Shreemati Nathibai Damodar Thackersey Women's University

1, Nathibai Thackersey Road, New Marine Lines, Mumbai-400020, Maharashtra (India)

Program Structure Scheme

For

Post Std 10+2,
4 Year(s) Bachelor Degree Program in

Faculty of Science and Technology

Bachelor Of Technology(B.Tech.)

(Credits System)

(Revised 2019-Regular)

Electronics & Communication

Program Code: -

Publisher's Note

This Shreemati Nathibai Damodar Thackersey Women's University has great Pleasure in publishing this program structure for Post Std 10+2 program for 4 Year(s) Bachelor Degree Program as "Bachelor Of Technology" (Revised 2019 - Regular) (Electronics & Communication) under the Faculty of "Faculty of Science and Technology".

On behalf of the University, I thank experts and authorities of the University for the interest taken and the whole hearted co-operation extended by them in bringing out this publication.

Date: 12/16/2021 2:16:52 PM
Shreemati Nathibai Damodar Thackersey Women's University ,1, Nathibai Thackersey Road, New Marine Lines, Mumbai-400020, Maharashtra (India) Registrar

Program Objective(s)

The Bachelor Of Technology Consists of following 3 program part(s):

Sr.No.	Program Part Name	Program Part Abbrevation	Examination Pattern
1	First Year	FY	Semester
2	Second Year	SY	Semester
3	Third Year	TY	Semester

The Bachelor Of Technology is available in following medium of instruction/s:

1. English

Program Part: FY Separate Passing Head: No, Min: 0, Max: 1050, Total Credits: 38.00

Term: Sem I Separate Passing Head: No, Min Courses: 8, Max Courses: 8, Min:0,Max:450, Total Credits: 17.50

The papers for FY - Sem I are classified into following groups:

1.Compulsory Group (Min Papers: 8, Max Papers: 8,
Separate Passing Head: No, Max. Marks: 450)
Select minimum 8 paper(s)
Select maximum 8 paper(s)

Papers:

110011	Applied Science (Physics and Chemistry)
110012	Mathematics-I
120011	Basic Electrical Engineering
120012	Engineering Graphics and Design
110021	Applied Science Lab
120021	Basic Electrical Engineering Lab
120022	Engineering Graphics and Design Lab
180051	Induction Programme

Term: Sem II Separate Passing Head: No, Min Courses: 10, Max Courses: 10, Min:0,Max:600, Total Credits: 20.50

The papers for FY - Sem II are classified into following groups:

1.Compulsory Group (Min Papers: 10, Max Papers: 10,
Separate Passing Head: No, Max. Marks: 600)
Select minimum 10 paper(s)
Select maximum 10 paper(s)

Papers:

210011	Applied Science (Physics and Chemistry)
210012	Mathematics-II
220011	Programming for Problem Solving
220012	Workshop/Manufacturing Practices
230011	English
210021	Applied Science Lab
220021	Programming for Problem Solving Lab
220022	Workshop/Manufacturing Practices Lab
230021	English Practical
280011	Environmental Sciences

Program Part: SY Separate Passing Head: No, Min: 0, Max: 1500, Total Credits: 41.00

Term: Sem III Separate Passing Head: No, Min Courses: 10, Max Courses: 10, Min:0,Max:750, Total Credits: 19.00

The papers for SY - Sem III are classified into following groups:

1.Compulsory Group (Min Papers: 9, Max Papers: 9,
Separate Passing Head: No, Max. Marks: 700)
Select minimum 9 paper(s)
Select maximum 9 paper(s)

Papers:

341211	Electronic Devices (ENC)
341221	Electronic Devices Lab (ENC)
341212	Digital System Design (ENC)
341222	Digital System Design Lab (ENC)
341214	Computer Architecture (ENC)
311211	Applied Mathematics (ENC)
381251	Constitutions of India (ENC)
391221	Data Structure and Algorithms Lab (ENC)
341213	Signals and System(ENC)

2.Optional Group (Min Papers: 1, Max Papers: 1,
Separate Passing Head: No, Max. Marks: 50)
Select minimum 1 paper(s)
Select maximum 1 paper(s)

Papers:

331211	Economics for Engineer (ENC)
331212	Women Law (ENC)

Term: Sem IV Separate Passing Head: No, Min Courses: 10, Max Courses: 10, Min:0,Max:750, Total Credits: 22.00

The papers for SY - Sem IV are classified into following groups:

1.Compulsory Group (Min Papers: 9, Max Papers: 9,
Separate Passing Head: No, Max. Marks: 750)
Select minimum 9 paper(s)
Select maximum 9 paper(s)

Papers:

441211	Electromagnetic Waves (ENC)
441221	Electromagnetic Waves Lab (ENC)
441212	Analog Circuits (ENC)
441222	Analog Circuits Lab (ENC)
441213	Microcontrollers (ENC)
441223	Microcontrolles Lab (ENC)
441214	Probability Theory and Stochastic Processes (ENC)
441215	Network Theory (ENC)
491221	Object Oriented Programming (ENC)

2.Optional Group (Min Papers: 1, Max Papers: 1,
Separate Passing Head: No, Max. Marks: 50)
Select minimum 1 paper(s)
Select maximum 1 paper(s)

Papers:

431211	Creating and Managing IPR/Patenting (ENC)
431212	Professional Ethics (ENC)
431213	Critical Thinking (ENC)
431214	Fundamentals of Management for Engineers (ENC)

Program Part: TY Separate Passing Head: No, Min: 0, Max: 1550, Total Credits: 48.00

Term: Sem V Separate Passing Head: No, Min Courses: 11, Max Courses: 11, Min:0,Max:750, Total Credits: 20.00

The papers for TY - Sem V are classified into following groups:

1.Compulsory Group (Min Papers: 9, Max Papers: 9,
Separate Passing Head: No, Max. Marks: 600)
Select minimum 9 paper(s)
Select maximum 9 paper(s)

Papers:

541211	Analog and Digital Communications
541221	Analog and Digital Communications Lab
541212	Digital Signal Processing
541222	Digital Signal Processing Lab
541213	Control Systems
541223	Electronics Measurement Lab
531211	Effective Technical Communication
531221	Effective Technical Communication Lab
580011	Essence of Indian Traditional Knowledge

2.Elective Group I (Min Papers: 1, Max Papers: 1,
Separate Passing Head: No, Max. Marks: 100)
Select minimum 1 paper(s)
Select maximum 1 paper(s)

Papers:

550111	Embedded System

3.Elective Lab Group I (Min Papers: 1, Max Papers: 1,
Separate Passing Head: No, Max. Marks: 50)
Select minimum 1 paper(s)
Select maximum 1 paper(s)

Papers:

550121	Embedded System Lab

Term: Sem VI Separate Passing Head: No, Min Courses: 11, Max Courses: 11, Min:0,Max:800, Total Credits: 28.00

The papers for TY - Sem VI are classified into following groups:

1.Compulsory Group (Min Papers: 5, Max Papers: 5,
Separate Passing Head: No, Max. Marks: 250)
Select minimum 5 paper(s)
Select maximum 5 paper(s)

Papers:

640111	Computer Network
640121	Computer Network Lab
640122	Mini Project
691221	Web Technology Lab / Tutorial
6912	Honours Subject

2.Elective Group II (Min Papers: 1, Max Papers: 1,
Separate Passing Head: No, Max. Marks: 100)
Select minimum 1 paper(s)
Select maximum 1 paper(s)

Papers:

650111	Microwave Theory and Techniques

3.Elective Group III (Min Papers: 1, Max Papers: 1,
Separate Passing Head: No, Max. Marks: 100)
Select minimum 1 paper(s)
Select maximum 1 paper(s)

Papers:

650112	Speech and Audio Processing
650113	Scientific Computing
650114	VLSI Design

4.Open Elective Group I (Min Papers: 1, Max Papers: 1,
Separate Passing Head: No, Max. Marks: 100)
Select minimum 1 paper(s)
Select maximum 1 paper(s)

Papers:

660111	Database Management
660112	Advance Programming

5.Open Elective Group II (Min Papers: 1, Max Papers: 1,
Separate Passing Head: No, Max. Marks: 100)
Select minimum 1 paper(s)
Select maximum 1 paper(s)

Papers:

660113	Internet Of Things
660114	RTOS

6.Open Elective lab Group I (Min Papers: 1, Max Papers: 1,
Separate Passing Head: No, Max. Marks: 50)
Select minimum 1 paper(s)
Select maximum 1 paper(s)

Papers:

660121	Database Management
660122	Advance Programming

7.Open Elective lab Group II (Min Papers: 1, Max Papers: 1,
Separate Passing Head: No, Max. Marks: 100)
Select minimum 1 paper(s)
Select maximum 1 paper(s)

Papers:

660123	Internet Of Things Lab
660124	RTOS Lab

SNDT Women's University

(Sndt.digitaluniversity.ac)

Syllabus B. Tech. in Electronics and Communication Engineering

SNDT Women's University

1, NathibaiThackersey Road,
Mumbai 400 020

(Applicable to students taking admission in and after 2019)

Credit Definition

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits
2 Hours Practical(Lab)/week	1 credit

Range of credits –

- Credits of 160 for a student to be eligible to get an Undergraduate degree in Electronics and Communication Engineering (ENC).
- A student will be eligible to get an Undergraduate degree with **Minor Engineering Degree, if she completes an additional** 18 **credits. These could be acquired through MOOCs offered at Institutes or approved by the department(Swayam** ,NPTELetc) or designed internally or with other agencies in the Institute.
- **If the student does not pass the minor degree s subject/subjects the minor degree will not be awarded and no backlog exam for the same will be conducted**

Structure of ENC program:

Sr. No	Category	Credits
1	Humanities and Social Sciences including management courses (HSMC)	11
2	Basic Science courses (BSC)	23
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc (ESC)	17
4	Professional core courses (EC)	50
5	Professional Elective courses relevant to chosen specialization/branch (ECEL)	21
6	Open subjects – Electives from other technical and /or emerging subjects (OE)	16
7	Project work, seminar and internship in industry or elsewhere	17
8	Professional Skills	5
9	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	4 courses
	Total	160

Course code and Definition:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
V	Viva
D	Duration of Paper
TP	Term Paper
TW	Term Work
P/V	Practical/Viva
BSC	Basic Science Courses
ESC	General Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
EC	Core courses
ECEL	Program Elective
OE	Open Elective
PS	Professional Skills
MC	Mandatory courses
ECP	Project Stage
MD	Minor Degree

- **Basic Science Courses(BSC)**

BSC	Name	Hours/Week (L:T:P)	Credit	Sem
	Applied Science (Physics and Chemistry)	**3:1:0**	**4**	**I**
	Mathematics-I	**3:1:0**	**4**	**I**
	Applied Science Lab	**0:0:3**	**1.5**	**I**
	Applied Science (Physics and Chemistry)	**3:1:0**	**4**	**II**
	Applied Science Lab	**0:0:3**	**1.5**	**II**
	Mathematics-I	**3:1:0**	**4**	**II**
	Applied Mathematics	**3:1:0**	**4**	**III**
Total Credits			**23**	

- **General Engineering Science Courses (ESC)**

ESC	Name	Hours/Week (L:T:P)	Credit	Sem
	Basic Electrical Engineering	**3:1:0**	**4**	**I**
	Basic Electrical Engineering Lab	**0:0:2**	**1**	**I**
	Engineering Graphics and Design	**1:0:0**	**1**	**I**
	Engineering Graphics and Design Lab	**0:0:4**	**2**	**I**
	Programming for Problem Solving	**3:0:0**	**3**	**II**
	Programming for Problem Solving Lab	**0:0:4**	**2**	**II**
	Workshop/Manufacturing Practices	**1:0:0**	**1**	**II**
	Workshop/Manufacturing Practices Lab	**0:0:4**	**2**	**II**
	Visualization and Design Thinking (MOOC)	**1:0:0**	**1**	**VIII**
Total Credits			**17**	

- **Humanities and Social Sciences Including Management courses (HSMC)**

HSMC	Name	Hours/Week (L:T:P)	Credit	Sem
HSMC-101	English*	2:0:0	2	II
	English Practical*	0:0:2	1	II
HSMC-02 (MOOC)	Women Law *	1:0:0	1	III
	Economics for Engineers*	1:0:0		
HSMC-03 (MOOC)	Creating and Managing IPR	2:0:0	2	IV
	Professional Ethics*	2:0:0		
	Fundamentals of Management for Engineers*	2:0:0		
	Effective Technical Communication *	3:0:0	3	V
	Effective Technical Communication Lab*	0:0:2	1	
	Disaster Management	1:0:0	1	VII
Total Credits			11	

