Program Structure for Second Year UG Technology (EX)

Semester-IV-Credit Scheme

Course Code	Course Name	Teaching Scheme (Hrs.) TH – P – TUT	Total (Hrs.)	Credits Assigned TH – P – TUT	Total Credits	Course Category
EXC401	Applications of Mathematics in Engineering-II	3– 0 – 1	04	3 – 0 – 1	04	BS
EXC402	Microcontrollers	3– 0 – 0	03	3 – 0 – 0	03	PC
EXC403	Linear Integrated Circuits	3– 0 – 0	03	3 – 0 – 0	03	PC
EXC404	Principles of Communication Engineering	3 – 0 – 0	03	3 – 0 – 0	03	PC
EXC405	Signals and Systems	3 – 0 – 0	03	3 – 0 – 0	03	PC
EXL402	Microcontrollers Laboratory	0 – 2 – 0	02	0 – 1 – 0	01	PC
EXL403	Linear Integrated Circuits Laboratory	0 – 2 – 0	02	0 – 1 – 0	01	PC
EXL404	Principles of Communication Engineering Laboratory	0 – 2 – 0	02	0 – 1 – 0	01	PC
EXPR42	Project Based Learning- Mini Project Laboratory -II	0 – 2 – 0	02*	0 – 1 – 0	01	PBL
EXXS45	Skill Based Learning – V	0 – 2 – 0	02	0 – 1 – 0	01	SAT
EXXS46	Skill Based Learning – VI	0 – 2* - 0	02	0 – 1 – 0	01	SAT
Total		**15– 12– 01**	**28**	**15 - 06 - 01**	**22**	

***SAT Hours are under Practical head but can be taken as Theory or Practical or both as per the need**

Program Structure for Second Year UG Technology (EX)

Semester-IV Examination Scheme

Course Code	Course Name	Examination Scheme									
		Marks									
		CA				ESE	Exam Duration In Hrs.	TW	O	P	Total
		T1	T2	Average (T1&T2)	IA						
EXC401	Applications of Mathematics in Engineering-II	30	30	30	10	60	2 ½	25	-	-	125
EXC402	Microcontrollers	30	30	30	10	60	2 ½	-	-	-	100

EXC403	Linear Integrated Circuits	30	30	30	10	60	2 ½	-	-	-	100
EXC404	Principles of Communication Engineering	30	30	30	10	60	2 ½	-	-	-	100
EXC405	Signals and Systems	30	30	30	10	60	2 ½	-	-	-	100
EXL402	Microcontroller Laboratory	-	-	-	-	-	-	25	25	-	50
EXL403	Linear Integrated Circuits Laboratory	-	-	-	-	-	-	25	-	25	50
EXL404	Principles of Communication Engineering Laboratory	-	-	-	-	-	-	25	-	25	50
EXPR42	Project Based Learning-Mini Project Lab-II	-	-	-	-	-	-	25	-	25	50
EXXS45	Skill Based Learning – V	-	-	-	-	-	-	25	-	-	25
EXXS46	Skill Based Learning – VI	-	-	-	-	-	-	25	-	-	25
Total		150	150	**150**	**50**	**300**	-	**175**	**25**	**75**	**775**

Course Code	**Course Name**	**Credits (TH+P+TUT)**
EXC401	**Applications of Mathematics in Engineering -II**	**3+0+1**
Prerequisite:	1. Engineering Mathematics-I 2. Engineering Mathematics-II 3. Applications of Mathematics in Engineering-I & Binomial Distribution	
Course Objectives:	1. To understand line and contour integrals and expansion of complex valued functions in a power series. 2. To understand the basic techniques of statistics for data analysis, Machine learning and AI. 3. To understand probability distributions and expectations. 4. To understand the concepts of vector spaces used in the field of machine learning and engineering problems. 5. To understand the concepts of Quadratic forms and Singular value decomposition. 6. To understand the concepts of Calculus of Variations.	
Course Outcomes:	Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals. Apply the concept of Correlation and Regression to the engineering problems in data science, machine learning and AI. Apply the concepts of probability and expectation for getting the spread of the data and distribution of probabilities. Apply the concept of vector spaces and orthogonalization process in Engineering Problems. Use the concept of Quadratic forms and Singular value decomposition which	

	are very useful tools in various Engineering applications. Find the externals of the functional using the concept of Calculus of variation

