Fiber Communication), GPON	CO5	03	06
	5.2 Wireless networks: LAN: WiFi 6, Li-Fi, MAN: 5G Architecture		03	
6. NGN Vision, Scenarios and Advances.	NGN Networks: Perspectives and Potentials, Some Possible Scenarios, Virtual Space Flight, Virtual International Congress, Virtual Global Exhibition, Virtual Classroom, e-Education and Experimental Laboratory, NGN Advances etc.	CO6	03	03
II. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
Total hours				42

Books:	
Text Books	1. Next-Generation Network Services: By Robert Wood, Published Nov 1, 2005 by Cisco Press. Part of the Networking Technology series 2. Next Generation Telecommunications Network, Parliament office of Science and Technology (Postnote). Dec 2007, No. 296 Ref. www.parliament.uk.
Reference Books	1.Next Generation Network Services: Technologies & Strategies by Neill Wilkinson, Jhon Wiley & Sons Publication, Edition: 1. 2.Next Generation Networks: Perspectives and Potentials by Jingming Li Salina, Pascal Salina, Publisher:John Wiley & Sons, 2008 3.Best Practices for Implementing Next Generation Networks (NGN) in the Asia and Pacific Region, International Telecommunication Union, Telecommunication Development Bureau, June 2012.
Useful Links:	
1. https://opennetworking.org/reference-designs/ng-sdn/	
2. https://opennetworking.org/software-defined-standards/specifications/	
4. https://opennetworking.org/wp-content/uploads/2014/10/openflow-switch-v1.5.1.pdf	
5. https://opennetworking.org/stratum/	
6. https://opennetworking.org/sd-ran/	
Assessment:	
Continuous Assessment for 40 marks: 1. Test 1 – 15 marks 2. Test 2 – 15 marks 3. Internal assessment - 10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty	
End Semester Examination will be of 60 marks for 3 hours duration.	
Term work:	
1. Term work should consist of a Minimum of 8 experiments. 2. Journal must include at least 2 assignments on content of theory and practical of the course “Next Generation Networks”. 3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work.	

4. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks.

Course Code	Course Name	Credits (TH+P+TU)
1UETDLC8032	Industrial Internet of Things	(3+0+0)

Prerequisite:	1. Internet of Things 2. Basic knowledge of computer and internet 3. Computer Communication Networks
Course Objectives:	The objectives of this course are to: 1. Understand the concepts of Industry 4.0 and basics of Industrial IoT. 2. Apply Sensing, actuation, Communication and Networking in Industrial IoT. 3. Understand the need of security, analytics for Industrial IoT. 4. Apply the Industrial IoT-for various Application Domains.
Couse Outcomes:	On successful completion of the course the students will be able to: 1. Explain the concepts of Industry 4.0. 2. Discuss the basics of Industrial IoT. 3. Analyze the use of Sensing, actuation, Communication and Networking in Industrial IoT. 4. Implementation of analytics in Industrial IoT. 5. Describe need of Security in IoT 6. Demonstrate various Industrial IoT-Application Domains

Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs./ Module
I. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction	---	02	02
1. Industry 4.0	1.1 Introduction to Industry 4.0: Globalization, The Fourth Revolution, Sustainability Assessment of Manufacturing Industry	CO1	03	06
	1.2 Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Cyber Security in Industry 4.0		03	
2. Industrial IoT	Introduction to IIoT, IIoT Business Model, IIoT Reference Architecture	CO2	06	06
3. Sensing & actuation, Communication and Networking	3.1 IIoT- Sensing & actuation	CO3	03	08
	3.2 IIoT- Processing		02	
	3.3 IIoT- Communication and Networking		03	
4. Analytics	Role of Analytics in IoT, Data visualization Techniques, Big Data Analytics, Software Defined Networks	CO4	08	08
5. Security	Introduction to web security, Conventional web technology and relationship with IIoT, Vulnerabilities of IoT, IoT security, Security model for IoT.	CO5	05	05
6. Application Domains	Inventory Management & Quality Control, Plant Safety and Security, Facility Management	CO6	06	06
II. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
Total hours				42

Books:	
Text Books	1. Sudip Misra, Chandana Roy, Anandarup Mukherjee, "Introduction to Industrial Internet of Things and Industry 4.0", ISBN 9780367897581,Published December 15, 2020 by CRC Press
Reference Books	1.Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", (Apress) 2.Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat "Industrial Internet of Things: Cyber manufacturing Systems", (Springer)
Useful Links:	
https://onlinecourses.nptel.ac.in/noc20_cs69	
Assessment:	
Continuous Assessment for 40 marks: 1. Test 1 – 15 marks 2. Test 2 – 15 marks 3. Internal assessment - 10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty	
End Semester Examination will be of 60 marks for 3 hours duration.	
Term work:	
1. Term work should consist of a Minimum of 8 experiments. 2. Journal must include at least 2 assignments on content of theory and practical of the course "Industrial Internet of Things". 3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work. 4. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks.	

Course Code	Course Name	Credits (TH+P+TUT)
1UETDLC8033	**System On Chip**	**(3+0+0)**

Prerequisite:	1. Mixed Signal VLSI Design 2. Basic VLSI Design Lab
Course Objectives:	1. To introduce modern system design using SoC 2. To understand the concept of hardware-software co-design
Couse Outcomes:	At the End of the course students will be able to 1. Explain basics of SoC 2. Design and verify the SoC systems 3. Explain the physical design flow 4. Analyze routing issues in SoC 5. Interpret complex SoC systems 6. Explain non-technical issues related to the SoC

Module No. & Name	Sub Topics	CO mapped	Hrs./Subtopic	Total Hrs./ Module
I. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction	---	02	02
1. Introduction to SoC Design	1.1 The fundamental trends of SoC design, SoC design flow, The Semiconductor Economics, Challenges in SoC design	CO6	03	08
	1.2 Hardware system structure, Software structure, Accelerating Processors for traditional software task, System Design with multiple processor design	CO1	05	
2. System Level Design	2.1 Complex SoC system architecture, Processor centric SoC organization, Communication Design Hardware and Software interconnects	CO2	03	05
	2.2Balancing computation and Communication, SoC Design flow, Non-processor building block in SoC design	CO5	02	
3. RTL Synthesis	Review of Verilog - RTL Coding and RTL Synthesis RTL coding guidelines, Synthesizable coding style, FSM Coding style, Memory Modeling.	CO2	08	08
4. SoC Verification	Verification technology options, Verification methodology. System level verification, block-level verification. Timing verification.	CO1	08	08
5. Physical Design	Partitioning, Floor Planning, Placement, Routing, Goals of routing - Global routing –Maze routing, Detailed routing, Over the Cell Routing, Physical verification and design sign-off.	CO3	07	07
6. Routing	Clock routing, Power and Ground routing, Clock tree synthesis.	CO4	03	03
II. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
Total hours				42

Books:

Text Books	1. Rowen, Chris. Engineering the complex SOC: fast, flexible design with configurable processors. Pearson Education, 2008. 2. Rashinkar, Prakash, Peter Paterson, and Leena Singh. System-on-a-chip Verification: Methodology and Techniques. Springer Science & Business Media, 2007. 3. Vahid, Frank. Digital design with RTL design, VHDL, and Verilog. John Wiley & Sons, 2010.
Reference Books	1. Rajsuman, Rochit. System-on-a-chip: Design and Test. Artech House, Inc., 2000. 2. Sait, Sadiq M., and Habib Youssef. VLSI physical design automation: theory and practice. Vol. 6. World Scientific, 1999. 3. Chang, Henry, et al. Surviving the SoC revolution. Dordrecht: Kluwer academic publishers, 1999.
Useful Links:	
https://nptel.ac.in/courses/117/101/117101058/	
https://nptel.ac.in/courses/108/107/108107129/	
http://cmosedu.com/	
Assessment:	
Continuous Assessment for 40 marks: 1. Test 1 – 15 marks 2. Test 2 – 15 marks 3. Internal assessment - 10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty	
End Semester Examination will be of 60 marks for 3 hours duration.	
Term work:	
1. Term work should consist of a Minimum of 8 experiments. 2. Journal must include at least 2 assignments on content of theory and practical of the course "System On Chip". 3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work. 4. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks.	