*** Comman for Electronics Engineering and Electronics and CommunicationCourse**

- **Any one course to be selected from HSMC-02 and HSMC-03**

- **Core Courses (EC)**

Core Course ID	Name	Hours/Week (L:T:P)	Credit	Sem
	Electronic Devices*	3:0:0	3	III
	Electronic Devices Lab*	0:0:2	1	III
	Digital System Design*	3:0:0	3	III
	Digital System Design Lab*	0:0:2	1	III

	Signals and Systems*	**3:0:0**	**3**	**III**
	Computer Architecture*	**3:0:0**	**3**	**III**
	Electromagnetic Waves*	**3:0:0**	**3**	**IV**
	Electromagnetic Waves Labs*	**0:0:2**	**1**	**IV**
	Analog Circuits*	**3:0:0**	**3**	**IV**
	Analog Circuits Lab*	**0:0:2**	**1**	**IV**
	Microcontrollers*	**3:0:0**	**3**	**IV**
	Microcontrollers Lab*	**0:0:2**	**1**	**IV**
	Network Theory*	**3:0:0**	**3**	**IV**
	Probability Theory and Stochastic Processes *	**3:0:0**	**3**	**IV**
	Analog and Digital Communication*	**3:0:0**	**3**	**V**
	Analog and Digital Communication Lab*	**0:0:2**	**1**	**V**
	Digital Signal Processing*	**3:0:0**	**3**	**V**
	Digital Signal Processing Lab*	**0:0:2**	**1**	**V**
	Control Systems*	**3:0:0**	**3**	**V**
	Electronic Measurement Lab*	**0:0:2**	**1**	**V**
	Computer Network	**3:0:0**	**3**	**VI**
	Computer Network Lab	**0:0:2**	**1**	**VI**
	Mini Project *	**0:0:4**	**2**	**VI**
Total			**50**	

- **Professional Elective Courses (ECEL)**

ECEL Course ID	Name	Hours Per Week L:T:P	Credit	Sem
	Embedded System	3:0:0	3	V
	Embedded System Lab	0:0:2	1	V
ECEL-I (Select One)	Speech and Audio Processing	3:0:0	3	VI
	Scientific Computing	3:0:0		
	VLSI Design	3:0:0		
	Microwave Theory and Techniques	3:0:0	3	VI
	Information Coding and Security	3:0:0	3	VII
	Information Coding and Security Tutorial	0:1:0	1	VII
	Mobile Communications and WSN	3:0:0	3	VII
	Mobile Communications and WSN Lab	0:0:2	1	VII
	Fiber Optic Communication	3:0:0	3	VII
Total Credits			21	

- The actual list of electives will depend on the availability of faculty and their research interests.

- **Open Electives (OE)**

OE	Professional Skills	Hours/Week (L:T:P)	Credits	Sem
OE-I (Select any one)	Database Management	3:0:0	3	VI
	Advance Programing			

OE-I Lab (Select any one)	Database Management Lab	0:0:2	1	VI
	Advance Programing			
OE-II (Select any one)	Internet of Things	3:0:0	3	VI
	RTOS			
OE-II Lab (Select any one)	Internet of Things Lab	0:0:2	1	VI
	RTOS Lab			
OE-III (Select any one)	Artificial Intelligence	3:0:0	3	VII
	Computer Vision			
	Cloud Robotics			
OE-III Lab (Select any one)	Artificial Intelligence	0:0:2	1	VII
	Computer Vision			
	Cloud Robotics			
OE-IV (Select any one)	Machine Learning	3:0:0	3	VII
	Big Data Analysis			
	Cybersecurity and Forensics			
OE-IV Lab(Select any one)	Machine Learning Lab	0:0:2	1	VII
	Big Data Analysis Lab			
	Cybersecurity and Forensics Lab			
Total Credits			16	

- The actual list of electives will depend on the availability of faculty and their research interests.

- **Professional Skills (PS)**

PS	Professional Skills	Hours/Week (L:T:P)	Credits	Sem
	Data Structure	0:0:2	1	III
	Object Oriented Programing	0:1:2	2	IV

	Web Technology	**0:1:2**	**2**	**VI**
Total Credits			**5**	

- MandatoryCourses

MC Course ID	Mandatory Courses	Hours Per Week L:T:P	Credits	Sem
	Induction Program		**0**	**I**
	Environmental Science		**0**	**II**
	Constitution of India	**1:0:0**	**0**	**III**
	Essence of indian Traditional Knowledge	**1:0:0**	**0**	**V**

	SHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech** **Subject : Syllabus for Electronics and Communication Engineering**	**Proposed in 2020**

Semester V

Category	Course Title	Hours/Week			Cr	D	TP	TW	P/V	Total
		L	T	P						
EC	Analog and Digital Communication *	3	-	-	3	2.5	75	25	-	100
EC	Analog and Digital Communication Lab *	-	-	2	1	-	25	25	P&V	50
EC	Digital Signal Processing*	3	-	-	3	2.5	75	25	-	100
EC	Digital Signal Processing Lab*	-	-	2	1	-	25	25	-	50
EC	Control Systems*	3	-	-	3	2.5	75	25	-	100
EC	Electronic Measurement Lab*	-	-	2	1	-	25	25	-	50
ECEL	Embedded System	3	-	-	3	2.5	75	25	-	100
ECEL	Embedded System Lab	-	-	2	1	-	25	25	P&V	50
HSMC	Effective Technical Communication *	3	-	-	3	1.5	50	-	-	50
HSMC	Effective Technical Communication Lab *	-	-	2	1	-	-	50	-	50
MC	Essence of Indian Traditional Knowledge*#$ (MOOC)	1	-	-	0	-	25	25	-	50
MD	Minor Degree Subject	3	1	-	4					
	Total	19	@1	10	20 @4					750@

[#] - Passing in this subject is Mandatory

* - Common for Electronics Engineering Course

[$] Humanities Elective: $MOOC/swayam Based courses on the following lines has to be completed . Certificate has to be provided by individual students to get evaluated. Evaluation marking given above.

Semester VI

Category	Course Title	Hours/Week			Cr	D	TP	TW	P/V	Total
		L	T	P						
EC	Computer Network	3	-	-	3	2.5	75	25	-	100
EC	Computer Network Lab	-	-	2	1	-	25	25	P&V	50
ECEL	Microwave Theory and Techniques	3	-	-	3	2.5	75	25	-	100
ECEL	ECEL-I	3	-	-	3	2.5	75	25	-	100
OE	OE-I	3	-	-	3	2.5	75	25	-	100
OE	OE-I Lab	-	-	2	1	-	25	25	-	50
OE	OE-II	3	-	-	3	2.5	75	25	-	100
OE	OE-II Lab	-	-	2	1	-	25	25	P&V	50
EC	Mini Project *	-	-	4	2	-	25	25	P&V	50
PS	Web Technology Lab/Tutorial	-	1	2	2	-	25	25	P&V	50
MD	Minor Degree Subject@	3	-	2	4					
	Total	15 @3	1	14	22 @4					750@

* - Common for Electronics Engineering Course

@- Honourscourse

Pogram

Sr.No	ECEL-I
1	Speech and Audio Processing
2	Scientific Computing
3	VLSI Design

Elective

Open Elective List

Sr.No	OEI	OEII
1	Database Management	Internet of Things
2	Advance Programing	RTOS

Minor Degree Course

Students can choose AIML (MD2) or Data Science (MD7) as a minor degree course.

Sr.No	Minor Degree
MD 1	Introduction toAI&MachineLearning
MD 2	Introduction toDataAnalytics
MD 3	DeepLearningandNeuralNetwork
MD 4	SpecialtopicsinArtificialIntelligence
MD 5	Applications ofAI
MD 6	Introduction toDataScience
MD 7	Introduction toAIandML
MD 8	ComputationalData analytics
MD 9	WebDataMining
MD 10	Analysing,VisualizingandApplyingdatasciencewithpython

Semester V

Course code					
Category	**EC**				
Course title	**Analog and Digital Communication(Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester V**
	3	**0**	**2**	**4**	

Pre-requisites (if any)	-
Course Objective	1. The students will be able to 2. Acquire knowledge about physics of basic semiconductor devices 3. Understand different electronic devices 4. Analyse characteristic of different semiconductor devices **5.** Knowledge about advanced semiconductor devices and their applications
Course Outcomes	**At the end of this course students will demonstrate the ability to** 1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth 2. Analyze the behavior of a communication system in presence of noise 3. Investigate pulsed modulation system and analyze their system performance 4. Analyze different digital modulation schemes and can compute the bit error performance

Module No.	Sr. No	Topic and Details	No. of Hours assigned	Weightage in %
I	**1**	Review of signals and systems, Frequency domain representation of signals, Principles of AmplitudeModulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.	**10**	**33 %**
II	**1**	Review of probability and random process. Gaussian and white noise characteristics,Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De- emphasis, Threshold effect in angle modulation.		
	2	Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM),Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers		
II	**1**	Diodes and Applicationscovering, Semiconductor Diode as a Switch, Clipper ,clamper and doubler. Diode as a Rectifier (Half Wave and Full Wave Rectifiers) with and without Filters; Breakdown Mechanisms, C,LC ,CLC Filter, IC based regulators, Zener as a regulator	**16**	**33%**
III	**1**	Elements of Detection Theory, Optimum detection of signals in noise,Coherent communication with waveforms- Probability of Error evaluations. BasebandPulse Transmission- Inter symbol Interference and Nyquist criterion.Pass band Digital Modulation schemes- Phase Shift Keying, Frequency Shift	**14**	**34 %**

		Keying,Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.		
	2	Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channels- Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation.		
Total			**40**	**100**

ANALOG AND DIGITAL COMMUNICATION LAB

Hands on experiment based on above contents.

Suggested Text / Reference Books

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
3. Taub H.and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.
4. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley, 1965.
5. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.
6. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.

Course code					
Category	**EC**				
Course title	**Digital Signal Processing(Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester V**

	3	**0**	**2**	**4**	
Pre-requisites (if any)	-				
Course Objective	**The students will be able to** 1. Acquire knowledge about basic components of digital circuits 2. Understand working of different combinational and sequential circuits **3.** Learn designing and analysis of different combinational and sequential circuits				
Course Outcomes	**At the end of this course students will demonstrate the ability to** 1. Represent signals mathematically in continuous and discrete time and frequency domain 2. Get the response of an LSI system to different signals 3. Design of different types of digital filters for various applications				

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	1	Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling andreconstruction of signals;	**12**	**32**
	2	Discrete systems attributes, Z-Transform, Analysis of LSI systems, frequencyAnalysis, Inverse Systems, Discrete Fourier Transform (DFT), Fast Fourier Transform Algorithm, Implementation of Discrete Time Systems		
II	**1**	Designof FIR Digital filters: Windowmethod,Park-McClellan's method.	**15**	**35**
	2	Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Lowpass, Bandpass, Band-stop and High pass filters.		
III	**1**	Effect of finite register length in FIR filter design.Parametric and non-parametric spectral estimation.	**13**	**33**
	2	Introduction to multiratesignalprocessing. Application of DSP.		
Total			**40**	**100**

Digital Signal Processing Lab:

Hands on experiments based on above contents.

Suggested Text / Reference Books

1. S.K.Mitra, Digital Signal Processing: A computer-based approach.TMH
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
4. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
5. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
6. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons.

Course code					
Category	**EC**				
Course title	**Control Systems (Theory)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester V**
	3	**-**	**-**	**3**	
Pre-requisites (if any)	-				

Course Objective	**The students will be able to** 1. Understand the properties of continuous and discrete time signals. 2. Understand the properties of continuous and discrete time systems. 3. Use mathematical models of signals for analysis. 4. Represent a system by mathematical model. 5. Analyse and predict the behaviour of linear systems. **6.** Use different tools in the time- and frequency- domain
Course Outcomes	**At the end of this course students will demonstrate the ability to** 1. Characterize a system and find its study state behavior 2. Investigate stability of a system using different tests 3. Design various controllers 4. Solve liner, non-liner and optimal control problems

Module No.	Sr. No	Topic and Details	No. of Hours assigned	Weightage in %
I	**1**	Introduction to control problem- Industrial Control examples. Transfer function. System with dead-time. System response. Control hardware and their models: potentiometers, synchros, LVDT, dc and ac servomotors, tacho-generators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators. Closed-loop systems. Block diagram and signal flow graph analysis.	**10**	**33%**
		Feedback control systems- Stability, steady-state accuracy,transient accuracy, disturbance rejection,insensitivity and robustness. proportional, integral and derivative systems. Feed-forward and multi-loop control configurations, stability concept, relative stability, Routh stability criterion.		
II	**1**	Time response of second-order systems, steady-state errors and error constants.Performance specifications in time-domain. Root locus method of design. Lead and lag compensation.	**16**	**34%**
	2	Frequency-response analysis- Polar plots, Bode plot, stability in frequency domain, Nyquist plots. Nyquiststability criterion. Performance specifications in frequency-domain.		