Module No. & Name	Sub Topics	CO Mapped	Hrs/ Sub Topic	Total Hrs/ Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	-	02	02
1. Complex Integration	1 Line Integral, Cauchy's Integral theorem for simple connected and multiply connected regions (without proof), Cauchy's Integral formula (without proof)	1	03	07
	2 Taylor's and Laurent's series (without proof).		02	
	3 Definition of Singularity, Zeroes, poles of f(z), Residues, Cauchy's Residue Theorem (without proof).		02	
2. Statistical Techniques	1 Cla Karl Pearson's Coefficient of correlation (r)	2	01	06
	2 Spearman's Rank correlation coefficient (R) (repeated and non-repeated ranks)		01	
	3 Lines of regression		02	
	4 Fitting of first and second degree curves		02	
3. Probability Distributions	1 Baye's Theorem, Random variable: Probability distribution for discrete and continuous random variables, Density function and distribution function	3	02	07
	2 Expectation, mean and variance		02	
	3 Probability distribution: Poisson & normal distribution		03	
4. Linear Algebra: Vector Spaces	1 Vectors in n-dimensional vector space, norm, dot product, The Cauchy-Schwarz inequality (with proof), Unit vector	4	02	06
	2 Orthogonal projection, Orthonormal basis, Gram-Schmidt process for vectors		02	
	3 Vector spaces over real field, Subspaces.		02	
5. Linear Algebra:	1 Quadratic forms over real field, Linear Transformation of Quadratic form,	5	01	07

Module No. & Name	Sub Topics	CO Mapped	Hrs/ Sub Topic	Total Hrs/ Module
Quadratic Forms	Reduction of Quadratic form to diagonal form using congruent transformation.			
	2 Rank, Index and Signature of quadratic form, Sylvester's law of inertia, Value class of a quadratic form-Definite, Semi definite and Indefinite		02	
	3 Reduction of Quadratic form to a canonical form using congruent transformations		02	
	4 Singular Value Decomposition		02	
6. Calculus of Variations	1 Euler- Lagrange equation (Without Proof), When F does not contain y, When F does not contain x, When F contains x, y, y'	6	02	06
	2 Isoperimetric problems- Lagrange Method		02	
	3 Functions involving higher order derivatives: Rayleigh-Ritz Method		02	
ii. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization	-	01	01
			Total:	**42**

Books:	
Text Books	1. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication 2. Advanced engineering mathematics H.K. Das, S. Chand, Publications. 3. Higher Engineering Mathematics B. V. Ramana, Tata Mc-Graw Hill Publication.
Reference Books	1. Complex Variables and Applications, Brown and Churchill, McGraw-Hill education. 2. Probability, Statistics and Random Processes, T. Veerarajan, McGraw-Hill education. 3. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa publication 4. Advanced Engineering Mathematics Wylie and Barret, Tata McGraw Hill. 5. Beginning Linear Algebra Seymour Lipschutz Schaum's outline series, Mc-Graw Hill Publication
Useful Links:	https://nptel.ac.in/courses/111/108/111108066/ https://nptel.ac.in/courses/111/103/111103070/

	https://nptel.ac.in/courses/111/105/111105041/ https://www.coursera.org/learn/complex-analysis

Continuous Assessment (CA):
The distribution of Continuous Assessment marks will be as follows –

1.	Class Test 1 (T-1)	30 marks
2.	Class Test 2 (T-2)	30 marks
3.	Internal Assessment	10 marks

Class Tests (30 Marks):
Two class tests of 30 marks each should be conducted in a semester. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 40% syllabus (but excluding contents covered in Test I) is completed. Duration of each test shall be one hour and 15 Minutes. Average of the two class tests (T-1 and T-2) will be considered for Continuous Assessment.

Internal Assessment (IA):
Marks will be awarded based on the rubrics designed.

End Semester Theory Examination will be of 60 Marks with Two Hours and 30 Minutes duration.

Course Code	**Course Name**	**Credits (TH+P+TUT)**
EXC402	**Microcontrollers**	**3+0+0**
Prerequisite:	Digital System Design	
Course Objectives:	1. To develop background knowledge of Computers and its memory System. 2. To understand the architecture of 8051 and ARM7 core. 3. To write programs for 8051 microcontrollers. 4. To understand the design of Microcontroller and ARM Applications.	
Course Outcomes:	1. Outline Microcomputer system and various microcomputers architecture model 2. Outline Memory System concept of microcomputer 3. Outline the detailed architecture of 8051. 4. Write programs for 8051 microcontrollers and Interface various peripheral devices to the microcontrollers. 5. Outline the detailed architecture of ARM7 Core. 6. Write Assembly language and Embedded C program for microcontrollers.	