Course Code	Course Name	Credits (TH+P+TUT)
1UETDLC8034	Integrated Circuit Technology	(3+0+0)

Prerequisite:	1. Electronics Devices and Circuits-1 2. Digital Circuit Design 3.VLSI Design
Course Objectives:	1. To teach fundamental principles of fabrication of VLSI devices and circuits. 2. To learn about measurement, packaging and testing of ICs 3. To be familiar with fabrication of ICs in SOI, GaAs and Bipolar Technologies 4. To disseminate knowledge about novel VLSI devices
Couse Outcomes:	1. Students will be able to demonstrate a clear understanding of CMOS fabrication flow and technology scaling 2. Students will be able to describe various MOS fabrication processes 3. Students will be able to explain semiconductor measurements, packaging, testing 4. Students will be able to know about advanced semiconductor technologies 5. Students will be able to discuss physical mechanism in Novel devices. 6.Students will be able verify processes and device characteristics via simulations

Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs./ Module
I. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction	---	02	02
1.Crystal Growth, wafer preparation and wafer fabrication	1.1 Semiconductor Manufacturing: Semiconductor technology trend, Clean rooms,Wafer cleaning and Guttering.	CO1	03	07
	1.2 Semiconductor Substrate: Crystal structure, Crystal defects, Czochralski growth, Float Zone growth, Bridgman growth of GaAs, Wafer Preparation and specifications.		04	
2.Fabrication Process- I	2.1 Epitaxy: Classification, Molecular Beam Epitaxy	CO2, CO6	01	10
	2.2 Silicon Oxidation: Thermal oxidation process, Kinetics of growth, Properties of Silocon Dioxide, Oxide quality		01	
	2.3 Device Isolation: LOCOS, Shallow Trench Isolation (STI).		02	
	2.4 Deposition: Physical Vapor Deposition-Evaporation and Sputtering, Chemical Vapor Deposition: APCVD, LPCVD, PECVD		02	
	2.5 Diffusion: Nature of diffusion, Diffusion in a concentration gradient, diffusion equation, diffusion system, problems in diffusion		02	
	2.6 Ion Implantation: Penetration range-Nuclear& Electronic stopping and Range, implantation damage, Annealing-Rapid thermal annealing, ion implantation systems.		02	
3.Fabrication	3.1Etching: Basic concepts and Classification	CO2,	02	10

Process- II	3.2 Lithography: Introduction to Lithography process, Types of Photoresist, Types- electron beam, ion beam and X-ray lithography	CO6	02	
	3.3 Metallization and Contacts: Introduction to Metallization, Schottky contacts and Ohmic contacts.		02	
	3.4 CMOS Process Flow: N well, P-well and Twin tub, CMOS Latch Up		02	
	3.5 Design rules, Layout of MOS based circuits (gates and combinational logic), Buried and Butting contact		02	
4.Measuring and Testing	4.1 Semiconductor Measurements: Conductivity type, Resistivity, Hall Effect measurements, Drift Mobility	CO3	02	04
	4.2 Testing: Technology trends affecting testing, VLSI testing process and test equipment, test economics and product quality		02	
5.VLSI Technologies	5.1 SOI Technology: SOI fabrication using SIMOX, Bonded SOI and Smart Cut ,PD SOI and FD SOI Device structure and their features	CO4	02	04
	5.2 Advanced Technologies: low κ and high κ, BiCMOS, HκMG Stack, Strained Silicon.		02	
	5.3 GaAs Technologies: MESFET Technology, MMIC technologies, MODFET			
6.Novel Devices and Materials	6.1 Multigate Devices: Various multigate device configurations-double gate, triple gate (FinFET) and Gate All Around (Nanowire)	CO5, CO6	04	04
	6.2 Nanowire: Concept, VLS method of fabrication, Nanowire FET, Types: Horizontal and Vertical Nanowires, III-V compound Materials in Nanowires.			
II.Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
Total hours				42

Books:

Text Books	1. James D. Plummer, Michael D. Deal and Peter B. Griffin, "Silicon VLSI Technology", Pearson Indian Edition 2. Sorab K. Gandhi, "VLSI Fabrication Principles", Wiley, Student Edition 3. Stephen A. Campbell, "The Science and Engineering of Microelectronic Fabrication", Oxford University Press, 2nd Edition.
Reference Books	1. G. S. May and S. M. Sze, "Fundamentals of Semiconductor Fabrication", Wiley, First Edition. 2. Kerry Bernstein and N. J. Rohrer, "SOI Circuit Design Concepts", Kluwer Academic Publishers, 1st Edition. 3. James E. Morris and KrzysztolIniewski, "Nanoelectronic Device Applications Handbook",CRC Press 4. Michael L. Bushnell and Vishwani D. Agrawal, "Essentials of Electronic Testing for digital, memory and mixed-signal VLSI circuits", Springer

Useful Links:

1. https://nptel.ac.in/courses/117/103/117103066/
2. https://www.youtube.com/watch?v=lpXNCwsnxjM

Assessment:

Continuous Assessment for 40 marks:

1. Test 1 – 15 marks
2. Test 2 – 15 marks
3. Internal assessment - 10 marks

Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty

End Semester Examination will be of 60 marks for 3 hours duration.

Term work:

1. Term work should consist of a Minimum of 8 experiments.
2. Journal must include at least 2 assignments on content of theory and practical of the course "Integrated Circuit Technology".
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work.
4. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks.

Course Code	Course Name	Credits (TH+P+TUT)
1UILC8041	Project Management	(3+0+0)

Course Objectives:	1. To familiarize the students with the use of a structured methodology/approach for each and every unique project undertaken, including utilizing project management concepts, tools and techniques. 2. To appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure.
Couse Outcomes:	1. Apply selection criteria and select an appropriate project from different options. 2. Write work break down structure for a project and develop a schedule based on it. 3. Identify opportunities and threats to the project and decide an approach to deal with them strategically. 4. Use Earned value technique and determine & predict status of the project. 5. Capture lessons learned during project phases and document them for future reference 6. Inculcate leadership qualities and ethics.

Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs./ Module
I. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction	---	02	02
1.Project Management Foundation	1.1 Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stage gate process.	CO1	02	05
	1.2 Role of project manager. Negotiations and resolving conflicts. Project management in various organization structures. PM knowledge areas as per Project Management Institute (PMI).		03	
2.Initiating Projects	2.1 How to get a project started, Selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models)	CO2	03	06
	2.2 Project portfolio process, Project sponsor and creating charter; Project proposal. Effective project team, Stages of team development & growth (forming, storming, norming & performing), team dynamics.		03	
3. Project Planning and Scheduling	3.1 Work Breakdown structure (WBS) and linear responsibility chart, Interface Co-ordination and concurrent engineering,	CO3	03	08
	3.2 Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques. PERT, CPM, GANTT chart.		03	
	3.3 Introduction to Project Management Information System (PMIS).		02	

4.Planning Projects	4.1 Crashing project time, Resource loading and leveling, Goldratt's critical chain, Project Stakeholders and Communication plan.	CO4	02	06
	4.2 Risk Management in projects: Risk management planning, Risk identification and risk register.		02	
	4.3 Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks		02	
5. Executing Projects	5.1 Planning monitoring and controlling cycle. Information needs and reporting, engaging with all stakeholders of the projects. Team management, communication and project meetings.	CO5	03	08
	5.2 Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep. Project audit.		03	
	5.3 Project procurement management, contracting and outsourcing.		02	
6.Project Leadership and Ethics	6.1 Introduction to project leadership, ethics in projects. Multicultural and virtual projects.	CO6	03	06
	6.2 Customer acceptance; Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report; doing a lessons learned analysis; acknowledging successes and failures; Project management templates and other resources; Managing without authority; Areas of further study.		03	
II. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
Total hours				42

Books:

Text Books	1. Jack Meredith & Samuel Mantel, Project Management: A managerial approach, Wiley India, 7th Edition. 2. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th Ed, Project Management Institute PA,USA 3. Gido Clements, Project Management, Cengage Learning.
Reference Books	1.Gopalan, Project Management,, Wiley India 2.Dennis Lock, Project Management, Gower Publishing England, 9th Edition

Assessment:

Continuous Assessment for 40 marks:

1. Test 1 – 15 marks
2. Test 2 – 15 marks
3. Internal assessment - 10 marks

Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty

End Semester Examination will be of 60 marks for 3 hours duration.