	3	Frequency-domainmethods of design, Compensation & their realization in time & frequency domain. Lead and Lag compensation.Op-amp based and digital implementation of compensators. Tuning of process controllers. State variable formulation and solution.		
III	**1**	State variable Analysis- Concepts of state, state variable, state model, state modelsfor linear continuous time functions, diagonalization of transfer function, solution of state equations, concept of controllability & observability.	**14**	**33%**
	2	Introduction to Optimal control & Nonlinear control, Optimal Control problem,Regulator problem, Output regulator, treking problem. Nonlinear system – Basic concept & analysis.		
Total			**40**	**100**

Suggested Text / Reference Books

1. Gopal. M., "Control Systems: Principles and Design", Tata McGraw-Hill, 1997.
2. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, 1993.
3. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991.
4. Nagrath& Gopal, "Modern Control Engineering", New Age International, New Delhi.

Course code					
Category	**EC**				
Course title	**Electronic Measurement Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester V**
	-	**-**	**2**	**1**	

Pre-requisites (if any)	
Course Objective	**The students will be able to** 1.To know the procedures for measuring Resistance, Inductance and Capacitance of different ranges. 2. To perform experiments to measure three phase power, frequency, core losses. 3.To design experiments for calibration of energy meter. 4.To know the industrial practices of Measuring earth resistance, dielectric strength of transformer oil & Testing of underground cables
Course Outcomes	**At the end of this course students will demonstrate the ability to** 1.Upon completion of study of the course should be able to calibrate and test single phase energy meter, calibrate PMMC voltmeter and calibrate LPF wattmeter 2.Student should be able to measure resistance, inductance and capacitance 3.Students should be able to measure 3-Φ active power and reactive power, 4.Students should be able to test current transformers and dielectric strength of oil. 5.Students should be able to calibrate LVDT and resistance strain gauge.

Topic and Details
Any 8 of the Following Experiments are to be Conducted: 1.Calibration of single phase energy Meter 2.Measurement of low resistance using Kelvin's double Bridge. 3.Capacitance Measurement using Schering Bridge. 4.Inductance Measurement using Anderson bridge 5.Measurement of 3 phase reactive power withsingle phase wattmeter for balanced loading 6.Calibration of LPF wattmeter by Phantom testing 7.Measurement of 3 phase power with single watt meter and 2 No's C.T. 8.C.T. testing using Siliesbee's method –Measurement of %ratio error and phase angleerror of given C.T 9.Dielectric oil testing using H.T.testing Kit 10.LVDT and capacitance pickup-characteristics and calibration 11.Resistance stain gauge-strain measurement and calibration 12.Measurement of parameters of choke coil using three voltmeters and three ammeters method.

Category	**ECEL**				
Course title	**Embedded System (Theory& Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester V**
	3	**0**	**2**	**4**	
Pre-requisites (if any)	-				

Course Objective	**The students will be able to** 1. To understand the basic building blocks of computer and their interconnection **2.** To study various input output devices, memories and CPU structures
Course Outcomes	**At the end of this course students will demonstrate the ability to** 1. Suggest design approach using advanced controllers to real-life situations. 2. Design interfacing of the systems with other data handling / processing systems. **3.** Appreciate engineering constraints like energy dissipation, data exchange speeds etc

Module No.	Sr. No	Topic and Details	No. of Hours assigned	Weightage in %
I	**1**	The concept of embedded systems design, Embedded microcontroller cores, embedded memories.	**10**	**33%**
II	**1**	Examples of embedded systems, Technological aspects of embedded systems: interfacing between analog and digital blocks, signal conditioning, digital signal processing.	**15**	**33%**
	2	sub-system interfacing, interfacing with external systems, user interfacing.		
III	**1**	Design trade-offs due to process compatibility, thermal considerations, etc., Software aspects of embedded systems: real time programming languages and operating systems for embedded systems.	**15**	**34%**
Total			**40**	**100**

Suggested Text / Reference Books

1. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.
2. Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.

3. V.K. Madisetti, "VLSI Digital Signal Processing", IEEE Press (NY, USA), 1995.
4. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.
5. K.J. Ayala, "The 8051 Microcontroller: Architecture, Programming, and Applications", Penram Intl, 1996.

Embedded System Lab:
Hands on experiments based on above contents

Course code					
Category	**Humanities and Social Sciences Including Management courses(HSMC)**				
Course title	**Effective Technical Communication (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester V**
	3	**-**	**2**	**4**	
Pre-requisites (if any)					
Course Objective	**The students will be able to attain** 1. Good Knowledge of Series and Transforms 2. Confidence in using mathematics to analyse and solve problems both in academic and technical field **3.** Skill in Formulating and analysing mathematical problems				
Course Outcomes	**At the end of this course students will demonstrate the ability to** 1. explain Series and Transforms 2. use mathematics to analyse and solve problems both in academic and technical field 3. use skill in Formulating and analysing mathematical problems				

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.	**08**	**20%**
II	**1**	Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.	16	40%

	2	Self-Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, taking notes; Complex problem solving; Creativity		
III	**1**	Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.	16	
	2	Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, taking notes, Complex problem solving, Creativity.		**40%**
		Total	40	100

Suggested Text / Reference Books

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
7. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

Effective Technical Communication Lab:
Hands on experiments based on above contents.

Course code					
Category	**Mandatory Courses (MC)**				
Course title	**EssenceofIndianTraditional Knowledge**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester V**
	1	**-**	**-**	**-**	
Pre-requisites (if any)					
Course Objective	**The students will be able to** Understand essence of Indian traditions and culture				
Course Outcomes	**At the end of this course students will demonstrate the ability to** Explainessence of Indian traditions and culture				

Topic and Details
Humanities Elective: $MOOC/swayam Based courses on the following lines has to be completed . Certificate has to be provided by individual students to get evaluated. Evaluation marking given above.

Course code						
Category	**Minor Degree**					
Course title	Introduction to AI &Machine Learning					
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester V**	
	3	**-**	**2**	**4**		
Pre-requisites (if any)						
Course Objective	**The students will be able to** 1. Toreviewand strengthenimportantmathematicalconceptsrequiredfor AI&ML. 2. Introducetheconceptof learningpatterns fromdataanddevelop astrong theoretical foundationforunderstandingstate ofthe art Machine Learning algorithms.					
Course Outcomes	**At the end of this course students will demonstrate the ability to** 1. Design and implement machine learning solutions to classification, regression and clustering problems. 2. Evaluateand interpret the results of the different ML techniques. **3.** Design and implement various machine learningalgorithmsinarange ofReal-worldapplications					

Module No.	Sr. No	Topic and Details	No. of Hours assigned	Weightage in %
I	**1**	Defining Artificial Intelligence, Defining AI techniques, Using Predicate Logic andRepresenting Knowledge as Rules, Representing simple facts in logic, Computable functions and predicates, Procedural vs Declarative knowledge, Logic Programming, Mathematical foundations: Matrix Theory andStatistics for Machine Learning.	**12**	**20%**
II	**2**	Idea of Machines learning from data, Classification of problem –Regression and Classification, Supervised and Unsupervised learning.	**08**	**20%**
III	**1**	Linear Regression: Model representation for single variable, Single variable Cost Function,GradientDecent for Linear Regression, Gradient Decent inpractice	**10**	**20%**
IV	**1**	Logistic Regression: Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Overfitting.	**07**	**20%**
V	**1**	Discussion on clustering algorithms and use-cases cantered around clustering and classification.	**5**	**20%**
		Total	**42**	**100**

Lab Work:

1. Implementation of logical rules in Python.
2. Using any data apply the concept of:
   a. Liner regression
   b. Gradient decent
   c. Logistic regression
3. To add the missing value in any data set.
4. Perform and plot under fitting and overfitting in a data set.

5. Implementation of clustering and classification algorithms

Text Books/References:

1. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 1st Edition2011.
2. Anindita Das Bhattacharjee, "Practical Workbook Artificial Intelligence and SoftComputing for beginners, Shroff Publisher-X team Publisher.
3. M.C. Trivedi, A Classical Approach to Artificial Intelligence, Khanna PublishingHouse, Delhi.
4. Jeeva Jose, Introduction to Machine Learning, Khanna Publishing House,Delhi.
5. Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet PublishingLimited, 2017.
6. Tom Mitchell, Machine Learning, McGraw Hill, 2017.
7. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer,2011.
8. T. Hastie, R. Tibshirani, J. Friedman. The Elements of StatisticalLearning, 2e, 2011.Tsang. Foundations of constraint satisfaction. Covers constraints satisfaction problemsAvailable free online.
9. Paradigm of Artificial Intelligence Programming, by Peter Norvig.
10. Artificial Intelligence: A New Synthesis, by Nils J Nilsson.
11. Artificial Intelligence (3rd Edition), by Patrick Henry Winston.
12. Artificial Intelligence, by Saroj Kaushik, Cengage Learning

Course code					
Category	**Minor Degree**				
Course title	Introduction to Data Science				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester V**
	3	**-**	**2**	**4**	
Pre-requisites (if any)					

Course Objective	**The students will be able to** 1. Provide you with the knowledge and expertise to become a proficient data scientist 2. Demonstrate an understanding of statistics andmachinelearning concepts that are vital for data science; 3. Produce Python code to statistically analyse a dataset; 4. Critically evaluate data visualisations based on their design and use forcommunicating stories from data;
Course Outcomes	**At the end of this course students will demonstrate the ability to** 1. Explainhow data is collected, managed and stored for data science; **2.** Understand the key concepts in data science, including their real-world applicationsand the toolkitused by data scientists; **3.** Implement data collection and management scripts usingMongoDB.

Module No.	Sr. No	Topic and Details	No. of Hours assigned	Weightage in %
I	**1**	Introduction to Data Science, Different Sectors using Data science, Purpose andComponents of Python in Data Science.	**12**	**20%**
II	**2**	Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDAQuantitative technique, EDA- Graphical Technique, Data Analytics Conclusion and Predictions	**08**	**20%**
III	**1**	Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDAQuantitative technique, EDA- Graphical Technique, Data Analytics Conclusion and Predictions	**10**	**20%**
IV	**1**	Data Visualization- Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects- Exercise: create your own visualization of a complex dataset.	**07**	**20%**
V	**1**	Applications of Data Science, Data Science and Ethical Issues- Discussions on privacy, security, ethics- A look back at Data Science- Next-generation data scientists.	**5**	**20%**
		Total	**42**	**100**

Lab Work:

1. Python Environment setup and Essentials.
2. Mathematical computing with Python (NumPy).
3. Scientific Computing with Python (SciPy).
4. Data Manipulation with Pandas.
5. Prediction using Scikit-Learn
6. Data Visualization in python using matplotlib

Text Books/References:

1. Joel Grus, Data Science from Scratch, Shroff Publisher Publisher /O'Reilly Publisher Media
2. V.K. Jain, Big Data and Hadoop, Khanna Publishing House

3. V.K. Jain, Data Sciences & Analytics, Khanna Publishing House
4. Annn Ng, Kenneth Soo, Numsense! Data Science for the Layman, Shroff Publisher Publisher
5. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly Publisher Media.
6. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets.v2.1, Cambridge University Press.
7. Jake VanderPlas, Python Data Science Handbook, Shroff Publisher Publisher/O'Reilly Publisher Media
8. Philipp Janert, Data Analysis with Open Source Tools, Shroff Publisher Publisher/O'Reilly Publisher Media.