Module No. & Name	**Sub Topics**	**CO Mapped**	**Hrs/ Sub Topic**	**Total Hrs/ Module**
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	-	02	02
1. Overview of	1.1 Overview of microcomputer	1	01	05

Module No. & Name	Sub Topics		CO Mapped	Hrs/ Sub Topic	Total Hrs/ Module
Microcomputer based System		systems and their building blocks, Memory			
	1.2	Interfacing, Steps taken by the microprocessor to fetch and executes an instruction from the memory		01	
	1.3	Concepts of Program counter register, Reset, Stack and stack pointer , Subroutine, Interrupts and Direct Memory Access		01	
	1.4	Concept of RISC & CISC Architecture		01	
	1.5	Harvard & Von Neumann Architecture		01	
	1.6	Comparison between Microprocessor and Microcontroller, Applications of microcontrollers			
2. The Memory Systems	2.1	Classification of Memory : Primary and Secondary	2	01	04
	2.2	Types of Semiconductor memories		01	
	2.3	Cache Memory		01	
	2.4	Virtual Memory Concept with Memory Management Unit with Segmentation and Paging (Address Translation Mechanism)		01	
3. 8051 Microcontroller	3.1	Features, architecture and pin configuration	3	02	08
	3.2	CPU timing and machine cycle		01	
	3.3	Input / Output ports		01	

Module No. & Name	Sub Topics	CO Mapped	Hrs/ Sub Topic	Total Hrs/ Module
	3.4 Memory organization		01	
	3.5 Counters and timers		01	
	3.6 Interrupts		01	
	3.7 Serial data input and output		01	
4. 8051 Assembly Language Programming and Interfacing	4.1 Addressing modes	4	01	10
	4.2 Instruction set		01	
	4.3 Need of Assembler & Cross Assemble, Assembler Directives		01	
	4.4 Programs related to: arithmetic, logical, delay subroutine , input, output, timer, counters, port, serial communication, and interrupts		04	
	4.5 Interfacing with LEDs, Relay and Keys, LCD and Seven Segment Display		03	
5. ARM7	5.1 Introduction & Features of ARM 7	5	01	08
	5.2 Concept of Cortex-A, Cortex-R and Cortex-M		01	
	5.3 Architectural inheritance, Pipelining		02	
	5.4 Programmer's model		01	
	5.5 Brief introduction to exceptions and interrupts handling		01	
	5.6 Instruction set: Data processing, Data Transfer, Control flow		02	
6. ARM Programming with	6.1 General Purpose Input Output	6	01	04
	6.2 Timer Mode		01	

Module No. & Name	Sub Topics	CO Mapped	Hrs/ Sub Topic	Total Hrs/ Module
Embedded C	6.3 Pulse–Width Modulator Configuration		02	
ii. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization	-	01	01
			Total:	**42**

Books:	
Text Books	1. C. Kenneth J. Ayala and D. V. Gadre, "The 8051 Microcontroller & Embedded system using assembly & 'C' ", Cengage Learning, Edition 2010. 2. Douglas V Hall, SSSP Rao "Microprocessors & Interfacing", McGraw Hill 3. M. A. Mazidi, J. G. Mazidi and R. D. Mckinlay, "The 8051 Microcontroller & Embedded systems", Pearson Publications, Second Edition 2006. 4. James A. Langbridge, "Professional Embedded Arm Development", Wrox, John Wiley Brand & Sons Inc., Edition 2014 5. Lyla Das, Embedded Systems: An Integrated Approach‖, Pearson Publication, First Edition 2013 6. Steve Furber, "ARM System on chip Architecture", Pearson, 2nd edition. 7. Shibu K. V "Introduction to embedded systems" McGraw Hill.
Reference Books	1. "MCS@51 Microcontroller, Family User's Manual" Intel 2. P89V51RB2/RC2/RD2 8-bit 80C51 5 V low power 16/32/64 kB flash microcontroller, Data Sheet NXP founded by Philips 3. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Fifth Edition, Tata McGraw-Hill
Useful Links:	Course: Microprocessors and Microcontrollers by Prof. Santanu Chattopadhyay (IIT Kharagpur); https://swayam.gov.in/nd1_noc20_ee42/preview

Continuous Assessment(CA):
The distribution of Continuous Assessment marks will be as follows –

1.	Class Test 1 (T-1)	30 marks
2.	Class Test 2 (T-2)	30 marks
3.	Internal Assessment	10 marks

Class Tests (30 Marks):
Two class tests of 30 marks each should be conducted in a semester. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 40% syllabus (but excluding contents covered in Test I) is completed. Duration of each test shall be one hour and 15 Minutes. Average of the two class tests (T-1 and T-2) will be considered for Continuous Assessment.
Internal Assessment (IA):

Marks will be awarded based on the rubrics designed.
End Semester Theory Examination will be of 60 Marks with Two Hours and 30 Minutes duration.