Course Code	Course Name	Credits (TH+P+TUT)
1UILC8042	Finance Management	(3+0+0)

Course Objectives:	1. Overview of Indian financial system, instruments and market 2. Basic concepts of value of money, returns and risks, corporate finance, working capital and its management 3. Knowledge about sources of finance, capital structure, dividend policy
Couse Outcomes:	After successful completion of course student will be able to: 1. Students will be able to describe Indian financial system 2. Students will be able to apply basic concepts of returns and risks. 3. Students will be able to use basic concepts of Time value of money. 4. Students will be able to understand sources of finance, capital structure, dividend policy 5 Students will be able to discuss basic concepts of corporate finance 6 Students will be apply to use basic concepts of working capital management

Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs./ Module
I. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction	---	02	02
1. Overview of Indian Financial System:	1.1 Characteristics, Components and Functions of Financial System	CO1	02	06
	1.2 Financial Instruments: Meaning, Characteristics and Classification of Basic Financial Instruments- Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills.		02	
	1.3 Financial Markets: Meaning, characteristics and Classification of Financial Markets Capital Market, Money Market and Foreign Currency Market		02	
	1.4 Financial Institutions: Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges			
2. Concepts of Returns and Risks:	2.1 Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio.	CO2	04	08
	2.2 Time Value of Money: Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.		04	
3. Overview of Corporate Finance	Objectives of Corporate Finance; Functions of Corporate Finance—Investment Decision, Financing Decision, and Dividend Decision. Financial Ratio Analysis: Overview of Financial Statements—	CO3	08	08

	Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis.			
4. Capital Budgeting:	Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value(NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR) Working Capital Management: Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.	CO4	04	04
5. Sources of Finance	Long Term Sources—Equity, Debt, and Hybrids; Mezzanine Finance; Sources of Short Term Finance—Trade Credit, Bank Finance, Commercial Paper; Project Finance. Capital Structure: Factors Affecting an Entity's Capital Structure; Overview of Capital Structure Theories and Approaches— Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure.	CO5	03 02	05
6. Dividend Policy	Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach	CO6	08	08
II. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
Total hours				42
Books:				
Text Books	1. Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi. 2. Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.			
Reference Books	1. Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi. 2. Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.			

	3. Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi. 4. Financial Management, 11th Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.
Assessment:	
Continuous Assessment for 40 marks: 1. Test 1 – 15 marks 2. Test 2 – 15 marks 3. Internal assessment - 10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty	
End Semester Examination will be of 60 marks for 3 hours duration.	

Course Code	Course Name	Credits (TH+P+TUT)
1UILC8043	Entrepreneurship Development and Management	(3+0+0)

Course Objectives:	1. To acquaint with entrepreneurship and management of business. 2. Understand Indian environment for entrepreneurship. 3. Idea of EDP, MSME. 4. Discuss the government plan for startup business. 5. Analyze the business risk. 6. Discuss the successful business stories.
Couse Outcomes:	Upon completion of the course, the learners will be able to: 1. Explain the concept of Business Plan and the Role of Money and Capital Markets in Entrepreneurial Development. 2. Analyze Key regulations and legal aspects of entrepreneurship in India. 3. Explain Government Policies for Startup. 4. Describe Different Government initiatives for Startup. 5. Explain Issues and Problems Faced by Micro and Small Enterprises. 6. Describe Growth Strategies for small businesses.

Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs./ Module
I. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction	---	02	02
1. Overview Of Entrepreneurship:	1.1 Definitions, Roles and Functions/Values of Entrepreneurship, History of Entrepreneurship Development.	CO1	01	04
	1.2 Role of Entrepreneurship in the National Economy, Functions of an Entrepreneur.		01	
	1.3 Entrepreneurship and Forms of Business Ownership Role of Money and Capital Markets in Entrepreneurial Development: Contribution of Government Agencies in Sourcing information for Entrepreneurship.		02	
2. Business Plans And Importance Of Capital To Entrepreneurship:	2.1 Introduction: Preliminary and Marketing Plans, Management and Personnel.	CO2	02	09
	2.2 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.		03	
	2.3 Entrepreneurship And Business Development: Starting a New Business, Buying an Existing Business.		02	
	2.4 New Product Development, Business Growth and the Entrepreneur Law and its Relevance to Business Operations.		02	
3. Women's Entrepreneurship Development	Women's Entrepreneurship Development, Social Entrepreneurship-Role and Need, EDP Cell, Role of Sustainability and Sustainable Development for SMEs, Case Studies, Exercises.	CO3	05	05

4. Indian Environment for Entrepreneurship	4.1 Key Regulations and Legal Aspects, MSMED Act 2006 and its Implications, Schemes and Policies of the Ministry of MSME, Role and Responsibilities of various Government Organisations, Departments, Banks etc.	CO4	03	09
	4.2 Role of State Governments in Terms of Infrastructure Developments and Support etc.		04	
	4.3 Public Private Partnerships, National Skill Development Mission, Credit Guarantee Fund, PMEGP, Discussions, Group Exercises etc.		02	
5. Effective Management of Business	5.1 Issues and Problems Faced by Micro and Small Enterprises and Effective Management of M and S Enterprises.	CO5	04	08
	5.2 Risk Management, Credit Availability, Technology Innovation, Supply Chain Management, Linkage with Large Industries, Exercises, E-Marketing.		04	
6. 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	CO6	04	04
II. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
Total hours				42

Books:

Text Books	1. P Charantimath, Entrepreneurship Development- Small Business Enterprise, Pearson 2. R Hisrich and M Peters, Entrepreneurship, The McGraw Hill Company. 3. D Kuratko, Entrepreneurship- Principles and Practices, Thomson Publication
Reference Books	1. Dr T Chhabra, Entrepreneurship Development, Sun India Publications, New Delhi. 2. Law and Practice Relating to Micro, Small and Medium Enterprises, Taxmann Publication Ltd. 3. L Maddhurima, S Shikah, Entrepreneurship, Excel Books. **4.** R Bansal, STAY Hungry STAY Foolish, CIIE, IIM Ahmedabad

Useful Links:

1. www.msme.gov.in

2.www.dcmesme.gov.in

3.www.msmetraining.gov.in

Assessment:

Continuous Assessment for 40 marks:

1. Test 1 – 15 marks
2. Test 2 – 15 marks
3. Internal assessment - 10 marks

Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty

End Semester Examination will be of 60 marks for 3 hours duration.

Course Code	Course Name	Credits (TH+P+TUT)
1UILC8044	Human Resource Management	(3+0+0)

Course Objectives:	1. To introduce the students with basic concepts, techniques and practices of the human resource management. 2. To provide opportunity of learning Human resource management (HRM) processes, related with the functions, and challenges in the emerging perspective of today's organizations. 3. To familiarize the students about the latest developments, trends & different aspects of HRM. 4. To acquaint the student with the importance of inter-personal & inter-group behavioral skills in an organizational setting required for future stable engineers, leaders and managers.
Couse Outcomes:	**Upon completion of the course, the learners will be able to:** 1. Describe the concepts, aspects, techniques and practices of human resource management. 2. Describe the Human resource management (HRM) processes, functions, changes and challenges in today's emerging organizational perspective. 3. Apply the knowledge about the latest developments and trends in HRM. 4. Analyze the knowledge of Cross-cultural Leadership and Decision Making. 5. Apply the knowledge of behavioral skills learnt and integrate it with in interpersonal and intergroup environment emerging as future stable engineers and managers. 6. Apply the Labor Laws & Industrial Relations and various Act.

Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs./ Module
I. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction	---	02	02
1. Introduction to HR	1.1 Human Resource Management- Concept, Scope and Importance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions.	CO1	02	05
	1.2 Human resource development (HRD): changing role of HRM – Human resource Planning, Technological change, Restructuring and rightsizing, Empowerment, TQM, Managing ethical issues.		03	
2. Organizational Behavior (OB)	2.1 Introduction to OB Origin, Nature and Scope of Organizational Behavior, Relevance to Organizational Effectiveness and Contemporary issues.	CO2	01	07
	2.2 Personality: Meaning and Determinants of Personality, Personality development, Personality Types, Assessment of Personality Traits for Increasing Self Awareness.		02	
	2.3 Perception: Attitude and Value, Effect of perception on Individual Decision-making, Attitude and Behaviour.		02	