Semester - VI

Semester VI

Course code					
Category	**Core Course (EC)**				
Course title	**Computer Network (Theory and Lab)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VI**
	3	**0**	**2**	**4**	
Pre-requisites (if any)	-				
Course Objective	**The students will be able to** 1. learnnetworkingthoroughly. 2. Design a network for a particularapplication. 3. Analyze the performance of thenetwork.				
Course Outcomes	**At the end of this course students will demonstrate the ability to** 4. Understand the concepts of networkingthoroughly. 5. Design a network for a particularapplication. 6. Analyze the performance of thenetwork.				

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	Introduction to computer networks and the Internet: Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic ail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layeringconcepts.	**10**	**33 %**
II	**1**	Switching in networks: Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet	**16**	**34%**

		switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical		
	2	Multiplexing. Transport layer: Connectionless transport - User Datagram Protocol, Connection-oriented transport – Transmission Control Protocol, Remote Procedure Call. Transport layer: Connectionless transport - User Datagram Protocol, Connection-oriented transport – Transmission Control Protocol, Remote ProcedureCall.		
	3	Congestion Control and Resource Allocation: Issues in ResourceAllocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.		
III	**1**	Network layer: Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing	**14**	**33%**
	2	Link layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, Switches.		
		Total	**40**	**100**

Text Reference books:

1. J.F. Kurose and K. W. Ross, " Computer Networking – A top down approach featuring the Internet", Pearson Education, 5thEdition
2. L. Peterson and B. Davie, " Computer Networks – A Systems Approach" Elsevier Morgan Kaufmann Publisher, 5th Edition.
3. T. Viswanathan, "Telecommunication Switching System and Networks", PrenticeHall
4. S. Keshav, " AnEngineering Approach to Computer Networking" , PearsonEducation
5. B. A. Forouzan, " Data Communications and Networking", Tata McGraw Hill, 4th Edition
6. Andrew Tanenbaum, " Computer networks", PrenticeHall
7. D. Comer, " Computer Networks and Internet/TCP-IP", PrenticeHall
8. WilliamStallings,"Dataandcomputercommunications",PrenticeHall

Computer Network Laboratory

Hands-on experiments related to the course.

Course code						
Category	**ECEL**					
Course title	**Microwave Theory andTechniques**					
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VI**	
	3	**0**	**0**	**3**		
Pre-requisites (if any)	-					
Course Objective	**The students will be able to** 1. Learn various microwave system components theirproperties. 2. Analyzemicrowave systems, the different mathematical treatment is required compared to general circuitanalysis. 3. Design microwave systems for different practicalapplication.					
Course Outcomes	**At the end of this course students will demonstrate the ability to** 4. Understand various microwave system components theirproperties. 5. Appreciate that during analysis/ synthesis of microwave systems, the different mathematical treatment is required compared to general circuitanalysis. 6. Design microwave systems for different practicalapplication.					

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	Introduction to Microwaves-History of Microwaves, Microwave Frequency bands;Applications of Microwaves: Civil and Military, Medical, EMI/EMC.	**10**	**33 %**
	2	Mathematical Model of Microwave Transmission-Concept of Mode, Features ofTEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwavetransmission.		

	3	Analysis of RF and Microwave Transmission Lines- Coaxial line, Rectangular waveguide, Circular waveguide, Strip line, Micro stripline.		
II	**1**	Microwave Network Analysis- Equivalent voltages and currents for non-TEMlines, Network parameters for microwave circuits, Scattering Parameters.	**16**	**34%**
	2	Passive and Active Microwave Devices- Microwave passive components:Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Oscillators, Mixers. Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave Tubes: Klystron, TWT, Magnetron.		
	3	Microwave Design Principles- Impedance transformation, ImpedanceMatching,Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design. Microwave Antennas- Antenna parameters, Antenna for ground based systems, Antennas for airborne and satellite borne systems, PlanarAntennas.		
III	**1**	Microwave Measurements- Power, Frequency and impedance measurement tmicrowave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure. Measurement of Microwave antennaparameters.	**14**	**33%**
	2	Microwave Systems- Radar, Terrestrial and Satellite Communication, Radio Aidsto Navigation, RFID, GPS. Modern Trends in Microwaves Engineering- Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference and Electromagnetic Compatibility (EMI & EMC), Monolithic Microwave ICs, RFMEMS for microwave components, Microwave		

		Imaging.		
		Total	**40**	**100**

Text/Reference Books:

1. R.E. Collins, Microwave Circuits, McGrawHill
2. K.C. Gupta and I.J. Bahl, Microwave Circuits, Artechhouse

Course code						
Category	**ECEL-I**					
Course title	**Speech and Audio Processing**					
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VI**	
	3	**0**	**0**	**3**		
Pre-requisites (if any)	**-**					
Course Objective	**The students will be able to** 1. Understand the speechsignal 2. Analyze the quality and properties of speechsignal. 3. enhance the speech and audiosignals.					
Course Outcomes	**At the end of this course students will demonstrate the ability to** 4. Mathematically model the speechsignal 5. Analyze the quality and properties of speechsignal. 6. Modify and enhance the speech and audiosignals.					

Module No.	Sr. No	Topic and Details	No. of Hours assigned	Weightage in %
I	**1**	Introduction- Speech production and modeling - Human Auditory System;General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness. Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters,convolution; Power spectral density, periodogram, autoregressive model, autocorrelationestimation. .	**10**	**33 %**
	2	Linear Prediction of Speech- Basic concepts of linear prediction; LinearPrediction Analysis of non-stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.		
II	**1**	Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer,logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types.	**16**	**34%**
	2	Scalar Quantization of LPC- Spectral distortion measures, Quantization based onreflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF. Linear Prediction Coding- LPC model of speech production; Structures of LPCencoders and decoders; Voicing detection; Limitations of the LPC model.		
III	**1**	Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero- state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.	**14**	**33%**

	2	Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards		
		Total	**40**	**100**

Text/Reference Books:

1. "Digital Speech" byA.M.Kondoz, Second Edition(WileyStudents *Edition),2004.*
2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C. Chu, WileyInter science,2003.

Course code					
Category	**ECEL-I**				
Course title	**Scientific Computing**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VI**
	3	**0**	**0**	**3**	
Pre-requisites (if any)	**-**				
Course Objective	**The students will be able to** 1. learn the significance of computing methods, their strengths and applicationareas. 2. Perform the computations on various data using appropriate computationtools.				
Course Outcomes	**At the end of this course students will demonstrate the ability to** 1.Understand the significance of computing methods, their strengths and applicationareas. 2.Perform the computations on various data using appropriate computationtools.				

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	Introduction: Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability andAccuracy, Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-	**10**	**33 %**

		Point Arithmetic, Cancellation.		
	2	System of liner equations: Linear Systems, Solving Linear Systems, Gaussian elimination,Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for LinearSystems		
II	**1**	Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and ColumnPivoting Eigenvalues and singular values:Eigenvalues and Eigenvectors, Methods for Computing All Eigenvalues, Jacobi Method, Methods for Computing Selected Eigenvalues, Singular Values Decomposition, Application of SVD	**16**	**34%**
	2	Nonlinear equations: Fixed Point Iteration, Newton's Method, Inverse Interpolation Method Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares Interpolation:Purpose for Interpolation, Choice Of Interpolating,Function, Polynomial Interpolation, Piecewise PolynomialInterpolation		
III	**1**	Numerical Integration And Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation, Initial Value Problems for ODES, Euler's Method, Taylor Series Method, Runga-Kutta Method, Extrapolation Methods, Boundary Value Problems For ODES, Finite Difference Methods, Finite Element Method, EigenvalueProblems	**14**	**33%**

	2	Partial Differential Equations,Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, IterativeMethods Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets,Random Numbers And Simulation, Stochastic Simulation, Random Number Generators, Quasi-RandomSequences		
		Total	**40**	**100**

Text/ Reference Books:

1. Heath Michael T., " ScientificComputing: An Introductory Survey" , McGraw-Hill, 2nd Ed.,2002
2. Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, "Numerical Recipes: The Art of Scientific Computing", Cambridge University Press, 3rd Ed.,2007
3. Xin-she Yang (Ed.)., " Introduction To Computational Mathematics" , World Scientific Publishing Co., 2nd Ed.,2008
4. Kiryanov D. and Kiryanova E., " Computational Science", Infinity Science Press, 1st Ed.,2006
5. Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, " Scientific Computing With MATLAB And Octave", Springer, 3rd Ed.,2010

	SHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech** **Subject : Syllabus for Electronics and Communication Engineering**	**Proposed in 2020**

Course code						
Category	**ECEL-I**					
Course title	**VLSI Design**					
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VI**	
	3	**0**	**0**	**3**		
Pre-requisites (if any)	-					
Course Objective	**The students will be able to** 1. To understand the Basic NMOS, CMOS & Bi CMOS circuits and their process technology. 2. To understand the Designing of stick diagrams and layouts for OS transistors. 3. To learn the concepts of modelling of Delay techniques and MOS layers. 4. To learn the concepts of Technology Scaling of MOS transistors. 5. To understand the concepts of testing of combinational and sequential circuits and also the scan of design techniques.					
Course Outcomes	**At the end of this course students will demonstrate the ability to** 1. Knowledge on various I.C fabrication technologies like NMOS, PMOS, CMOSand Bi-CMOS and their Electrical properties 2. Draw the stick diagrams and layout diagrams of various logic circuits and analyze various design rules. 3. Design various combinational gate level logics 4. Implement and design of building blocks of data path and array sub systems **i.** Design and implement different programmable logic devices.					

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	**Review of microelectronics and Introduction to MOS technology:** Introduction MOS and related VLSI technology – NMOS-CMOS-BICMOS-Gas Technologies – thermal aspects of processing – production of E beam masks. **MOS and BICMOS circuit design process:** MOS layers – stick diagrams – design rules and layout – 2 µm meter – 1.2 µm meter CMOS rules – Layout diagrams – Symbolic diagrams.	**12**	**34 %**
	2	**Basic Circuit Concepts:** Sheet resistance – Area capacitance of layers – delay UNIT – wiring capacitances – choice of layers. **Scaling of MOS circuits:** Scaling models – Scaling function for device parameters – Limitation of Scaling.		

II	**1**	**Subsystem design process:** Architectural issues – switch logic – examples of structural design (Combinational logic)– design of ALU subsystem – commonly used storage elements – aspects of design rules.	**15**	**33%**
	2	**Test and Testability:** Design for testability built in self test (BIST) – teaching combinational logic – testing sequential logic – practical design for test guide lines – scan design techniques – etc.		
III	**1**	**Introduction to hardware description language (HDL)**Verilog/VHDL.A logic synthesis example.	**13**	**33%**
	2	**Floor-planning and Placement:** I/O and power planning, clock planning. Routing: global and detailed. Example design technique: mapping of architecture to silicon.		
		Total	**40**	**100**

Suggested Text / Reference Books

TEXT BOOKS:

1. Basic VLSI design by Douglas A, Pucknell, Kamran Eshraghian, Prantice Hall, 1996 3rd edition.
2. VERILOG HDL by Samir Palnitkar, 2nd edition, 2003

REFERENCE BOOK:

1. Mead, C.A and Conway, L.A., Introduction to VLSI Systems, Wesley – Wesley.

	SHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech** **Subject : Syllabus for Electronics and Communication Engineering**	**Proposed in 2020**

Course code						
Category	**OE-I**					
Course title	**Database Management(Theory and lab)**					
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VI**	
	3	**0**	**2**	**4**		
Pre-requisites (if any)	**-**					
Course Objective	**The students will be able to** 1. To understand the different issues involved in the design and implementation of a database system. 2. To study the physical and logical database designs, database modeling, relational, hierarchical, and networkmodels 3. To understand and use data manipulation language to query, update, and manage a database 4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), DataWarehousing.					
Course Outcomes	**At the end of this course students will demonstrate the ability to** 1. For a given query write relational algebra expressions for that query and optimize the developedexpressions 2. For a given specification of the requirement design the databases using E R method andnormalization. 3. For a given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, andDB2. 4. For a given query optimize its execution using Query optimizationalgorithms 5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, anddurability.					

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**

I	**1**	**Database system architecture:** Data Abstraction, DataIndependence,Data Definition Language(DDL), Data Manipulation Language(DML). **Data models:** Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulationoperations.	**16**	**34 %**
	2	**Relational query languages:** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQLserver. **Relational database design:** Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Losslessdesign. **Query processing and optimization:** Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.		
II	**1**	**Storage strategies**: Indices, B-trees, hashing. **Transaction processing:** Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Databaserecovery.	**14**	**33%**
III	**1**	**Database Security:** Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQLinjection.	**10**	**33%**
	2	**Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.		
		Total	**40**	**100**

Suggested books:

1. "Database System Concepts" , 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan,McGraw-Hill.