Course Code	Course Name	Credits (TH+P+TUT)
EXC403	**Linear Integrated Circuits**	**3+0+0**
Prerequisite:	Basic Electrical Engineering Electronic Devices & Circuits	
Course Objectives:	To understand the concepts, working principles and key applications of linear integrated circuits To perform analysis of circuits based on linear integrated circuits. To design circuits and systems for particular applications using linear integrated circuits.	
Course Outcomes:	Outline and classify all types of integrated circuits Explain the fundamentals and areas of applications for the integrated circuits. Design practical circuits that perform the desired operations Compare theoretical & practical results in integrated circuits. Identify the appropriate integrated circuit modules for designing engineering application Select and use an appropriate integrated circuit to build a given application.	

Module No. & Name	Sub Topics	CO Mapped	Hrs/ Sub Topic	Total Hrs/ Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	-	02	02
1. Introduction to Operational Amplifier	1 Block diagram of Op-Amp. Ideal and practical characteristics of op-amp.	1	02	07
	2 Configurations of Op-Amp: Open loop and closed loop configurations of Op-amp, Inverting and Non-inverting configuration of Op-amp and buffer.		02	
	3 Summing amplifier, difference amplifiers and Instrumentation amplifier using Op-amp. (using 2 opamp & 3 op amp)		03	
2. Linear Applications of Operational Amplifier	1 Voltage to current and current to voltage converter	2	03	08
	2 Integrator & differentiator (ideal & practical), Active Filters: First and Second order active low pass, high pass, band pass, band reject and Notch		03	

Module No. & Name	Sub Topics	CO Mapped	Hrs/ Sub Topic	Total Hrs/ Module
	filters. Filter approximation			
	3 Positive feedback, Barkhausen's criteria, Sine Wave Oscillators: RC phase shift oscillator, Wien bridge oscillator.		02	
3. Non-Linear Applications of Operational Amplifier	1 Comparators: Inverting comparator, non-inverting comparator zero crossing detectors, window, detector, level detector	3	02	07
	2 Schmitt Triggers: Inverting Schmitt trigger, non-inverting Schmitt trigger		03	
	3 Waveform Generators: Square wave generator and triangular wave generator. Basics of Precision Rectifiers: Half wave and full wave precision rectifiers. Peak detector		02	
4. Timer IC 555 and its applications	1 Functional block diagram and working of IC 555	4	02	07
	2 Design of Astable and Monostable multivibrator using IC 555		03	
	3 Applications of Astable and Monostable multivibrator as Pulse width modulator and Pulse Position Modulator		02	
5. Voltage Regulators	1 Functional block diagram, working and design of three terminal fixed voltage regulators (78XX, 79XX series). Introduction of LM317, LM 337	5	02	06
	2 Functional block diagram, working and design of general-purpose IC 723 (HVLC and HVHC).		02	
	3 Introduction and block diagram of switching regulator		02	
6. Special Purpose Integrated Circuits	1 Functional block diagram and working of VCO IC 566 and application as frequency modulator	6	02	04
	2 Functional block diagram and working of PLL IC 565 and application as FSK Demodulator		02	

Module No. & Name	Sub Topics	CO Mapped	Hrs/ Sub Topic	Total Hrs/ Module
ii. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization	-	01	01
			Total:	**42**

Books:	
Text Books	Ramakant A. Gaikwad, "Op-Amps and Linear Integrated Circuits", Pearson D. Roy Choudhury and S. B. Jain, "Linear Integrated Circuits", New Age International Publishers, 4th Edition
Reference Books	K. R. Botkar, "Integrated Circuits", Khanna Publishers (2004) Sergio Franco, "Design with operational amplifiers and analog integrated circuits",Tata McGraw Hill, 3rd Edition. David A. Bell, "Operational Amplifiers and Linear Integrated Circuits", Oxford University Press, Indian Edition. R. F. Coughlin and F. F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Prentice Hall, 6th Edition. J. Millman, Christos CHalkias, and Satyabrata Jit, Millman's, "Electronic Devices and Circuits," McGrawHill, 3rd Edition.
Useful Links:	NPTEL/ Swayam Course: Course: ICs MOSFETs Op-Amps & Their Applications by Prof. Hardik Jeetendra Pandya (IISc Bangalore); tps://swayam.gov.in/nd1_noc20_ee13/preview

Continuous Assessment(CA):
The distribution of Continuous Assessment marks will be as follows –

1.	Class Test 1 (T-1)	30 marks
2.	Class Test 2 (T-2)	30 marks
3.	Internal Assessment	10 marks

Class Tests (30 Marks):
Two class tests of 30 marks each should be conducted in a semester. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 40% syllabus (but excluding contents covered in Test I) is completed. Duration of each test shall be one hour and 15 Minutes. Average of the two class tests (T-1 and T-2) will be considered for Continuous Assessment.