	2.4 Motivation: Theories of Motivation and their Applications for Behavioral Change (Maslow, Herzberg, McGregor).		01	
	2.5 Group Behavior and Group Dynamics: Work groups formal and informal groups and stages of group development. Team Effectiveness: High performing teams, Team Roles, cross functional and self-directed team.		01	
	2.6 Case study		01	
3. Organizational Structure &Design	3.1 Structure, size, technology, Environment of organization; Organizational Roles & conflicts: Concept of roles; role dynamics; role conflicts and stress.	CO3	02	06
	3.2 Leadership: Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership.		02	
	3.3 Power and Politics: Sources and uses of power; Politics at workplace, Tactics and strategies.		02	
4. Human resource Planning	4.1 Recruitment and Selection process, Job-enrichment, Empowerment-Job-Satisfaction, employee morale.	CO4	02	05
	4.2 Performance Appraisal Systems: Traditional & modern methods, Performance Counselling, Career Planning.		01	
	4.3 Training & Development: Identification of Training Needs, Training Methods		02	
5. Emerging Trends in HR	5.1 Organizational development; Business Process Re-engineering (BPR), BPR as a tool for organizational development, managing processes & transformation in HR. Organizational Change, Culture, Environment.	CO5	03	06
	5.2 Cross Cultural Leadership and Decision Making: Cross Cultural Communication and diversity at work, Causes of diversity, managing diversity with special reference to handicapped, women and ageing people, intra company cultural difference in employee motivation.		03	
6. HR & MIS	6.1 Need, purpose, objective and role of information system in HR, Applications in HRD in various industries (e.g. manufacturing R&D, Public Transport, Hospitals, Hotels and service industries.	CO6	03	10
	6.2 Strategic HRM Role of Strategic HRM in the modern business world, Concept of Strategy, Strategic Management Process, Approaches to Strategic Decision Making; Strategic Intent – Corporate Mission, Vision, Objectives and Goals.		03	
	6.3 Labor Laws & Industrial Relations Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act.		04	
II. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
Total hours				42

Books:	
Text Books	1.S. Robbins, Organizational Behavior, Pearson Education Limited. 2.V.S.P. Rao, Human Resource Management, Excel publishing. 3.K. Aswathapa, Human resource management: Text & cases.
Reference Books	1.C. B. Mamoria and S. V. Gankar, Dynamics of Industrial Relations in India, Himalaya Publishing. 2.P. Subba Rao, Essentials of Human Resource management and Industrial relations, Himalaya Publishing. 3.L. Mullins, Management & Organizational Behavior, Pearson Publications.
Assessment:	
Continuous Assessment for 40 marks: 1. Test 1 – 15 marks 2. Test 2 – 15 marks 3. Internal assessment - 10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty	
End Semester Examination will be of 60 marks for 3 hours duration.	

Course Code	Course Name	Credits (TH+P+TUT)
1UILC8045	Professional Ethics and Corporate Social Responsibility	(3+0+0)

Course Objectives:	1.To understand professional ethics in business 2.To recognized corporate social responsibility
Couse Outcomes:	1. Explain rights and duties of business 2. Explain and understand the ethics in market and towards environment 3. Solve the problems of consumers and job discrimination ethically 4. Show corporate and social responsibility 5. Distinguish different aspects of corporate social responsibility 6. Explain global aspects of corporate social responsibility

Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs./ Module
I. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction	---	02	02
1. Professional Ethics and Business	The Nature of Business Ethics; Ethical Issues in Business; Moral Responsibility and Blame; Utilitarianism: Weighing Social Costs and Benefits; Rights and Duties of Business	CO1	04	04
2. Professional Ethics in the Marketplace	Perfect Competition; Monopoly Competition; Oligopolistic Competition; Oligopolies and Public Policy. Professional Ethics and the Environment: Dimensions of Pollution and Resource Depletion; Ethics of Pollution Control; Ethics of Conserving Depletable Resources	CO2	04	08
3. Professional Ethics of Consumer Protection	Markets and Consumer Protection; Contract View of Business Firm's Duties to Consumers; Due Care Theory; Advertising Ethics; Consumer Privacy Professional Ethics of Job Discrimination: Nature of Job Discrimination; Extent of Discrimination; Reservation of Jobs.	CO3	04	06
4. Introduction to Corporate Social Responsibility	Potential Business Benefits—Triple bottom line, Human resources, Risk management, Supplier relations; Criticisms and concerns—Nature of business; Motives; Misdirection. Trajectory of Corporate Social Responsibility in India	CO4	05	05
5. Corporate Social Responsibility	Articulation of Gandhian Trusteeship Corporate Social Responsibility and Small and Medium Enterprises (SMEs) in India, Corporate Social Responsibility and ublic-Private Partnership (PPP) in India	CO5	08	08
6. Corporate Social Responsibility in Globalizing India	Corporate Social Responsibility voluntary Guidelines, 2009 issued by the Ministry of Corporate Affairs, Government of India, Legal Aspects of Corporate Social Responsibility Companies Act, 2013.	CO6	08	08
II. Course Conclusio	Recap of Modules, Outcomes, Applications, and	---	01	01

	Summarization.			
Total hours				42
Books:				
Text Books	Business Ethics: Texts and Cases from the Indian Perspective (2013) by Ananda Das Gupta; Publisher Springer.			
Reference Books	1. Business Ethics: Texts and Cases from the Indian Perspective (2013) by Ananda Das Gupta; Publisher: Springer. 2. Corporate Social Responsibility: Readings and Cases in a Global Context (2007) by Andrew Crane, Dirk Matten, Laura Spence; Publisher: Routledge. 3. Business Ethics: Concepts and Cases, 7th Edition (2011) by Manuel G. Velasquez; Publisher: Pearson, New Delhi. 4. Corporate Social Responsibility in India (2015) by BidyutChakrabarty, Routledge, New Delhi.			
Assessment:				
Continuous Assessment for 40 marks: 1. Test 1 – 15 marks 2. Test 2 – 15 marks 3. Internal assessment - 10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty				
End Semester Examination will be of 60 marks for 3 hours duration.				

Course Code	Course Name	Credits (TH+P+TUT)
1UILC8046	Research Methodology	(3+0+0)

Prerequisite:	-----
Course Objectives:	1. To understand Research and Research Process 2. To acquaint students with identifying problems for research and develop research strategies 3. To familiarize students with the techniques of data collection, analysis of data and interpretation
Couse Outcomes:	1. Describe about the methodologies in research. 2. Prepare a preliminary research design for projects in their subject matter areas. 3. Accurately collect, analyze and report data. 4. Present complex data or situations clearly. 5. Review and analyze research findings. 6. Summarize the different aspects and steps in conducting research.

Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs./ Module
I. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction	---	02	02
1. Introduction and Basic Research Concepts	1.1 Research Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Research methods vs Methodology	CO1	02	09
	1.2 Need of Research in Business and Social Sciences		02	
	1.3 Objectives of Research		01	
	1.4 Issues and Problems in Research		02	
	1.5 Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical		02	
2. Types of Research	2.1. Basic Research	CO1, CO2	01	07
	2.2. Applied Research		01	
	2.3. Descriptive Research		01	
	2.4. Analytical Research		01	
	2.5. Empirical Research		01	
	2.6. Qualitative and Quantitative Approaches		02	
3. Research Design and Sample Design	3.1 Research Design: Meaning, Types and Significance	CO1	04	07
	3.2 Sample Design Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors		03	
4. Research Methodology	4.1 Meaning of Research Methodology	CO6	01	08
	4.2. Stages in Scientific Research Process: **a.** Identification and Selection of Research Problem **b.** Formulation of Research Problem **c.** Review of Literature **d.** Formulation of Hypothesis		07	

	e. Formulation of research Design **f.** Sample Design **g.** Data Collection **h.** Data Analysis Hypothesis testing and Interpretation of Data Preparation of Research Report			
5. Formulating Research Problem	Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis	CO4, CO5	04	04
6. Outcome of Research	6.1 Preparation of the report on conclusion reached	CO3	02	04
	6.2 Validity Testing & Ethical Issues		01	
	6.3 Suggestions and Recommendation		01	
II. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
Total hours				42

Books:	
Text Books	1. C. Kothari, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited, 1985.
Reference Books	1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors. 2. Kothari, C.R.,1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited. 3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step guide for Beginners, (2nd ed), Singapore, Pearson Education
Useful Links:	
https://libguides.newcastle.edu.au/researchmethods	
Assessment:	
Continuous Assessment for 40 marks: 1. Test 1 – 15 marks 2. Test 2 – 15 marks 3. Internal assessment - 10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty	
End Semester Examination will be of 60 marks for 3 hours duration.	