Suggested reference books

1 "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer SciencePress.
2 "Fundamentals of Database Systems" , 5th Edition by R. Elmasri and S. Navathe, PearsonEducation
3 "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu,Addison-Wesley

Database Management lab

Hands on experiments based on above contents

	SHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech** **Subject : Syllabus for Electronics and Communication Engineering**	**Proposed in 2020**

Course code						
Category	**OE-I**					
Course title	**Advance Programing (Theory and lab)**					
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VI**	
	3	**0**	**2**	**4**		
Pre-requisites (if any)	**-**					
Course Objective	**The students will be able to** 1. Develop, debug and execute programs which use reading, writing and manipulating single dimensional and multidimensional arrays. 2. Develop, debug and execute programs to perform memory access using Pointers 3. Develop, debug and execute modular programs by writing and using Functions 4. Appreciate use of various header files Define, test and implement constant and Macro 5. Implement different data types under a single structure 6. Utilize memory effectively using Union 7. Develop, debug and execute programs to read and write data from secondary storage devices					
Course Outcomes	**At the end of this course students will demonstrate the ability to** 1. Develop, debug and execute programs which use reading, writing and manipulating single dimensional and multidimensional arrays. 2. Develop, debug and execute programs to perform memory access using Pointers 3. Develop, debug and execute modular programs by writing and using Functions 4. Appreciate use of various header files Define, test and implement constant and Macro 5. Implement different data types under a single structure 6. Utilize memory effectively using Union 7. Develop, debug and execute programs to read and write data from secondary storage devices					

	SHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech** **Subject : Syllabus for Electronics and Communication Engineering**	**Proposed in 2020**

Module No.	Sr. No	Topic and Details	No. of Hours assigned	Weightage in %
I	**1**	Arrays Declaring and initializing One-Dimensional Array and array Operations Insertion, Searching, Merging, Sorting, . Deletion Introduction of String as array of characters Declaration and Initialization of String Two-Dimensional Array and its Operations i. Insertion, Deletion ii. Matrix addition operation Multi-Dimensional Arrays sscanf() and sprintf() Functions Drawbacks of Linear Arrays	**10**	**33 %**
	2	*Pointers* Introduction and Features of Pointers Declaration of Pointer Void Pointers Array of Pointers Pointers to Pointers		
II	**1**	*Functions* Basics of Functions Built-in and user defined Functions Using String, Math and other built-in functions	**14**	**33%**

		Advantages of using Functions Working of a Function Declaring, Defining and calling user defined Functions- The return Statement Call by Value and call by Reference Function as an Argument Recursion Advantages and Disadvantages of Recursion		
	2	*Preprocessor Directives* Introduction #define and #undef Directives #include ,#line Directive Predefined macros in ANSI C Standard I/O Predefined Streams in stdio.h Predefined macros in ctype.h		
III	**1**	*Structure and Union* Introduction and Features of Structures Declaration and Initialization of Structures Array of Structures Pointers to Structure typedef Enumerated Data Type Union	**16**	**34%**

		Union of Structures		
	2	*Files* Introduction File Operations i. Opening a File ii. Reading a File iii.Closing a File Text Modes Binary Modes File Functions i. fprintf() ii. fscanf() iii.getc() iv.putc() v. fgetc() vi.fputc() vii.fseek() viii. feof() Command Line Arguments		
		Total	**40**	**100**

Reference books:

1.Programming in 'C' by Kamthane,A.N.
Pearson publication

2.
Programming in ANSI C By Balaguruswami. E.

Advance Programing Lab

Programming experiments based on above contents.

	SHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech** **Subject : Syllabus for Electronics and Communication Engineering**	**Proposed in 2020**

Course code						
Category	**OE-II**					
Course title	**Internet of Things (Theory and lab)**					
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VI**	
	3	**0**	**2**	**4**		
Pre-requisites (if any)	-					
Course Objective	**The students will be able to** 1.Describe what IoT is and how it works today 2.Recognise the factors that contributed to the emergence of IoT 3.Design and program IoT devices 4.Use real IoT protocols for communication					
Course Outcomes	**At the end of this course students will demonstrate the ability to** After the completion of the course, the students will be able design some IOT based prototypes					

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	Introduction to IoT: Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks,Physical design of IoT, Logical design of IoT, Communication models & APIs.	**10**	**33 %**
	2	M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT		

II	**1**	M2M Architectural Overview–Building architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. Reference Architecture and Reference Model of IoT.	**14**	**33%**
	2	IoT Reference Architecture-Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment. Constraints affecting design in IoT world-Introduction, Technical design Constraints.		
III	**1**	Domain specific applications of IoT: Home automation, Industry applications, Surveillance applications, Other IoT application.	**16**	**34%**
	2	Developing IoTsolutions: Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi Implementation of IoT with Arduino andRaspberry, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT.		
		Total	**40**	**100**

References:

1.Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence",1stEdition, Academic Press, 2014.
2.Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014
3.FrancisdaCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 20134.Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493-9357-1

Internet of Things Lab:

Hands-on experiments based on above contents

	SHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech** **Subject : Syllabus for Electronics and Communication Engineering**	**Proposed in 2020**

Course code						
Category	**OE-II**					
Course title	**RTOS(Theory and lab)**					
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VI**	
	3	**0**	**2**	**4**		
Pre-requisites (if any)	**-**					
Course Objective	**The students will be able to** 1.To acquire knowledge about concepts related to OS. 2.To acquire knowledge about different types of scheduling algorithms 3.To study about Free RTOS 4.To understand the various functions of RTOS					
Course Outcomes	**At the end of this course students will demonstrate the ability to** 1.Describe the fundamental concepts of RTOS 2.Develop programs for real time services,firmware and RTOS. 3.Develop programs applications onFreeRTOS					

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.	**10**	**33 %**
II	**1**	Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.	**14**	**33%**

	2	Dealing RTOS design issues, RTOS design also involves issues like data sharing/reentrancy, priority inversion, starvations, latencies, Handling of interrupts in RTOS and timing analysis. Hands on exercises using Semaphores and Mutex provides better understanding of these topics to developers		
III	**1**	Multiprocessor and Distributed System Model, Multiprocessor Priority-Ceiling Protocol, Schedulabilityof Fixed-Priority End-to-End Periodic Tasks, Scheduling Algorithms for End-to-End Periodic Tasks, End-to-End Tasks in Heterogeneous Systems, Predictability and Validation of Dynamic Multiprocessor Systems, Scheduling of Tasks	**16**	**34%**
	2	Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols, Real Time Protocols, Communication in Multicomputer System, Case Study of Real Time Operating Systems.		
		Total	**40**	**100**

Text &References:Books:

1..Rajib Mall, "Real-Time Systems: Theory and Practice," Pearson, 2008.
2. Jane W. Liu, "Real-Time Systems" Pearson Education, 2001
.3. Krishna and Shin, "Real-TIme Systems," Tata McGraw Hill. 1999.
4. Real Time Systems by Jane W. S. Liu, Pearson Education Publication.
5. Real-Time Systems: Scheduling, Analysis, and Verification by Prof. Albert M. K. Cheng, John Wiley and Sons Publications.

RTOS Lab:

Hands-on experiments based on above contents

	SHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech** **Subject : Syllabus for Electronics and Communication Engineering**	**Proposed in 2020**

Course code					
Category	**EC**				
Course title	**Mini Project**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VI**
	0	**0**	**4**	**2**	
Pre-requisites (if any)	**-**				
Course Objective	**The students will be able to** 1. Solve a problem statement either from rigorous literature survey or from the requirements raised from needanalysis. 2. Design, implement and test the prototype/algorithm in order to solve the conceived problem. 3. Write comprehensive report on mini projectwork.				
Course Outcomes	**At the end of this course students will demonstrate the ability to** 1. Conceive a problem statement either from rigorous literature survey or from the requirements raised from needanalysis. 2. Design, implement and test the prototype/algorithm in order to solve the conceived problem. 3. Write comprehensive report on mini projectwork.				

Guidelines:

1. The mini-project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuitdesign.
2. The mini project may bea complete hardware or a combination of hardware and software. The software part in mini project should be less than 50% ofthe total work.
3. Mini Project should cater to a small system required in laboratory or reallife.
4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity isintroduced.
5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives ofmini-project.

6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of thesemester.
7. The student is expected to exert on design, development and testing of the proposed work as per theschedule.
8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control paneldesign.
9. Completed mini project and documentation in the form of mini project report is to be submitted at the end ofsemester.
10. The tutorial sessions should be used for discussion on standard practices used forelectronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /reportwriting.

	SHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech** **Subject : Syllabus for Electronics and Communication Engineering**	**Proposed in 2020**

Course code						
Category	**PS**					
Course title	**Web Technology Lab/Tutorial**					
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VI**	
	0	**1**	**2**	**2**		
Pre-requisites (if any)	**-**					
Course Objective	**The students will be able to** 1.To teach students the basics of server side scripting using PHP 2.To explain web application development procedures 3.To impart servlet technology for writing business logic 4.To facilitate students to connect to databases using JDBC					
Course Outcomes	**At the end of this course students will demonstrate the ability to** 1.Create web pages using PHP 2.Identify the difference between the HTML PHP and XML documents. 3.Identify the engineering structural design of XML and parse tree 4.Analyze the difference between and PHP and XML.					

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	Introduction to PHP: Declaring variables, data types, arrays, strings, operations, expressions, control structures, functions, Reading data from web form controls like Text Boxes, radio buttons, lists etc., Handling File Uploads, Connecting to database (My SQL as reference), executing simple queries, handling results, Handling sessions and cookies.File Handling in PHP: File operations like opening, closing, reading, writing, appending, deleting etc. on text and binary files, listing directories.	**5**	**33 %**
II	**1**	UNIT – IIClient side Scripting: Introduction to JavaScript: JavaScript language – declaring variables, scope of variables functions, event handlers (on click, on submit etc.), Document Object Model, Form validations. Simple AJAX applications.Systems.	**4**	**33%**

III	**1**	XML: Introduction to XML, Defining XML tags, their attributes and values, Document type definition, XML Schemas, Document Object model, XHTMLParsing XML Data - DOM and SAX parsers in javaDynamic Multiprocessor Systems, Scheduling of Tasks	**4**	**34%**
		Total	**13**	**100**

REFERENCE BOOKS:

1.Web Programming, building internet applications, Chris Bates 2nd edition, Wiley Dremtech

2.Java Server Pages – Hans Bergsten, SPD O'Reilly

3.Java Script, D.Flanagan, O'Reilly, SPD.

4.Beginning Web Programming-Jon Duckett WROX.

5.Programming world wide web, R.W. Sebesta. Fourth Edition, Pearson. 6.Internet and World Wide Web – How to program, Dietel and Nieto, Pearson.

Web Technology Lab

Practical performance based on above contents.

Course code					
Category	**Minor Degree**				
Course title	Introduction to Data Analytics				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester VI**
	3	**-**	**2**	**4**	
Pre-requisites (if any)					
Course Objective	**The students will be able to** 1. Provide you with the knowledge and expertise to become a proficient data Scientist 2. Demonstrate an understanding of statistics andmachinelearning concepts that are vital for datascience;				

	3. Produce Python code to statistically analyse a dataset; 4. Critically evaluate data visualisations based on their design and use forcommunicating stories from data
Course Outcomes	**At the end of this course students will demonstrate the ability to** 1. Explain how data is collected, managed and storedfor data science; **2.** Understand the key concepts in data science,including their real-world applicationsand the toolkitused by data scientists; **3.** Implement data collection and management scripts usingMongoDB..

	SHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech** **Subject : Syllabus for Electronics and Communication Engineering**	**Proposed in 2020**

Module No.	Sr. No	Topic and Details	No. of Hours assigned	Weightage in %
I	**1**	Introduction to Data Science, Different Sectors using Data science, Purpose and Components of Python in Data Science	**07**	**20%**
II	**2**	Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDA-Quantitative technique, EDA-Graphical Technique, Data Analytics Conclusion and Predictions	**07**	**20%**
III	**1**	FeatureGeneration and FeatureSelection (Extracting Meaning from Data)- Motivating application: user (customer) retention- Feature Generation (brainstorming, role of domainexpertise, and place for imagination)- Feature Selection algorithms	**11**	**20%**
IV	**1**	Data Visualization- Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects- Exercise: create your own visualization of a complex dataset.	**10**	**20%**
V	**1**	Applications of Data Science, Data Science and Ethical Issues- Discussions on privacy, security, ethics- A look back at Data Science- Next-generation data scientists.	**07**	**20%**
		Total	**42**	**100**

Lab Work:

1. Python Environment setup and Essentials.
2. Mathematical computing with Python (NumPy).
3. Scientific Computing with Python (SciPy).
4. Data Manipulation with Pandas.
5. Prediction using Scikit-Learn
6. Data Visualization in python using matplotlib

Text Books/References:

1. Joel Grus, Data Science from Scratch, Shroff Publisher Publisher /O'Reilly Publisher Media
2. V.K. Jain, Big Data and Hadoop, Khanna Publishing House

3. V.K. Jain, Data Sciences & Analytics, Khanna Publishing House
4. Annalyn Ng, Kenneth Soo, Numsense! Data Science for the Layman, Shroff Publisher Publisher
5. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly Publisher Media.
6. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.
7. Jake VanderPlas, Python Data Science Handbook, Shroff Publisher Publisher/O'Reilly Publisher Media
8. Philipp Janert, Data Analysis with Open Source Tools, Shroff Publisher Publisher/O'Reilly Publisher Media

Course code					
Category	**Minor Degree**				
Course title	Introduction to AI and ML				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester VI**
	3	**-**	**2**	**4**	
Pre-requisites (if any)					
Course Objective	**The students will be able to** 1. To understand basics of machine learning in data science. 2. To understand various basic machine learning algorithm that can be used with various type of data.				
Course Outcomes	**At the end of this course students will demonstrate the ability to** 1. To explain how data is collected, managed andstored for data science; 2. To use various type of Machine learning mode **3.** To implement various ML algorithms on data models				

	SHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech** **Subject : Syllabus for Electronics and Communication Engineering**	**Proposed in 2020**

Module No.	Sr. No	Topic and Details	No. of Hours assigned	Weightage in %
I	**1**	Linear Regression: Basic facts of linear regression, implementation of linear regression, case studies of linear regression using data set	**06**	**20%**
II	**2**	Logistic Regression: Basic facts and implementation of logistic regression, solve a case study to predict output using existing data set	**08**	**20%**
III	**1**	Clustering and Principle Component Analysis: K means and hierarchical clustering, how to make market strategies using clustering, recommendation and PCA	**11**	**20%**
IV	**1**	Support Vector Machine: basics of SVM and use it to detect the spam emails and recognize alphabets	**09**	**20%**
V	**1**	Model Selection and advanced regression: use of Lasso and Ridge.	**08**	**20%**
		Total	**42**	**100**

Lab Work:

1. Use python to predict employee attrition in a firm and help them plan their manpower. (take data set from kaggle).
2. Create customer clusters using different market strategies on a data set.
3. Make a movie recommendation system.
4. Develop a prediction mechanism to predict which employee can go on leave in a company in near future.
5. Recognizing alphabets using SVM.

Text Books/References:

1. Machine Learning using Python, U Dinesh Kumar and Manaranjan Pradhan, John Wiley & Sons.
2. A Classical Approach to Artificial Intelligence, M.C. Trivedi, Khanna Publishing House.
3. Machine Learning, V.K. Jain, Khanna Publishing House.
4. Advanced Data Analytics Using Python: With Machine Learning, Deep Learning by By Sayan Mukhopadhyay, Apress.
5. Practical Data Mining" by Monte F. Hancock, Auerbach Publication.
6. "Machine Learning for Absolute Beginners: A Plain English Introduction (Second Edition)" by Oliver Theobald.
7. Practical Data Science with R, Nina Zumel, John Wiley & Sons.
8. Python for Data Science for Dummies, John Paul Mueller, Luca Massaron,John Wiley & Sons.
9. Big Data and Analytics, Seema Acharya and Subhashini Chellappan, WileyPublication.
10. Introduction to Machine Learning, Jeeva Jose, Khanna Publishing House.

Semester III

Category	Course Title	Hours/Week			Cr	D	TP	TW	P/V	Total
		L	T	P						
EC	Electronic Devices*	3	-	-	3	2.5	75	25	-	100
EC	Electronic Devices Lab*	-	-	2	1	-	25	25	P&V	50
EC	Digital System Design*	3	-	-	3	2.5	75	25	-	100
EC	Digital System Design Lab*	-	-	2	1	-	25	25	P&V	50
EC	Signals and Systems*	3	-	-	3	2.5	75	25	-	100
EC	Computer Architecture*	3	-	-	3	2.5	75	25	-	100
BSC	Applied Mathematics*	3	1	-	4	2.5	75	25	-	100
MC	Constitution of India#*$	-	-	-	0	-	25	25	-	50
HSMC	HSMC-02 *$ (MOOC)	-	-	-	1	-	-	50	-	50
PS	Data Structure and Algorithms Lab*	-	-	2	1	-	25	25	P&V	50
	Total	17	1	6	20					750

 # - This subject is non credit but Passing in this subject is Mandatory. A total of 16 hours need to be completed.

*** - Common for Electronics Engineering Course**

$ This course can be an online MOOC/swayam/course designed by the institute or affiliated institutes. Courses on the following can be done . Certificate has to be provided by individual students to get evaluated.

HSMC-02	**Women Law**
	Economics for Engineer

Semester IV

Category	Course Title	Hours/Week			Cr	D	TP	TW	P/V	Total
		L	T	P						
EC	Electromagnetic Waves*	3	-	-	3	2.5	75	25	-	100
EC	Electromagnetic Waves Labs*	-	-	2	1	-	25	25	P&V	50
EC	Analog Circuits*	3	-	-	3	2.5	75	25	-	100
EC	Analog Circuits Lab*	-	-	2	1	-	25	25	P&V	50
EC	Microcontrollers*	3	-	-	3	2.5	75	25	-	100
EC	Microcontrollers Lab*	-	-	2	1	-	25	25	-	50
EC	Probability Theory and Stochastic Processes *	3	-	-	3	2.5	75	25	-	100
EC	Network Theory*	3	-	-	3	2.5	75	25	-	100
HSMC	HSMC-03*$	-	-	-	2	-	25	25	-	50
PS	Object Oriented Programing *	-	2	2	2	-	50	50	P&V	100
	Total	15	2	8	22					800

- Passing in this subject is Mandatory

* - Common for Electronics Engineering Course

$ Humanities Elective: $MOOC/swayam Based courses on the following lines has to be completed . Certificate has to be provided by individual students to get evaluated. Evaluation marking given above.

HSMC-03
Creating and Managing IPR/Patenting
Professional Ethics
Critical Thinking
Fundamentals of Management for Engineers

Semester V

Category	Course Title	Hours/Week			Cr	D	TP	TW	P/V	Total
		L	T	P						
EC	Analog and Digital Communication *	3	-	-	3	2.5	75	25	-	100
EC	Analog and Digital Communication Lab *	-	-	2	1	-	25	25	P&V	50
EC	Digital Signal Processing*	3	-	-	3	2.5	75	25	-	100
EC	Digital Signal Processing Lab*	-	-	2	1	-	25	25	-	50
EC	Control Systems*	3	-	-	3	2.5	75	25	-	100
EC	Electronic Measurement Lab*	-	-	2	1	-	25	25	-	50
ECEL	Embedded System	3	-	-	3	2.5	75	25	-	100
ECEL	Embedded System Lab	-	-	2	1	-	25	25	P&V	50
HSMC	Effective Technical Communication *	3	-	-	3	1.5	50	-	-	50
HSMC	Effective Technical Communication Lab *	-	-	2	1	-	-	50	-	50

MC	**Essence of Indian Traditional Knowledge*#$ (MOOC)**	**1**	**-**	**-**	**0**	**-**	**25**	**25**	**-**	**50**
ACH	**Honours Subject**	**3**	**1**	**-**	**4**					
	Total	**19**	**@1**	**10**	**20 @4**					**750@**

- Passing in this subject is Mandatory

***** - Common for Electronics Engineering Course

$ Humanities Elective: $MOOC/swayam Based courses on the following lines has to be completed . Certificate has to be provided by individual students to get evaluated. Evaluation marking given above.

Semester VI

Category	Course Title	Hours/Week			Cr	D	TP	TW	P/V	Total
		L	T	P						
EC	**Computer Network**	**3**	**-**	**-**	**3**	**2.5**	**75**	**25**	**-**	**100**
EC	**Computer Network Lab**	**-**	**-**	**2**	**1**	**-**	**25**	**25**	**P&V**	**50**
ECEL	**Microwave Theory and Techniques**	**3**	**-**	**-**	**3**	**2.5**	**75**	**25**	**-**	**100**
ECEL	**ECEL-I**	**3**	**-**	**-**	**3**	**2.5**	**75**	**25**	**-**	**100**
OE	**OE-I**	**3**	**-**	**-**	**3**	**2.5**	**75**	**25**	**-**	**100**
OE	**OE-I Lab**	**-**	**-**	**2**	**1**	**-**	**25**	**25**	**-**	**50**
OE	**OE-II**	**3**	**-**	**-**	**3**	**2.5**	**75**	**25**	**-**	**100**
OE	**OE-II Lab**	**-**	**-**	**2**	**1**	**-**	**25**	**25**	**P&V**	**50**
EC	**Mini Project ***	**-**	**-**	**4**	**2**	**-**	**25**	**25**	**P&V**	**50**
PS	**Web Technology Lab/Tutorial**	**-**	**1**	**2**	**2**	**-**	**25**	**25**	**P&V**	**50**
ACH	**Honours Subject@**	**4**	**-**	**-**	**4**					

	Total	15 @3	1	14	22 @4					750@

* - Common for Electronics Engineering Course

@- Honours course

Program Elective

Sr.No	ECEL-I
1	Speech and Audio Processing
2	Scientific Computing
3	VLSI Design

Open Elective List

Sr.No	OEI	OEII
1	Database Management	Internet of Things
2	Advance Programing	RTOS

Semester VII

Category	Course Title	Hours/Week			Cr	D	TP	TW	P/V	Total
		L	T	P						
ECEL	Information Theory and Coding	3	-	-	3	2.5	75	25	-	100
ECEL	Information Theory and Coding Tutorial	-	1	-	1	-	25	25	V	50
ECEL	Mobile Communications and WSN	3	-	-	3	2.5	75	25	-	100
ECEL	Mobile Communications and WSN lab	-	-	2	1	-	25	25	P&V	50
ECEL	Fiber Optic Communication	3	-	-	3	2.5	75	25	-	100
OE	OE-III	3	-	-	3	2.5	75	25	-	100
OE	OE-III Lab	-	-	2	1	-	25	25	-	50
OE	OE-IV	3	-	-	3	2.5	75	25	-	100
OE	OE-IVLab	-	-	2	1	-	25	25	-	50

ECP	Major Project-1	-	-	-	2	-	50	50	V	100
HSMC	Disaster Management$	1	-	-	1	1.5	-	50	-	50
MD	Minor Degree	3	1	-	4					
	Total	16 @3	1 @1	6	22 @4					850@

@- honours Courses

Open Elective List

Sr. No	OE-III	OE-IV
1	Artificial Intelligence	Machine Learning
2	Computer Vision	Big Data Analysis
3	Mobile Robotics	Cybersecurity and Forensic

Semester VIII

Category	Course Title	Hours/Week			Cr	D	TP	TW	P/V	Total
		L	T	P						
ESC	Design Thinking and visualization $	1	-	-	1	-		50	-	50
ECP	Internship ^	-	-	-	4	-	50	50	V	100
ECP	Major Project-II	-	-	-	14	-	200	200	V	400
MD	Minor Degree subject 4 and 5	-	-	-	8	-	-	-	-	
	Total	1			19 @8					550@

@- honours Courses

^ Under Internship the student should pursue a Internship Program (of min 4 weeks and max 6 months)with a company or in-house under the college and/or agency Supervisor. The students undergoing such a program include compulsory industrial training or in-house

training in college of 4 credits, by the end of the eighth semester. The student will have to submit the attendance record , a detailed report and presentation by the end of semester.
Under Major Project the student/students will have to complete a working simulation/prototype with a detailed report and evaluations .
$- MOOC Course from Swayam /NPTEL or any agency on Design Thinking , Data Visualization with regular assignments and one presentation in College.