Internal Assessment (IA):
Marks will be awarded based on the rubrics designed.

End Semester Theory Examination will be of 60 Marks with Two Hours and 30 Minutes duration.

Course Code	Course Name	Credits (TH+P+TUT)
EXC404	**Principles of Communication Engineering**	**3 + 0 + 0**
Prerequisite:	1. Applications of Mathematics in Engineering-I 2. Electronics Devices & Circuits	
Course Objectives:	1. To illustrate the fundamentals of basic communication systems. 2. To understand various analog modulation and demodulation techniques. 3. To focus on applications of analog modulation and demodulation techniques. 4. To explain the key concepts of analog and digital pulse modulation and demodulation.	
Course Outcomes:	1. Explain the basic components and types of noises in the communication system. 2. Analyse the concepts of amplitude modulation and demodulation. 3. Analyse the concepts of angle modulation and demodulation. 4. Compare the performance of AM and FM receivers. 5. Describe analog and digital pulse modulation techniques. 6. Illustrate the principles of multiplexing and de-multiplexing techniques.	

Module No. & Name	Sub Topics	CO Mapped	Hrs/ Sub Topic	Total Hrs/ Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction	-	02	02
Basics of Communication System	Block diagram, electromagnetic spectrum, signal bandwidth and power, types of communication channels	1	02	03
	Types of noise, signal to noise ratio, noise figure, and noise temperature		01	
Amplitude Modulation and Demodulation	Basic concept, mathematical analysis, signal representation (time domain and frequency domain), need for modulation, modulation index, bandwidth, voltage distribution, and power calculation	2	02	10
	Analyse the concepts of amplitude modulation and demodulation DSBFC: Principles, modulating circuits, low level and high-level transmitters DSB suppressed carrier: - Balanced modulators with diode (Ring modulator and		06	

Module No. & Name	Sub Topics	CO Mapped	Hrs/ Sub Topic	Total Hrs/ Module
	FET) Single Side Band (SSB): -Principle, Filter method, phase shift method and third method Independent sideband (ISB) and Vestigial Side Band (VSB) transmitters			
	3 Amplitude demodulation: Diode detector, practical diode detector. Advantages, disadvantages and applications of AM, Comparison of different types of AM		02	
Angle Modulation and Demodulation	1 Frequency and Phase modulation (FM and PM): Basic concepts, mathematical analysis, FM wave (time and frequency domain), sensitivity, phase and frequency deviation, modulation index, deviation ratio, bandwidth requirement of angle modulated waves, narrowband FM and wideband FM	3	02	10
	2 Varactor diode modulator, FET reactance modulator, stabilized reactance modulator-AFC, Direct FM transmitter, indirect FM Transmitter		04	
	3 FM demodulation: Balanced slope detector, Foster-Seely discriminator, ratio detector, Phase lock loop (PLL) FM demodulator. Noise triangle in FM, pre-emphasis and de-emphasis. amplitude limiting and thresholding in FM, Advantages, disadvantages and applications of FM and PM, Comparison of AM, FM, PM		04	
Radio Receivers	1 TRF, Super-heterodyne receiver, receiver parameters, and choice of IF.	4	01	04
	2 AM receiver circuits and analysis, simple AGC, delayed AGC, forward AGC, and communication receiver		02	
	3 FM receiver circuits, Comparison of AM, FM receiver		01	
Pulse Modulation and Demodulation Techniques	1 Theorem for low pass and band pass signals, proof with spectrum, Nyquist criteria, Sampling techniques, aliasing error, and aperture effect	5	03	10
	2 Generation and Detection of PAM, PWM,		03	

Module No. & Name	Sub Topics	CO Mapped	Hrs/ Sub Topic	Total Hrs/ Module
	PPM, advantages, disadvantages and applications of pulse communication			
	3 Pulse Code Modulation, DPCM, Delta modulation, adaptive delta modulation, Advantages, Disadvantages and Application of Pulse transmission techniques		04	
Multiplexing & De-multiplexing	FDM transmitter & receiver block diagram, Hierarchical FDM, FDM in Telephone System, Advantages, disadvantages and applications of FDM.	6	01	02
	2 TDM transmitter & receiver block diagram, signalling rate, Crosstalk and guard time Advantages, disadvantages and applications of TDM.		01	
Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization	-	01	01
			Total:	**42**