Course Code	Course Name	Credits (TH+P+TUT)
1UILC8047	IPR and Patenting	(3+0+0)

Prerequisite:	---
Course Objectives:	1.To understand intellectual property rights protection system 2.To promote the knowledge of Intellectual Property Laws of India as well as International treaty procedures 3.To get acquaintance with Patent search and patent filing procedure and applications
Couse Outcomes:	**After successful completion of the course student will be able to** 1. Explain Intellectual Property assets 2. Explain the enforcements in IPR 3. Investigate the issues in IPR. 4. Illustrate basics of patent. 5. Explain the patent rules 6. Apply the procedure of filing patent nationally and internationally

Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs./ Module
I. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction	---	02	02
1. Introduction to Intellectual Property Rights (IPR)	1.1 Meaning of IPR, Different category of IPR instruments Patents, Trademarks, Copyrights, Industrial Designs, Plant variety protection, Geographical indications, Transfer of technology etc.	CO1	03	05
	1.2 Importance of IPR in Modern Global Economic Environment: Theories of IPR, Philosophical aspects of IPR laws, Need for IPR, IPR as an instrument of development		02	
2. Enforcement of Intellectual Property Rights	2.1 Introduction, Magnitude of problem, Factors that create and sustain counterfeiting/piracy, International agreements, International organizations (e.g. WIPO, WTO) active in IPR enforcement.	CO2	03	07
	2.2 Indian Scenario of IPR: Introduction, History of IPR in India, Overview of IP laws in India, Indian IPR, Administrative Machinery, Major international treaties signed by India, Procedure for submitting patent and Enforcement of IPR at national level etc.		04	
3. Emerging Issues in IPR	Challenges for IP in digital economy, e-commerce, human genome, biodiversity and traditional knowledge etc.	CO3	05	05
4. Basics of	Definition of Patents, Conditions of	CO4	07	07

Patents	patentability, Patentable and non-patentable inventions, Types of patent applications (e.g. Patent of addition etc), Process Patent and Product Patent, Precautions while patenting, Patent specification Patent claims, Disclosures and non-disclosures, Patent rights and infringement, Method of getting a patent			
5. Patent Rules	Indian patent act, European scenario, US scenario, Australia scenario, Japan scenario, Chinese scenario, Multilateral treaties where India is a member (TRIPS agreement, Paris convention etc.)	CO5	08	08
6. Procedure for Filing a Patent (National and International)	Legislation and Salient Features, Patent Search, Drafting and Filing Patent Applications, Processing of patent, Patent Litigation, Patent Publication etc, Time frame and cost, Patent Licensing, Patent Infringement. Patent databases: Important websites, Searching international databases	CO6	07	07
II. Course Conclusio	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
Total hours				42

Books:

Text Books	1. Rajkumar S. Adukia, 2007, A Handbook on Laws Relating to Intellectual Property Rights in India, The Institute of Chartered Accountants of India 2. Keayla B K, Patent system and related issues at a glance, Published by National Working Group on Patent Laws 3. T Sengupta, 2011, Intellectual Property Law in India, Kluwer Law International Tzen Wong and Graham Dutfield, 2010, Intellectual Property and Human Development: Current Trends and Future Scenario, Cambridge University Press 4. Cornish, William Rodolph & Llewelyn, David. 2010, Intellectual Property: Patents, Copyrights, Trade Marks and Allied Right, 7th Edition, Sweet & Maxwell 5. Lous Harns, 2012, The enforcement of Intellactual Property Rights: A Case Book, 3rd Edition, WIPO
Reference Books	1. Prabhuddha Ganguli, 2012, Intellectual Property Rights, 1st Edition, 2. TMHR Radha Krishnan & S Balasubramanian, 2012, Intellectual Property Rights, 1st Edition, Excel Books 3. R Radha Krishnan & S Balasubramanian, 2012, Intellectual Property Rights, 1st Edition, Excel Books 4. M Ashok Kumar and mohd Iqbal Ali, 2-11, Intellectual Property Rights, 2nd Edition, Serial Publications 5. Kompal Bansal and Praishit Bansal, 2012, Fundamentals of IPR for Engineers, 1st Edition, BS Publications 6. Entrepreneurship Development and IPR Unit, BITS Pilani, 2007, A Manual on Intellectual Property Rights, 7. Mathew Y Maa, 2009, Fundamentals of Patenting and Licensing for Scientists and Engineers, World Scientific Publishing Company 8. N S Rathore, S M Mathur, Priti Mathur, Anshul Rathi, IPR:

	Drafting,Interpretation of Patent Specifications and Claims**,** New India Publishing Agency 9. Vivien Irish, 2005, Intellectual Property Rights for Engineers,IET 10. Howard B Rockman, 2004, Intellectual Property Law for Engineers and scientists, Wiley-IEEE Press
Assessment:	
Continuous Assessment for 40 marks: 1. Test 1 – 15 marks 2. Test 2 – 15 marks 3. Internal assessment - 10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty	
End Semester Examination will be of 60 marks for 3 hours duration.	

Course Code	Course Name	Credits (TH+P+TUT)
1UILC8048	Digital Business Management	(3+0+0)

Course Objectives:	1.To familiarize with digital business concept 2.To acquaint with E-commerce 3.To give insights into E-business and its strategies
Couse Outcomes:	**After the successful completion of this course, learner will be able to:** 1. Identify drivers of digital business. 2. Reviewing the concepts of E-commerce. 3. Devise the services of Digital Business. 4. Illustrate various techniques of managing E-business. 5. Illustrate various approaches of E-business Strategy. 6. Prepare E-business Plan.

Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs./ Module
I. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction	---	02	02
1. Introduction to Digital Business	1.1 Introduction, Background and current status, E-market places, structures, mechanisms, economics and impacts Difference between physical economy and digital economy.	CO1	06	09
	1.2 Drivers of digital business- Big Data & Analytics, Mobile, Cloud Computing, Social media, BYOD, and Internet of Things(digitally intelligent machines /services) Opportunities and Challenges in Digital Business.		03	
2. Overview of E-Commerce	E-Commerce- Meaning, Retailing in e-commerce-products and services, consumer behaviour, market research and advertisement B2B-E-commerce-selling and buying in private e-markets, public B2B exchanges and support services, e-supply chains, Collaborative Commerce, Intra business EC and Corporate portals Other E-C models and applications, innovative EC System-From E-government and learning to C2C, mobile commerce and pervasive computing EC Strategy and Implementation-EC strategy and global EC, Economics and Justification of EC, Using Affiliate marketing to promote your e-commerce business, Launching a successful online business and EC project, Legal, Ethics and Societal impacts of EC	CO2	06	06
3. Digital Business Support services	ERP as e –business backbone, knowledge Tope Apps, Information and referral system Application Development: Building Digital business applications and infrastructure	CO3	06	06
4. Managing E-Business	Managing Knowledge, Management skills for e-business, Managing Risks in e-business Security Threats to e-business -Security Overview, Electronic Commerce Threats, Encryption,	CO4	06	06

	Cryptography, Public Key and Private Key Cryptography, Digital Signatures, Digital Certificates, Security Protocols over Public Networks: HTTP, SSL, Firewall as Security Control, Public Key Infrastructure (PKI) for Security, Prominent Cryptographic Applications			
5. E-Business Strategy	E-business Strategic formulation- Analysis of Company's Internal and external environment, Selection of strategy, E-business strategy into Action, challenges and E-Transition (Process of Digital Transformation)	CO5	04	04
6. Materializing e-business	From Idea to Realization-Business plan preparation. Case Studies and presentations	CO6	08	08
II. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
Total hours				42

Books:

Text Books	1.A textbook on E-commerce**,** Er Arunrajan Mishra, Dr W K Sarwade, Neha Publishers & Distributors, 2011. 2.E-commerce from vision to fulfilment, Elias M. Awad, PHI-Restricted, 2002 3.Digital Business and E-Commerce Management, 6th Ed, Dave Chaffey, Pearson, August 2014 4.Introduction to E-business-Management and Strategy, Colin Combe, ELSVIER, 2006
Reference Books	1. Digital Business Concepts and Strategy, Eloise Coupey, 2nd Edition, Pearson 2. Trend and Challenges in Digital Business Innovation, Vinocenzo Morabito, Springer 3. Digital Business Discourse Erika Darics, April 2015, Palgrave Macmillan 4. E-Governance-Challenges and Opportunities in: Proceedings in 2nd International Conference theory and practice of Electronic Governance 5. Perspectives the Digital Enterprise –A framework for Transformation, TCS consulting journal Vol.5 6. Measuring Digital Economy-Anewperspective-DOI:10.1787/9789264221796 enECD Publishing

Assessment:

Continuous Assessment for 40 marks:

1. Test 1 – 15 marks
2. Test 2 – 15 marks
3. Internal assessment - 10 marks

Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty

End Semester Examination will be of 60 marks for 3 hours duration.