SEMESTER VI

Course code					
Category	**EC**				
Course title	**Computer Network (Theory and Lab)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester - VI**
	3	**-**	**2**	**4**	

Pre-requisites (if any)	
Course Objective	**The students will be able to** **1. Learn networking thoroughly.** **2. Understand the designing of a network for a particular application.** **3. Learn the analysis of the performance of the network.**
Course Outcomes	**At the end of this course students will demonstrate the ability to** **1. Understand the concepts of networking thoroughly.** **2. Design a network for a particular application.** **3. Analyse the performance of the network.**

Module No.	Sr. No	Topic and Details	No. of Hours assigned	Weightage in %
I	**1**	Introduction to computer networks and the Internet: Introduction to Networking devices, basic definitions, Layering architecture: The OSI model. Description of layers, TCP/IP protocol suit, Layering concepts.	**12**	**33%**
	2	Application layer: Application layer protocols, Client-server as a key model, Web and Hyper Text Transfer Protocol, File transfer, Electronic mail, Domain name system, Peer-to-Peer file sharing, Socket programming,		

II	**1**	Transport layer: Transport layer protocol, Connectionless transport User Datagram Protocol, Connection-oriented transport – Transmission Control Protocol, . Reliable data transfer - Stop-and-wait, Go-Back-N and Selective Repeat Protocols, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.	**16**	**34 %**
	2	Network layer: Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms-Distance Vector routing, Link State routing, Unicast, Broadcast and Multicast, Routing in the Internet RIP, OSPF, and BGP, IPv4 addressing		
III	**1**	Data Link layer: Link-layer and its services, Ethernet, hubs, bridges, and switches, Link-layer addressing, ALOHA, slotted ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, Pure and slotted ALOHA, CSMA, CSMA/CD, and CSMA/CA	**12**	**33%**
	2	Physical layer: Introduction to Physical layer and its services, Multiplexing, different types of multiplexing, introduction to transmission media, Guided media, Unguided media, Introduction to switching, Types of switching techniques, switching and TCP/IP layers.		
		Total	**40**	**100**

Text Reference books:

1. J.F. Kurose and K. W. Ross, " Computer Networking – A top down approach featuring the Internet", Pearson Education, 5thEdition
2. L. Peterson and B. Davie, " Computer Networks – A Systems Approach" Elsevier Morgan Kaufmann Publisher, 5th Edition.
3. T. Viswanathan, "Telecommunication Switching System and Networks", PrenticeHall
4. S. Keshav, " AnEngineering Approach to Computer Networking" , PearsonEducation
5. B. A. Forouzan, " Data Communications and Networking", Tata McGraw Hill, 4th Edition
6. Andrew Tanenbaum, " Computer networks", PrenticeHall
7. D. Comer, " Computer Networks and Internet/TCP-IP", PrenticeHall
8. William Stallings,"Data And Computer Communications",PrenticeHall

SEMESTER VII

Course code	
Category	**(ECEL)**

Course title	**Information Theory and coding (Theory and Tutorial)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VII**
	3	**1**	**-**	**4**	
Pre-requisites (if any)	-				
Course Objective	**1.To learn the concept of information and entropy** **2.Study the Shannon's theorem for coding** **3.Able to do the calculation of channel capacity** **4.Learn to apply coding techniques**				
Course Outcomes	**At the end of the course, students will demonstrate the ability to:** **1.Understand the concept of information and entropy** **2.Understand Shannon's theorem for coding** **3.Calculation of channel capacity** **4.Apply coding techniques**				

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	Basics of information theory, entropy for discrete ensembles; Shannon's noiseless coding theorem; Encoding of discrete sources.	**10**	**33 %**
II	**1**	Markov sources; Shannon's noisy coding theorem and converse for discrete channels;Calculation of channel capacity and bounds for discrete channels; Application to continuous channels.	**16**	**33%**
III	**1**	Techniques of coding and decoding; Huffman codes and uniquely detectable codes;Cyclic codes, convolutional arithmetic codes.	**14**	**34 %**
		Total	**40**	**100**

Text/Reference Books:

1.N. Abramson, Information and Coding, McGraw Hill, 1963.

2.M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.

3.R.B. Ash, Information Theory, Prentice Hall, 1970.

4.Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.

Course code	
Category	**(ECEL)**

Course title	**Mobile Communications and WSN (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VII**
	3	**0**	**2**	**4**	
Pre-requisites (if any)	**-**				
Course Objective	**The students will be able to** **1. Explain the working principles of the mobile communication systems and the relation between the user features and underlying technology.** **2. Explore mobile communication systems for improved performance** **3. Explain research areas in the field of sensor networks** **4. Understand wireless sensor networks for a given application**				
Course Outcomes	**At the end of this course students will demonstrate the ability to** **1. Understand the working principles of the mobile communication systems.** **2. Understand the relation between the user features and underlying technology.** **3. Analyze mobile communication systems for improved performance** **4. Understand emerging research areas in the field of sensor networks** **5. Explain wireless sensor networks for a given application**				

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**

I	**1**	Cellular concepts- Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Evolution of cellular standards (1G to 5G).	**12**	**32**
	2	Signal propagation-Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels-Multipath and small scale fading- Doppler shift, statistical multipath channel models		
II	**1**	GMSK, multicarrier modulation, OFDM, MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing Tradeoff.	**15**	**35**
	2	Performance measures- Outage, average snr, average symbol/bit error rate. System examples- GSM, WCDMA, LTE		
III	**1**	Introduction to Mobile Ad-hoc Networks(MANETs) and Wireless Sensor Networks, Classification of Mobile Ad-hoc Networks(MANETs) and wireless sensor networks, Enabling technologies for Wireless Sensor Networks,	**13**	**33**
	2	Unique constraints and challenges in MANETs and wireless sensor networks Advantage and limitations of MANETs and Wireless Sensor Networks, Applications of Sensor Networks		
Total			**40**	**100**

Text/ReferenceBooks:

1.WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.

2.WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall, 1993.

3.Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.

4.AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995.

5.VK Garg &JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall, 1996.

6.Waltenegus Dargie,Christian Poellabauer,—Fundamentals Of Wireless Sensor Networks Theory And Practice,By John Wiley & Sons Publications ,2011

7.Sabrie Soloman,—Sensors Handbook" by McGraw Hill publication. 2009

8.Feng Zhao, Leonidas Guibas,—Wireless Sensor Networks,Elsevier Publications,2004

Course code					
Category	**(ECEL)**				
Course title	**Fiber Optic Communication**				
Scheme and Credits	**L**	**T**	**p**	**Credits**	**Semester VII**
	3	**-**	**-**	**3**	
Pre-requisites (if any)	**-**				
Course Objective	**The students will be able to** **1. Acquire the knowledge about principle and use of optical systems in communication** **2. Understand the physics of optical sources, detectors and switches** **3. Study and analyse characteristics of optical amplifiers** **4. Understand the effects of nonlinearities in optical systems.**				
Course Outcomes	**At the end of this course students will demonstrate the ability to** **1. Recognize and classify the structures of Optical fiber and types.** **2. Discuss the channel impairments like losses and dispersion.** **3. Analyze various coupling losses.** **4. Classify the Optical sources and detectors and to discuss their principle.**				

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	Introduction to vector nature of light, propagation of light,propagation of light in a cylindrical dielectric rod, Raymodel, wave model	**10**	**33%**
	2	Different types of optical fibers, Modal analysis of a step index fiber.Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.		

II	**1**	Optical sources -LEDs and Lasers, Photo-detectors -pin-diodes,APDs, detector responsivity ,noise, optical receivers. Optical link design-BER calculation,quantum limit,power penalties.	**16**	**34%**
	2	Optical switches -coupled mode analysis of directional couplers, electro-optics witches.		
III	**1**	Optical amplifiers-EDFA,Raman amplifier	**14**	**33%**
	2	WDM and DWDM systems .Principles of WDM networks		
	3	Non linear effects in fiber optic links.Concept of self-phase modulation, group velocity dispersion and solition based communication.		
Total			**40**	**100**

Suggested Text / Reference Books

1. **J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed.2013(IndianEdition).**
2. **2.T.Tamir,Integrated optics, (TopicsinApplied PhysicsVol.7),Springer-Verlag,1975.**
3. **3.J.Gowar,Optical communication systems,Prentice Hall India,1987.**
4. **4.S.E.Miller and A.G.Chynoweth,eds.,Optical fibre telecommunications, AcademicPress,1979.**
5. **5.G.Agrawal, Nonlinear fibre optics,Academic Press, 2ndEd.1994.**
6. **6.G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, NewYork, 1997**
7. **F.C.Allard,Fiber Optics Handbook for engineers and scientists, McGrawHill,NewYork(1990).**

Category	**OE-III**				
Course title	**Artificial Intelligence(Theory and lab)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VII**
	3	**-**	**2**	**4**	
Pre-requisites (if any)	**-**				
Course Objective	**Students will learn the basic concepts and techniques of Artificial Intelligence. They should be able to develop AI algorithms for solving practical problems.**				
Course Outcomes	**1.Understand the basic concepts and techniques of Artificial Intelligence.** **2.Apply AI algorithms for solving practical problems** **3.Describe human intelligence and AI** **4.Explain how an intelligent system works.** **5.Apply basics of Fuzzy logic and neural networks.** **6.Explain Expert System and implementation**				

Module No.	Sr. No	Topic and Details	No. of Hours assigned	Weightage in %
I	**1**	**Introduction** Introduction of Artificial Intelligence, Intelligent Systems, Categorization of Intelligent System , Components of AI Program, sub-areas of AI, the structure of Agents, Types of Agents, Nature of Agents, , Intelligent Agents, Learning Agents. Artificial Intelligence and its applications, Artificial Intelligence Techniques, Level of models, advantages and limitations of AI.	**15**	**34%**

	2	**Problem solving techniques** State space search, control strategies, heuristic search, problem characteristics, production system characteristics., Generate and test, Hill climbing, best first search, A* search, Constraint satisfaction problem, Mean-end analysis, Min-Max Search, Alpha-Beta Pruning, Additional refinements, Iterative Deepening.		
II	**1**	**Logic** Propositional logic, predicate logic, Resolution, Resolution in proportional logic and predicate logic, Clause form, unification algorithm	**15**	**34%**
	2	**Knowledge Representation schemes and reasoning** Mapping between facts and representations, Approaches to knowledge representation, procedural vs declarative knowledge, Forward vs. Backward reasoning, Matching, conflict resolution, Non-monotonic reasoning, Default reasoning, statistical reasoning, fuzzy logic Weak and Strong filler structures, semantic nets, frame, conceptual dependency, scripts		
III	**1**	**Planning** The Planning problem, planning with state space search, partial order planning, planning graphs, planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning, Continuous and Multi Agent planning.	**10**	**32%**
Total			**40**	**100**

Text Books/Suggested References:

1.A Classical Approach to Artificial Intelligence, M.C. Trivedi, Khanna Book Publishing, 2019.
2.Artificial Intelligence: A modern approach by Stuart Russel, Pearson Education, 2010.
3.Artificial Intelligence by Rich and Knight, The McGraw Hill, 2017. 4.Artificial Intelligence: A new synthesis by Nils and Nilson, Elsevier, 1997.
5.Artificial Intelligence by Luger, Pearson Education, 2002.
6.Artificial Intelligence by Padhy, Oxford Press, 2005. 7.https://www.edx.org/course/artificial-intelligence-ai 8.https://www.udemy.com/course/artificial-intelligence-az/

Lab:

1. **Installation and working on various AItools viz. Python, R tool, GATE, NLTK, MATLAB, etc.**
2. **Data preprocessing and annotation and creation of datasets.**
3. **Learn existing datasets and Treebanks**
4. **Implementation of searching techniques in AI.**
5. **Implementation of Knowledge representation schemes.**

6. **Natural language processing tool development.**
7. **Application of Machine learning algorithms.**
8. **Application of Classification and clustering problem.**
9. **Working on parallel algorithms.**
10. **Scientific distributions used in python for Data Science -Numpy, scify, pandas, scikit learn, stat models, nltk.**

Course code					
Category	**OE-IV**				
Course title	**Machine Learning**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester - VII**
	3	**-**	**2**	**4**	

Pre-requisites (if any)	
Course Objective	**The students will be able to** ● **Acquire the knowledge about the basics of Machine Learning. They will also** ● **Learn and apply different machine learning models to various datasets**
Course Outcomes	**At the end of this course students will demonstrate the ability to** ● **Understand basic applications and issues of Machine Learning** ● **Understand the different types of datasets** ● **Analyze and work with different datasets** ● **Analyze various Machine Learning techniques and algorithms** ● **Apply various algorithms to different datasets.**