Books:	
Text Books	1. Kennedy and Davis, "Electronics Communication System", Tata McGraw Hill, Fourth edition. 2. B.P. Lathi, Zhi Ding "Modern Digital and Analog Communication system", Oxford University Press, Fourth edition. 3. Wayne Tomasi, "Electronics Communication Systems", Pearson education, Fifth edition.
Reference Books	1. Taub, Schilling and Saha, "Taub's Principles of Communication systems", Tata McGraw Hill, Third edition. 2. P. Sing and S.D. Sapre, "Communication Systems: Analog and Digital", Tata McGraw Hill, Third edition. 3. Simon Haykin, Michel Moher, "Introduction to Analog and Digital Communication", Wiley, Second edition. 4. Dennis Roddy and John Coolen, Electronic Communication, Pearson, 4/e, 2011. 5. Louis Frenzel, "Communication Electronics", Tata McGraw Hill, Third Edition.
Useful Links:	PTEL/ Swayam Course: 1. Course: Analog Communication by Prof. Goutam Das (IIT Kharagpur); https://swayam.gov.in/nd1_noc20_ee69/preview 2. https://nptel.ac.in/courses/106/103/106103068/

Continuous Assessment(CA):
The distribution of Continuous Assessment marks will be as follows –

1.	Class Test 1 (T-1)	30 marks
2.	Class Test 2 (T-2)	30 marks
3.	Internal Assessment	10 marks

Class Tests (30 Marks):
Two class tests of 30 marks each should be conducted in a semester. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 40% syllabus (but excluding contents covered in Test I) is completed. Duration of each test shall be one hour and 15 Minutes. Average of the two class tests (T-1 and T-2) will be considered for Continuous Assessment.

Internal Assessment (IA):
Marks will be awarded based on the rubrics designed.

End Semester Theory Examination will be of 60 Marks with Two Hours and 30 Minutes duration.

Course Code	Course Name	Credits (TH+P+TUT)
EXC405	**Signals and Systems**	**3+0+0**
Prerequisite:	Applications of Mathematics in Engineering-I	
Course Objectives:	1. To introduce students to the idea of signal and system analysis and characterization in time and frequency domain. 2. To provide foundation of signal and system concepts to areas like communication, control and comprehend applications of signal processing in communication systems.	
Course Outcomes:	1. Describe different types of signals and systems 2. Apply convolution and correlation to continuous time and discrete time systems in time domain 3. Apply Fourier series to continues time and discrete time signals and systems 4. Apply Fourier transform to continues time and discrete time signals and systems 5. Apply Laplace transform to continues time LTI systems 6. Apply Z-transform to continues time LTI systems	

Module No. & Name	Sub Topics	CO Mapped	Hrs/ Sub Topic	Total Hrs/ Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	-	02	02

Module No. & Name	Sub Topics	CO Mapped	Hrs/ Sub Topic	Total Hrs/ Module
1. Introduction to signals and systems	1 Introduction to Signals: Definition, Basic Elementary signals -exponential, sine, step, impulse, ramp, rectangular, triangular. Operations on signals. Classification of Signals: Analog and discrete time signals, even and odd signals, periodic and non-periodic signals, deterministic and non-deterministic signals, energy and power signals.	1	04	08
	2 Systems and Classification of systems: System Representation, continuous time and discrete systems, system with and without memory, causal and non-causal system, linear and nonlinear system, time invariant and time variant system, stable system.		04	
2. Time domain analysis of Continuous Time and Discrete Time systems	1 Linear Time Invariant (LTI) systems: Impulse, step and exponential response, System Stability and Causality.	2	02	10
	2 Use of convolution integral and convolution sum for analysis of LTI systems, properties of convolution integral/sum, impulse response of interconnected systems.		04	
	3 Correlation and spectral Density: auto-correlation, cross correlation, analogy between correlation and convolution, energy spectral density, power spectral density, relation of ESD and PSD with auto-correlation.		04	
3. Review of Fourier series	1 Trigonometric and exponential Fourier series representation of signals, Gibb's phenomenon, Discrete Time Fourier Series, properties, analogy between Continuous Time Fourier Series (CTFS) and Discrete Time Fourier Series (DTFS).	2, 3	03	03
4. Fourier Analysis of Continuous and Discrete Time Signals and	1 Fourier transform of periodic and non-periodic functions, Properties of Fourier Transform (No proof required), Inverse Fourier Transform, Frequency Response:	3	06	06