Course Code	Course Name	Credits (TH+P+TUT)
1UILC8049	Environmental Management	(3+0+0)

Prerequisites	General Awareness of environment and factors affecting the environment.
Course Objectives:	1. Understand and identify environmental issues relevant to India and global concerns 2. Learn concepts of ecology 3. Familiarise environment related legislations 4. Understand to protect and sustain our natural resources of land, water, air, and vegetation.
Couse Outcomes:	1. Interpret the concept of environmental management. 2. Learn the ecosystem and interdependence, food chain etc. and interpret environment related legislations. 3. Identify the environmental issues important to India. 4. Learn the regulating policies of Government in environmental management. 5. Identify solutions to protect the environment from pollution. 6. Examine the quality environmental management.

Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs./ Module
I. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction	---	02	02
1. Introduction and Definition of Environment	1.1Significance of Environment Management for contemporary managers	CO1	02	10
	1.2.Career opportunities		01	
	1.3.Environmental issues relevant to India		02	
	1.4.Sustainable Development		03	
	1.5.The Energy scenario		02	
2. Global Environmental concerns	1.1 Global Warming	CO3	01	06
	1.2 Acid Rain		01	
	1.3 Ozone Depletion		01	
	1.4 Hazardous Wastes	CO3, CO5	0.5	
	1.5 Endangered life-species		0.5	
	1.6 Loss of Biodiversity		01	
	2.7 Industrial/Man-made disasters/Atomic/Biomedical hazards, etc		01	
3. Concepts of Ecology	3.1 Ecosystems and interdependence between living organisms	CO2	01	05
	3.2 Habitats		0.5	
	3.3 limiting factors		0.5	
	3.4 Carrying capacity		01	
	3.5 Food chain		01	
	3.6 Ecology		01	
4. Scope of Environment Management	4.1 Scope of Environment Management	CO1, CO4	03	10
	4.2 Role & functions of Government as a planning and regulating agency.		03	
	4.3 Environment Quality Management and Corporate Environmental Responsibility		04	
5. Quality	5.1 Total Quality Environmental Management	CO6	02	05

Environmental Management	5.2 ISO-14000		02	
	5.3 EMS certification		01	
6. General overview of major legislations	General overview of major legislations like Environment Protection Act, Air (P & CP) Act, Water (P & CP) Act, Wildlife Protection Act, Forest Act, Factories Act, etc.	CO3, CO4	03	03
II. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
Total hours				42

Books:

Text Books	1. Environmental Management: Principles and Practice, C J Barrow, Routledge Publishers London, 1999 2. A Handbook of Environmental Management Edited by Jon C. Lovett and David G. Ockwell, Edward Elgar Publishing 3. Environmental Management V Ramachandra and Vijay Kulkarni, TERI Press
Reference Books	1. Indian Standard Environmental Management Systems — Requirements With Guidance For Use, Bureau Of Indian Standards, February 2005 2. Introduction to Environmental Management, Mary K Theodore and Louise Theodore, CRC 3. Environment and Ecology, Majid Hussain, 3rd Ed. Access Publishing.2015 4. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Maclillan India, 2000

Useful Links:

1. https://libguides.library.qut.edu.au/EVB302_Environmental_pollution/links
2. https://www.epd.gov.hk/epd/epic/english/epichome.html
3. http://www.ecovacservices.com/Useful-Links-6-5511.html

Assessment:

Continuous Assessment for 40 marks:

1. Test 1 – 15 marks
2. Test 2 – 15 marks
3. Internal assessment - 10 marks

Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty

End Semester Examination will be of 60 marks for 3 hours duration.

Lab Code	Lab Name	Credits (P+TUT)
1UETL801	**Industrial Automation Lab**	**(1+0)**

Lab Prerequisite:	1. Electronics Devices and Circuits-I 2. Electronics Devices and Circuits-II
Lab Objectives:	1. To teach various online tools available by IIT 2. To learn working of sensors and actuators 3. To learn Industrial Automation and Control System
Lab Outcomes (LOs):	After successful completion of the course student will be able to 1. Learn and use various online simulation tools. 2. Perform simulation for sensors and actuators. 3. Perform experiment on Industrial Automation and Control System 4. Design ladder diagram for Industrial Applications

Lab No.	Experiment Title	LO mapped	Hrs./Lab
I.	Lab Prerequisite	---	02
1.	Use industrial grade sensors and transducer introduction and characteristics like proximity detector, linear encoder, rotary encoder, touch sensor, force sensor, accelerometer, RTDs, load cells and LVDT for measurement.	LO1, LO2	02
2.	Use Various actuators such as relay, solenoid valve, process control valve and motors for control applications.		02
3.	Simulate analog and digital function blocks.	LO1, LO3	02
4.	Relay logic diagram and ladder logic diagram.	LO1, LO4	02
5.	Understand and perform experiments on timers and counters.	LO1, LO3	02
6.	Logic implementation for traffic Control Application.		02
7.	Logic implementation for Bottle Filling Application.		02
8.	Tune PID controller for heat exchanger using DCS.		02
9.	Study Hardware and Software platform for DCS.		02

Useful Links:

1. http://ial-coep.vlabs.ac.in/
2. www.plctutor.com

Term work:

1. Term work should consist of a Minimum of 8 experiments.
2. Journal must include at least 2 assignments on content of theory and practical of the course “Industrial Automation”.
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work.
4. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks.

Oral: Oral examination will be based on experiment list and performance of experiment.

Lab Code	Lab Name	Credits (P+TUT)
1UETDLL8021	**Micro Electro Mechanical System Lab**	**(1+0)**

Lab Prerequisite:	1.Basic VLSI Design 2.Mixed Signal VLSI Design 3.Electronic Instrumentation and Measurement
Lab Objectives:	1. To provide knowledge of MEMS processing steps, used of materials with respect to specific applications. 2. To provide an understanding of basic design and operation of MEMS devices. 3. To provide an understanding of performance characteristics of MEMS devices.
Lab Outcomes (LOs):	After successful completion of the course students will be able to: 1. Perform practical's using online simulation tool with active participation 2. Demonstrate clear understanding of operation of MEMS devices 3. Write clear documentation for and interpret the results of the performed experiments 4. Communicate clearly and effectively. 5. The student will be able to write accurate documentation for experiments performed. 6. The student will be able apply ethical principles like timeliness and adhere to the rules of the laboratory.

Lab No.	Experiment Title	LO mapped	Hrs./Lab
I.	Lab Prerequisite	---	02
1.	Design electro-statically actuated cantilever.	LO1	02
2.	Design bimorph cantilever which acts as pressure sensor.		02
3.	Dynamic analysis of Beam.		02
4.	Find the tip deflection of the cantilever with different types of loads	LO2	02
5.	Find the tip deflection of the cantilever in sweep analysis		02
6.	Model and simulate Electro-mechanical actuator. Do dc and transient analysis		02
7.	Design the geometry of MEMS and find performance characteristics such as resonant frequency, deflection per voltage or temperature		02
8.	Simulate the harvested electrical power from mechanical vibrations using piezoelectric cantilever beam		02
9.	Model and simulate of accelerometer		02
10.	Case study of MEMS based device	LO3	02

Term work:

1. Term work should consist of a Minimum of 8 experiments.
2. Journal must include at least 2 assignments on content of theory and practical of the course "Micro Electro Mechanical System".
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work.
4. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks.

Oral: Oral examination will be based on experiment list and performance of experiment.

Lab Code	Lab Name	Credits (P+TUT)
1UETDLL8022	Web Designing Lab	(1+0)

Lab Prerequisite:	1. Data Structures 2. Basics of Programming Languages
Lab Objectives:	1. To design and create web pages using HTML5 and CSS3. 2. To Create web pages and provide client side validation. 3. To create dynamic web pages using server side scripting. 4. To use MVC framework for web application development.
Lab Outcomes (LOs):	1. Explain the core concepts and features of Web Technology 2. Design static web pages using HTML5 and CSS3 3. Apply the concept of client side validation and design dynamic web pages using JavaScript and JQuery. 4. Evaluate client and server side technologies and create Interactive web pages using PHP , AJAX with database connectivity using MySQL. 5. Explain the basics of XML, DTD and XSL and develop web pages using XML / XSLT. 6. Analyze end user requirements and Create web application using appropriate web technologies and web development framework.