Module No.	Sr. No	Topic and Details	No. of Hours assigned	Weightage in %

I	**1**	**Introduction** What Is Machine Learning?How Do We Define Learning?, How Do We Evaluate Our Networks?, How Do We Learn Our Network?, What are datasets and how to handle them?, Feature sets, Dataset division: test, train and validation sets, cross validation.	**15**	**34%**
I	**2**	**Basics of machine learning** Applications of Machine Learning, processes involved in Machine Learning, Introduction to Machine Learning Techniques: Supervised Learning, Unsupervised Learning and Reinforcement Learning, Real life examples of Machine Learning.		
II	**1**	**Supervised learning** Classification and Regression: K-Nearest Neighbor, Linear Regression, Logistic Regression, Support Vector Machine (SVM), Evaluation Measures: SSE, MME, R2, confusion matrix, precision, recall, F-Score, ROC-Curve	**15**	**34 %**
	2	**Unsupervised learning** Introduction to clustering, Types of Clustering: Hierarchical, Agglomerative Clustering and Divisive clustering; Partitional Clustering - K-means clustering.		
III	**1**	**Dimensionality reduction techniques and Deep Learning** Dimensionality reduction techniques: PCA, LDA, ICA. Introduction to Deep Learning, Gaussian Mixture Models, Natural Language Processing, Computer Vision.	**10**	**32%**
		Total	**40**	**100%**

Suggested Text / Reference Books

1. Introduction to Machine Learning, By Jeeva Jose, Khanna Book Publishing Co., 2020.
2. Machine Learning for Dummies, By John Paul Mueller and Luca Massaron, For Dummies, 2016.
3. Machine Learning, By Rajeev Chopra, Khanna Book Publishing Co., 2021.
4. Machine Learning: The New AI, By Ethem Alpaydin, The MIT Press, 2016.
5. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
6. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of StatisticalLearning, Springer 2009.
7. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.
8. Machine Learning, Tom M. Mitchell, McGraw Hill Education, 2017.
9. https://www.udacity.com/course/intro-to-machine-learning--ud120
10. https://www.coursera.org/learn/machine-learning-duke

Laboratory/ Practicals:

1.Python Introduction

2.Loops and Conditions and other preliminary stuff

3.Functions, Classes and Modules

4.Exceptions, Database access

5.Mathematical computing with Python packages like: numpy, Mat- plotLib, pandas Tensor Flow, Keras

6.Implement basic ML models like SVM, KNN, K-Means, Logistic Regression, Linear Regression

Course code					
Category	**OE-IV**				
Course title	**Big Data Analysis(Theory and lab)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester - VII**
	3	**-**	**2**	**4**	

Pre-requisites (if any)	
Course Objective	● **The students should be able to understand and apply big data flow to actual projects as well as apply data analytics life cycle to big data projects. The student should identify and successfully apply appropriate techniques and tools to solve big data problems.**
Course Outcomes	**After completion of course, students would be able to:** **1.Understand and apply big data flow to actual projects as well as apply data analytics life cycle to big data projects.** **2.Apply appropriate techniques and tools to solve big data problems** **3.Describe big data and use cases from selected business domains** **4.Explain NoSQL big data management** **5.Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics**

Module No.	Sr. No	Topic and Details	No. of Hours assigned	Weightage in %
I	1	**Introduction to big data** :Introduction to Big Data Platform, Traits of Big data, Challenges of Conventional Systems, Web Data, Evolution of Analytic Scalability, Analysis vs Reporting, Statistical Concepts: Sampling Distributions, Re-Sampling, Statistical Inference, Prediction Error.	12	33%
	2	**Basic data analysis and data analytic methods using R** :Regression Modelling, Multivariate Analysis, Bayesian Modelling, Inference and Bayesian Networks, Support Vector and Kernel Methods, Analysis of Time Series: Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks: Learning and Generalization, Competitive Learning, Principal Component Analysis and Neural Networks, Fuzzy Logic		
II	1	**Frequent item sets and clustering:** Market Based Model, Apriori Algorithm, Handling Large Data Sets in Main Memory, Limited Pass Algorithm, Counting Frequent item sets in a Stream, Clustering Techniques: Hierarchical, K-Means, Frequent Pattern based Clustering Methods.	15	34 %
	2	**Mining data streams:** Introduction to Streams Concepts: Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream: Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications, Case Studies, Real Time Sentiment Analysis, Stock Market Predictions.		
III	1	**Framework, technologies, tools and visualization:** Map Reduce: Hadoop, Hive, MapR, Sharding, NoSQL Databases: S3, Hadoop Distributed File Systems, Visualizations: Visual Data Analysis Techniques, Interaction Techniques; Systems and Analytics Applications, Analytics using Statistical packages, Industry challenges and application of Analytics	13	33%
		Total	40	100

Text Books/Suggested References:

1.Bart Baesens, "Analytics in a Big Data World: The Essential Guide to data Science and its Applications", Wiley publications, 2014.

2.V.K. Jain, Big Data & Hadoop, Khanna Book Publishing Co., Delhi. (ISBN 978-93-82609-131)

3.Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2003.

4.Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2020.

5.Jeeva Jose, Beginner's Guide for Data Analysis using R Programming, Khanna Book Publishing House, 2019.

6.Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", Wiley, 2012. 7.Glenn J. Myatt, "Making Sense of Data", Wiley, 2006.

Laboratory/ Practicals:

1.Describe big data and use cases from selected business domains.

2.Explain NoSQL big data management.

3.Install, configure, and run Hadoop and HDFS.

4.Perform map-reduce analytics using Hadoop.

Course code					
Category	**Project Stage(ECP)**				
Course title	**Major Project - I (ECP-I)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VII**
	-	**-**	**-**	**2**	
Pre-requisites (if any)	-				
Course Objective	**The objective of Major Project-I is to enable the student to** ● **take up investigative study in the broad field of Electronics & Communication Engineering, involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor.** ● **to provide a good initiation for the student(s) in R&D work**				
Course Outcomes	**At the end of this course students will demonstrate the ability to** ● **Analyze, model building, simulate, experiment, design and implement the practical solution for given problem statement(s) based on investigative study in the broad field of Electronics & Communication Engineering.** ● **Perform R&D for assigned work**				
Guidelines	**The assignment to normally include:** ● Survey and study of published literature on the assigned topic ● Working out a preliminary Approach to the Problem relating to the assigned topic ● Conducting preliminary Analysis / Modeling / Simulation / Experiment /Design / Feasibility ● Preparing a Written Report on the Study conducted for presentation to the Department ● Final Seminar, as oral Presentation before a departmental committee.				

Course code					
Category	**HSMC**				
Course title	**Disaster Management(Theory)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester - VII**
	1	**-**	**-**	**1**	

Pre-requisites (if any)	
Course Objective	**Students will be able to:** **1. learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.** **2. critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.** **3. develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.** **4. critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in**
Course Outcomes	**At the end of this course students will demonstrate the ability to** **1. demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.** **2.evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.** **3. understand the standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.** **4. understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in**

Module No.	Sr. No	Topic and Details	No. of Hours assigned	Weightage in %
I	1	**Introduction** Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	12	33%
	2	**Repercussions Of Disasters And Hazards:** Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts		
II	1	**Disaster Prone Areas In India:** Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics	15	34 %
	2	**Disaster Preparedness And ManagementPreparedness:** Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.		
III	1	**Risk Assessment:** Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.	13	33%
	2	**Disaster Mitigation:** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.		
		Total	40	100

Reference Books:

1.R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company. Model Curriculum of Engineering & Technology PG Courses [Volume-I][42]

2.Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.

3.Goel S. L., Disaster Administration And Management Text And Case Studies",Deep &Deep Publication Pvt. Ltd., New Delhi

SEMESTER VIII

Course code	

Category	**ESC**				
Course title	**Design Thinking and Visualization**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester VIII**
	1	**-**	**-**	**1**	
Pre-requisites (if any)	**-**				
Course Objective	**The students will be able to** • **Acquire the knowledge about the new ways of creative thinking** • **Learn the innovation cycle of Design Thinking process for developing innovative products which are useful for a student in preparing for an engineering career.**				
Course Outcomes	**At the end of this course students will demonstrate the ability to** • **Develop new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products** • **Propose real-time innovative engineering product designs** • **Perceive individual differences and its impact on everyday decisions and further Create a better customer experience**				

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	**Basics of Design Thinking** Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) – Empathize, Define, Ideate, Prototype, Test	**12**	**33%**
	2	**Being Ingenious & Fixing Problem** Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving		
II	**1**	**Process of Product Design** Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design, Examples of best product designs and functions, Assignment – Engineering Product Design	**15**	**34%**

	2.	**Design Thinking & Customer Centricity** Practical Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product Design		
III	**1**	**Visualization** Importance of visualization in design thinking, various visualization tools, how to use these Visualization tool for design thinking	**13**	**33%**
	2	**Feedback, Re-Design & Re-Create** Feedback loop, Focus on User Experience, Address "ergonomic challenges, User focused design, rapid prototyping & testing, final product, Final Presentation / Case study – "Solving Practical Engineering Problem through Innovative Product Design & Creative Solution"		
Total			**40**	**100**

Suggested Text / Reference Books

1. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", Wiley Publications, 2013.
2. Gavin Ambrose, Paul Harris, "Basics Design: Design Thinking", AVA Publishing, 2010.

Course code					
Category	**(ECP)**				
Course title	**Major Project - II (ECP-II)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VIII**
	-	**-**	**-**	**14**	
Pre-requisites (if any)	**-**				
Course Objective	**The object of Major Project II & Dissertation is to enable the student to** ● **Extend further the investigative study taken up under EEP-I, involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry.** ● **Get a good training in R&D work and technical leadership**				
Course Outcomes	**At the end of this course students will demonstrate the ability to** ● **Detailed Analysis / Modelling / Simulation/ Design/ Implementation for the practical solution of given problem statement(s) based on investigative study in the broad field of Electronics & Communication Engineering.** ● **Perform R&D for assigned work** ● **Build final product / process, perform testing and analyze results** ● **Prepare a paper for Conference presentation / Publication in Journals**				
Guidelines	**The assignment to normally include:** ● In depth study of the topic assigned in the light of the Report prepared under EEP-I. ● Reporting the Supervisor/ Mentor once or twice in the week. ● Review and finalization of the Approach to the Problem relating to the assigned topic. ● Preparing an Action Plan for conducting the investigation, including teamwork. ● Detailed Analysis / Modelling / Simulation / Design /Problem Solving /Experiment as needed. ● Final development of product /process, testing, results, conclusions and future directions. ● Preparing a paper for Conference presentation / Publication in Journals , if possible.				

	● Preparing a Dissertation in the standard format for being evaluated by the Department. ● Final Seminar Presentation before a Departmental Committee.

Course code					
Category	**(ECP)**				
Course title	**Internship**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VIII**
	-	-	-	**4**	
Pre-requisites (if any)	-				
Course Objective	**The students will be able to** ● get exposure to working in the industry. ● Improve their skills needed for professional life ● hands-on experience while working on industrial project during the internship				
Course Outcomes	**At the end of this course students will demonstrate the ability to** ● Confidently work on different projects with responsibilities ● Professional work ethic, skills, creativity, and ability to work with other people and generally fit in with the industry				
Guidelines	1. Under Internship, the Student should pursue an internship program of minimum 4 weeks with a company ,expected contact hours in industry 160 to 180hrs. 2. The students undergoing such a program include compulsory industrial training of 4 credits, by the end of the eighth semester. 3. Internships can be in offline or online mode. 4. Every student is required to prepare a file containing documentary proofs of the activities done by him in an industry. 5. Weekly progress reports should be mailed to faculty mentor and industry supervisor.				

	6. The student will have to submit the internship joining letter, daily attendance record , a detailed report and presentation and completion certificate from industry by the end of semester 7. Students should maintain a handwritten internship diary(include daily attendance and daily progress report) signed by an industry supervisor. 8. Students undergo industrial training at the concerned Industry / Organisation. In-between Faculty Member(s) evaluate(s) the performance of students once/twice and Evaluation Report of the students is submitted in the department with the consent of Industry persons/Trainers. 9. Internship can be extended for **PROJECT II** with permission from the institute. 10. Internship evaluation and Project II evaluation are separate .