Module No. & Name	Sub Topics	CO Mapped	Hrs/ Sub Topic	Total Hrs/ Module
Systems	computation of Magnitude and Phase Response, Limitations of Fourier Transform.			
5. Laplace Transform and Continuous time LTI systems	1. Need of Laplace Transform, Concept of Region of Convergence, Properties of Laplace Transform (No proof required), Relation between continuous time Fourier Transform and Laplace Transform, unilateral Laplace Transform, inverse Laplace Transform.	4	04	06
	2. Analysis of continuous time LTI systems using Laplace Transform: Causality and stability of systems in *s*-domain, Total response of a system.		02	
6. Z-Transform and Discrete time LTI systems	1. Need of z-Transform, z-Transform of finite and infinite duration sequences, Concept of Region of Convergence, z-Transform properties (No proof required), Standard z-transform pairs, relation between z-transform and discrete time Fourier Transform, one sided Z-Transform. Inverse z-Transform: Partial Fraction method only.	5	03	06
	2. Analysis of discrete time LTI systems using z-Transform: Systems characterized by Linear constant coefficient difference equation, Transfer Function, plotting Poles and Zeros of a transfer function, causality and stability of systems, Total response of a system.		03	
ii. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization	-	01	01
			Total:	**42**

Books:	
Text Books	1. Signals and Systems, Third Edition, Nagoor Kani, Tata McGraw Hill, 2011. 2. Signals and Systems, Fourth Edition, Rodger E Ziemer, William H. Tranter and D. Ronald Fannin, Pearson Education,2009. 3. Signals and Systems, Second Edition, Alan V. Oppenhiem, Alan S. Willsky and S. Hamid Nawab, Prentice-Hall of India, 2002. 4. Signals and Systems, Fourth Edition, Ramesh Babu, Scitech

Reference Books	1. Signals and Systems, Third edition, Hwei. P Hsu, Tata McGraw Hill, 2010 2. Signals and Systems, Second Edition, Simon Haykin and Barry Van Veen, John Wiley and Sons, 2004 3. Signals and Systems, First Edition, V. Krishnaveni and A. Rajeshwari Wiley-India, 2012
Useful Links:	1. Course: Principles of Signals & Systems by Prof. Aditya K. Jagannatham (IIT Kanpur); https://swayam.gov.in/nd1_noc20_ee15/preview 2. Signals and Systems Laboratory: Virtual Laboratory http://ssl-iitg.vlabs.ac.in/

Continuous Assessment(CA):
The distribution of Continuous Assessment marks will be as follows –

1.	Class Test 1 (T-1)	30 marks
2.	Class Test 2 (T-2)	30 marks
3.	Internal Assessment	10 marks

Class Tests (30 Marks):
Two class tests of 30 marks each should be conducted in a semester. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 40% syllabus (but excluding contents covered in Test I) is completed. Duration of each test shall be one hour and 15 Minutes. Average of the two class tests (T-1 and T-2) will be considered for Continuous Assessment.

Internal Assessment (IA):
Marks will be awarded based on the rubrics designed.

End Semester Theory Examination will be of 60 Marks with Two Hours and 30 Minutes duration.

Course Code	Course Name	Credits (P+TUT)
EXL402	**Microcontrollers Laboratory**	**1+0**

Lab Prerequisite:	Digital System Design
Lab Objectives:	1. To understand development tools of microcontroller based systems. 2. To learn programming for different microcontroller operation & interface to I/O devices. 3. To develop microcontroller based applications.

Lab Outcomes:	1. Outline different development tools required to develop microcontroller based systems 2. Write assembly language programs for arithmetic and logical operations, code conversion & data transfer operations for 8051 and ARM7 3. Write assembly language programs for general purpose I/O, Timers & Interrupts. 4. Programs for 8051 microcontrollers and Interface various peripheral devices to the microcontrollers and develop microcontroller based applications 5. Write accurate documentation for experiments performed. 6. Apply ethical principles like timeliness and adhere to the rules of the laboratory

Lab No.	Experiment Title	LO Mapped	Hrs/ Lab
Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	-	02
1	Study of development tools like Editor, Assembler-cross Assembler, Compiler-Cross compiler, Linker, Simulator, emulator etc.	1, 5, 6	02
2	Perform Arithmetic and Logical Operations (Using Immediate, Direct and Indirect addressing) 8051 and ARM 7	2, 5, 6	02
3	Code Conversion	2, 5, 6	02
4	Transfer of data bytes between Internal and External Memory	2, 5, 6	02
5	Experiments based on General Purpose Input-Output, Timers, Interrupts, Delay for 8051	3, 5, 6	02
6	Interfacing of Matrix Keyboard, LED, 7 Segment display, LCD, Stepper Motor, UART	4, 5, 6	02
7	Perform Arithmetic (Using Immediate, Direct and Indirect addressing) ARM 7	2, 5, 6	02
8	Perform Logical Operations (Using Immediate, Direct and Indirect addressing) ARM 7	2, 5, 6	02
9	Case Study/ Mini Project	1 to 6	10
		Total	**28**

erm work:

Term work should consist of a minimum of 8 experiments.