Lab No.	Experiment Title	LO mapped	Hrs./Lab
I.	Lab Prerequisite	---	02
1.	Installation and Setting of LAMP / WAMP / XAMP	LO1	02
2.	Create Simple web page using HTML5	LO2	02
3.	Design and Implement web page using CSS3 and HTML5		02
4.	Form Design and Client Side Validation using : a. Javascript and HTML5 b. Javascript and JQuery	LO3	02
5.	Develop simple web page using PHP	LO4	02
6.	Develop interactive web pages using PHP with database connectivity MYSQL		02
7.	Develop XML web page using DTD, XSL	LO5	02
8.	To implement MVC architecture	LO6	02
9.	Implement a webpage using Ajax and PHP	LO4	02
10.	Hosting the website with Domain Registration Process.	LO6	02
11.	Design a Web application using Laravel Framework		02

Useful Links:

1. www.nptelvideos.in
2. www.w3schools.com
3. http://spoken-tutorial.org

Term work:

1. Term work should consist of a Minimum of 8 experiments.
2. Journal must include at least 2 assignments on content of theory and practical of the course "Web Designing".
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work.
4. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks.

Oral: Oral examination will be based on experiment list and performance of experiment.

Lab Code	Lab Name	Credits (P+TUT)
1UETDLL8023	Advanced Power Electronics Lab	(1+0)

Lab Prerequisite:	Power Electronics, Linear Control System
Lab Objectives:	1.To enhance and expand the ideas of students for more complex power Electronic Systems. 2. To teach the analytical methods in power electronic systems. 3. To expose the students to various applications of power electronics in various Electronics equipment and drives.
Lab Outcomes (LOs):	After successful completion of the course students will be able to: 1. Simulate single and three phase rectifiers circuits. 2. Simulate single and three phase inverter circuits. 3. Design different DC-DC converter for SMPS, chopper circuits. 4. Perform speed control of DC motor. 5. Demonstrate speed control of AC drives in an energy efficient manner using power electronics. 6. Demonstrate various applications of power electronics

Lab No.	Experiment Title	LO mapped	Hrs./Lab
I.	Lab Prerequisite	---	02
1.	Single Phase Full Controlled Bridge Rectifier.	LO1	02
2.	Speed control of Separately excited DC motor using Armature Voltage Control	LO4	02
3.	Speed control of 3-phase Induction Motor using V/F control.	LO5	02
4.	Simulation of 3-phase fully controlled Bridge rectifier with R and RL load.	LO1	02
5.	Simulation of 1-phase fully controlled Bridge rectifier and study of various parameters.		02
6.	Simulation of 1-phase Inverter and study of various Performance parameters.	LO2	02
7.	Simulation of Closed loop dc-dc converter	LO4	02
8.	Study High Frequency Induction heating & Dielectric heating	LO6	02
9.	Study of operation and control of solid state relays.		02

Useful Links:

1. http://iitb.vlab.co.in/?sub=8&brch=117

2.http://vlabs.iitkgp.ernet.in/rcs/index.html

Term work:

1. Term work should consist of a Minimum of 8 experiments.
2. Journal must include at least 2 assignments on content of theory and practical of the course "Advanced Power Electronics".
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work.
4. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks.

Oral: Oral examination will be based on experiment list and performance of experiment.

Lab Code	Lab Name	Credits (P+TUT)
1UETDLL8024	**Virtual Instrumentation Lab**	**(1+0)**

Lab Prerequisites:	---
Lab Objectives:	1. To provide knowledge on design of process control by using virtual instrumentation techniques 2. To provide knowledge in process analysis by VI tools. 3. To give basic knowledge in describing function analysis. 4. Get adequate knowledge VI tool sets
Lab Outcomes:	After the successful completion of the course the students will be able to: 1. Execute mathematical operations by using LabVIEW 2. Analyze and design different type of programs based on data acquisition. 3. Design virtual instruments for practical applications 4. Write accurate documentation for experiments performed 5. Apply ethical principles like timeliness and adhere to the rules of the laboratory

Lab No.	Experiment Title	LO mapped	Hrs./Lab
I.	Lab Prerequisite	---	02
1.	Verification of arithmetic operations	LO1,LO4, LO5	02
2.	Verification of Boolean Expressions / half-adder & full-adder		02
3.	Implementation of array functions		02
4.	Program to convert Celsius into Fahrenheit & vice-versa	LO2,LO4, LO5	02
5.	Program for implementing seven segment display		02
6.	Program for calculating body mass index (BMI) using cluster		02
7.	Program to control temperature using thermistor / RTD & DAQ		02
8.	Program to control liquid flow using DAQ		02
9.	Program to control liquid level using DAQ		02
10.	Program to control pressure using DAQ		02
11.	Program for DC motor speed control using PID toolbox	LO3,LO4, LO5	02

Useful Links:

1. http://iitb.vlab.co.in/?sub=8&brch=117
2. http://vlabs.iitkgp.ernet.in/rcs/index.html

Term work:

1. Term work should consist of a Minimum of 8 experiments.
2. Journal must include at least 2 assignments on content of theory and practical of the course "Virtual Instrumentation".
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work.
4. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks.

Oral: Oral examination will be based on experiment list and performance of experiment.

Lab Code	Lab Name	Credits (P+TUT)
1UETDLL8031	**Next Generation Networks Lab**	**(1+0)**

Lab Prerequisite:	1. Computer Communication Networks 2. Next Generation Networks
Lab Objectives:	1. Learn how to build a network topology. 2. Explore Mininet emulator to perform networking tasks. 3. Learn about the GNS-3 environment for MPLS.
Lab Outcomes (LOs):	On successful completion of the course the students will be able to: 1. Analyze the working of Mininet. 2. Design different custom network topology using Mininet. 3. Create a SDN environment on Mininet. 4. Evaluate the Performance of MPLS layer 2 and 3 VPN in a GNS-3 5. Explain NUYSIM open-source 5G channel simulator.

Lab No.	Experiment Title	LO mapped	Hrs./Lab
I.	Lab Prerequisite	---	02
1.	Set up Mininet network emulation environment using Virtual Box and Mininet. Demonstrate the basic commands in Mininet.	LO1	02
2.	Implement different custom network topology (Simple, Linear, and Tree). Analyze flow tables.	LO2	02
3.	Create a SDN environment on Mininet and configure a switch to provide a firewall functionality	LO3	02
4.	Study various Layer 2 and Layer 3 MPLS Standard documents which are used by different vendors while developing their devices and network operating systems	LO4	02
5.	To Implement Layer 2 MPLS VPN technologies in a GNS-3 simulation environment.		02
6.	To evaluate the Performance of MPLS layer 3 VPN in a GNS-3	LO5	02
7.	Study of NUYSIM open-source 5G channel simulator		02
8.	Emulate a Data Center and manage it via a Cloud Network Controller: create a multi-rooted tree-like (Clos) topology in Mininet to emulate a data center.	LO3	02

Useful Lab Tools/Software:

1. MPLS Lab Tools/Software:

a) GNS3
b) Cisco IOS 7200 Enterprise
c) Wireshark
d) Putty (Built-in GNS3)

2. SDN Lab Tools/Software

a) Open Source Controller- Open Day Light (ODL) Controller
b) Open Source Controller- ONOS (Open Network Operating System) Controller
c) Mininet Tool (To Simulate SDN Open vSwitch)
d) Wireshark

3. SD-WAN Lab Tools/Software

a) Cisco Viptela Controller- vManage, vSmart,vBond Virtual Machine

b) Cisco viptela vEdge Router Virtual Machines

Term work:

1. Term work should consist of a Minimum of 8 experiments.
2. Journal must include at least 2 assignments on content of theory and practical of the course "Next Generation Networks".
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work.
4. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks.

Oral: Oral examination will be based on experiment list and performance of experiment.

Lab Code	Lab Name	Credits (P+TU)
1UETDLL8032	Industrial Internet of Things Lab	(1+0)

Lab Prerequisite:	1. Internet of Things 2. Basic knowledge of computer and internet 3. Computer Communication Networks
Lab Objectives:	The objectives of this course are to: 1.Identification of the basic requirements for Industrial IoT. 2.Apply Sensing, actuation, Communication and Networking in Industrial IoT. 3.Understand the need of analytics for Industrial IoT 4.Apply the Industrial IoT-for various Application Domains
Lab Outcomes (LOs):	On successful completion of the course the students will be able to: 1. Identify the use of Sensing & actuation, Communication and Networking in Industrial IoT Application. 2. Apply Sensing & actuation, Communication and Networking in Industrial IoT Application. 3. Implementation of analytics in Industrial IoT Application. 4. Demonstrate various Industrial IoT case studies. 5. Write accurate documentation for experiments performed. 6. Apply ethical principles like timeliness and adhere to the rules of the laboratory.

Lab No.	Experiment Title	LO mapped	Hrs./Lab
I.	Lab Prerequisite	---	02
1.	Identify the use of Sensing & actuation in Industrial IoT Application	LO1, LO5, LO6	02
2.	Identify the use of Communication and Networking in Industrial IoT Application		02
3.	Apply Sensing & actuation in Industrial IoT Application	LO2, LO5, LO6	02
4.	Apply Communication and Networking in Industrial IoT Application		02
5.	Implementation of analytics in Industrial IoT Application-I	LO3, LO5, LO6	02
6.	Implementation of analytics in Industrial IoT Application-II		02
7.	Case Study - Industrial IoT Application Domain-I	LO4, LO5, LO6	04
8.	Case Study - Industrial IoT Application Domain-II		04

Useful Links:

https://onlinecourses.nptel.ac.in/noc20_cs69

Term work:

1. Term work should consist of a Minimum of 8 experiments.
2. Journal must include at least 2 assignments on content of theory and practical of the course "Industrial Internet of Things".
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work.
4. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks.

Oral: Oral examination will be based on experiment list and performance of experiment.

Lab Code	Lab Name	Credits (P+TUT)
1UETDLL8033	System On Chip Lab	(1+0)

Lab Prerequisite:	1. Mixed Signal VLSI Design 2. Basic VLSI Design Lab
Lab Objectives:	1. To design digital systems using SoC 2. To analyze the performance of digital systems implemented using different design methodologies
Lab Outcomes (LOs):	After the successful completion of the course student will be able to 1. Design and implement systems with RTL design using Verilog. 2. Design and implement systems software logic on the FPGA 3. Design digital systems with software- hardware co-design. 4. Trouble shoot using debug ports 5. Interface boards using serial protocol.

Star (*) marked experiments are compulsory.

Lab No.	Experiment Title	LO mapped	Hrs./Lab
I.	Lab Prerequisite	---	02
1.	Write an application to blink an LED.	LO2	02
2.	Write an application to display different values on LEDs and verify it to be working		02
3.	Write a software application to add 2 numbers and display their sum		02
4.	Develop an accelerator which accepts start address, number of words as inputs and reads corresponding amount of data from BRAM, adds them and displays on LED	LO3	02
5.	Design a 4-bit wrap-around counter that increments every one second. The counter value is shown on the LEDS.	LO1	02
6.	Design a debouncer circuit switch.		02
7.	Design a counter with a button parser.		02
8.	Design an accumulator with memory block		02
9.	Design a calculator that can perform some basic functionality such as load, store, and sum of two operands.		02
10.	Design an UART transmitter	LO1,LO5	02
11.	Design an UART receiver	LO1	02
12.	Design a module that interfaces with Digi-lent video IP to draw a triangle to a monitor.		02
13.	Interfacing between PS and PL	LO3	02
14.	Flash LED using timer		02
15.	Design a system that will light an LED in response to a user input, but at the same time flash another LED at a frequency of 1Hz.		02
16.	Implement an interrupt-based design to send and receive data from the external board via SPI.	LO3,LO5	02

Term work:

1. Term work should consist of a Minimum of 8 experiments. 2.Journal must include at least 2 assignments on content of theory and practical of the course “System On Chip”. 3.The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work. 4.Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks.
Oral: Oral examination will be based on experiment list and performance of experiment.

Lab Code	Lab Name	Credits (P+TUT)
1UETDLL8034	Integrated Circuit Technology Lab	(1+0)

Lab Prerequisite:	VLSI Design
Lab Objectives:	1. To teach various online simulation tools available in nanohub.org 2. To learn various fabrication processes by performing simulation. 3. To draw layout for various CMOS devices using simulation tool.
Lab Outcomes (LOs):	After successful completion of the course student will be able to 1. Use various online simulation tools available in nanohub.org. 2. Perform simulation for various fabrication processes. 3. Generate Layout for various CMOS devices using simulation tool. 4. Write accurate documentation for experiments performed. 5. Apply ethical principles like timeliness and adhere to the rules of the laboratory.

Lab No.	Experiment Title	LO mapped	Hrs./Lab
I.	Lab Prerequisite	---	02
1.	To simulate oxidation process using online tool-a TCAD Lab on nanohub.org.	LO2, LO4, LO5	02
2.	To simulate diffusion process using online tool-a TCAD Lab on nanohub.org.		02
3.	To simulate Si and Ge PN junction using online tool- a TCAD Lab on nanohub.org.	LO1, LO4, LO5	02
4.	To simulate n/p type MOSFETs using online tool- a TCAD Lab on nanohub.org.		02
5.	To simulate carbon nanotube MOSFET using online tool-FETToy on nanohub.org.	LO2, LO4, LO5	02
6.	To simulate silicon nanowire MOSFET using online tool-FETToy on nanohub.org.		02
7.	To simulate SOI & double gate MOSFET using online tool-NanoMOS on nanohub.org.		02
8.	To draw and simulate layout for CMOS NAND and CMOS NOR. Tool- Microwind	LO3, LO4, LO5	02
9.	To draw and simulate layout for given equation. Tool-Microwind		02
10.	To draw and simulate layout for 6T SRAM Cell. Tool-Microwind		02

Useful Links:

https://nanohub.org/

Term work:

1. Term work should consist of a Minimum of 8 experiments.
2. Journal must include at least 2 assignments on content of theory and practical of the course "Integrated Circuit Technology".
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work.
4. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks.

Oral: Oral examination will be based on experiment list and performance of experiment.

Project Based Learning Code	Project Based Learning Name	Credits (P+TUT)
1UETPR86	**Major Project Lab-B**	**(6+0)**

PBL Pre-requisites:	Major Project Lab-A
PBL Objectives:	The Project work enables the students: 1. To develop the required skills and knowledge about research. 2. To analyze a specific problem or issue by using the latest technologies with a multidisciplinary approach. 3. To demonstrate proficiency in the design of a research project, application with appropriate research methods. 4. To implement and present research idea with appropriate solution
PBL Outcomes:	Learner will be able to: 1. Review literature, Design solutions, components or processes for complex engineering problems on the basis of research knowledge. 2. Implement projects using modern tools which are useful to society. 3. Apply contextual knowledge to assess the public health/safety/societal/environmental issues for sustainable development. 4. Document the work in project report and log book by referring reputed material. 5. Apply ethical principles and commit to professional ethics, responsibilities norms of the engineering practice and engage in independent and life-long learning. 6. Present their work in clear and effective manner with professional values like team work, time management and make financial arrangements.

Guidelines:

- To proceed with the project implementation work for the selected research idea.
- Projects can be designed in any domain of electronics by using recent technologies with multi-disciplinary approach.
- For developing project/problem, theoretical concepts should be implemented as a practical implementation.
- Project work must be carried out by the group of students with proper plan of work.
- Students should involve themselves in the unique way to suit their project requirements.
- The project work can be undertaken in a research institute or organization/company/any business establishment.
- Students must consult an internal guide along with external guide (if any) in implementation of the topic.
- Online log book to be prepared by each group, wherein the group can record weekly work progress, guide/supervisor can verify and record notes/comments.
- Students have to submit a weekly progress report to the internal guide whereas the internal guide has to keep track of the progress of the project and also has to maintain attendance reports. This progress report can be used for awarding the term work marks. In case of industry projects, visit by an internal guide will be preferred.
- Students shall be motivated to publish/present a paper based on their research work done.
- The publication should be in any national/international conferences or project presentations in any

national/international project competitions/symposium.

- Students should prepare thesis as per the guidelines by the institute.

Project Report Format:

At the end of semester a project report should preferably contain at least following details:-

1. Abstract
2. CO-PO mapping
3. Introduction
4. Literature Survey
   a) Comparative Survey of Existing system
   b) Limitation of the Existing system or research gap
5. Proposed System
   a) Problem Statement and Objective
   b) Methodology (your approach to solve the problem)
   c) Analysis/Framework/ Algorithm
   d) Details of Hardware & Software
   e) Design details
   f) Budget details
   g) Implementation Plan for next semester
6. Conclusion and future scope
7. References
8. Published papers and certificates

Term Work:

Distribution of marks for term work shall be as follows:

a) Weekly Attendance on Project Day
b) Contribution in the Project work
c) Project Report
d) Term End Presentation (Internal)

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

Distribution of Term work marks for both semesters shall be as below:		**Marks**
1.	Marks awarded by guide based on log book	10
2.	Marks awarded by review committee for presentation	10
3.	Quality of Project report	10
4.	Implementation of project	10
5.	• Effort taken by students • Paper publications • Idea/project/poster competition	10

Practical & Oral:

Practical & Oral examination of Major Project Lab-B should be conducted by Internal and External examiners. Students have to give a presentation and demonstration on Major Project Lab-B**.**