Journal must include assignments on content of theory and practical of the course.

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

Total 25 Marks (Experiments: 15-marks, Assignments/Case study/ Project/ demo/ presentation: 10-marks)

Oral/Practical/P&O:

Oral examination will be based on the experiment list and content of the entire theory syllabus carries 25-Marks

Course Code	Course Name	Credits (P+TUT)
EXL403	**Linear Integrated Circuits Laboratory**	**1+0**
Lab Prerequisite:	1. Basic Electrical Engineering 2. Electronic Devices & Circuits	
Lab Objectives:	To teach fundamental principles of standard linear integrated circuits. To develop an overall approach for students from selection of integrated circuit, study its specification, the functionality, design and practical applications	
Lab Outcomes:	1. Demonstrate an understanding of fundamentals of integrated circuits. 2. Analyse the various applications and circuits based on particular linear integrated circuits. 3. Explain the differences between theoretical, practical and simulated results in integrated circuits. 4. Apply the knowledge to do simple mathematical operations. 5. Write accurate documentation for experiments performed. 6. Apply ethical principles like timeliness and adhere to the rules of the laboratory.	

Lab No.	Experiment Title	LO Mapped	Hrs/ Lab
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	-	02
1	Design inverting, non-inverting amplifiers and buffers using IC 741.	1, 5, 6	02
2	Design the summing and difference amplifiers using op-amp.	1, 5, 6	02

Lab No.	Experiment Title	LO Mapped	Hrs/ Lab
3	Design voltage to current converter with grounded load.	1, 5, 6	02
4	Design and analyse Integrator	1, 5, 6	02
5	Design and analyse Differentiator	1, 5, 6	02
6	Design Schmitt trigger using Op-amp.	2, 5, 6	02
7	Design Wein bridge and RC phase shift Oscillator.	2, 5, 6	02
8	Design and analyse second order High pass and Low pass filter	2, 5, 6	02
9	Design and analyse Band pass and Band reject filter.	2, 5, 6	02
10	Design Astable Multivibrator using IC 555 for fixed frequency and variable duty cycle.	2, 5, 6	02
11	Design Monostable Multivibrator using IC 555.	2, 5, 6	02
12	Design High voltage Low current voltage regulator using IC 723.	3, 5, 6	02
13	Design High voltage High current voltage regulator using IC 723.	3, 5, 6	02
14	Design Frequency Modulator using IC 566	3, 5, 6	02
15	Design FSK Demodulator using IC 565	4, 5, 6	02
16	Design Instrumentation amplifier using 3 Op-Amp.	4, 5, 6	02
17	Design Precision rectifier (HWR & FWR)	4, 5, 6	02
18	Design Square & Triangular wave generator USING OP AMP	4, 5, 6	02
		Total	**38***
***Minimum 28 Hrs. Lab / Mini Project to be conducted**			

Useful Links:

. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/electronerds/experiments/inverting-amplifier-pvg/
. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/electronerds/experiments/adder-pvg/
. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/electronerds/experiments/integrator-pvg/
. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/electronerds/experiments/differentiator-pvg/
. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/electronerds/experiments/schmitt-trigger-pvg/
. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/electronerds/experiments/instrumentation-amplifier-pvg/index.html

Term work: 1. Term work should consist of a minimum of 8 experiments. 2. Journal must include assignments on content of theory and practical of the course. 3. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. 4. Total 25 Marks (Experiments: 15-marks, Assignments/Case study/Project/demo/presentation: 10-marks)
Oral/Practical/P&O: **Practical** examination will be based on the experiment list and content of the entire theory syllabus and carries 25-Marks

Course Code	Course Name	Credits (P+TUT)
EXL404	**Principles of Communication Engineering Laboratory**	**1+0**

Lab Prerequisite:	1. Usage of basic electronic instruments and components. 2. Fundamentals of Electronic Devices and circuits
Lab Objectives:	1. To understand the Time and Frequency domain representation of signals. 2. To demonstrate continuous wave modulation and demodulation. 3. To demonstrate analog and digital pulse communication. 4. To use simulation software to build communication circuits.
Lab Outcomes:	1. Demonstrate and compare analog modulation and demodulation techniques and sketch the appropriate waveform 2. Demonstrate and compare analog pulse modulation and demodulation techniques. 3. Demonstrate and compare digital pulse modulation and demodulation techniques. 4. Simulate analog and pulse modulation and demodulation techniques using MATLAB 5. Write accurate documentation for experiments performed. 6. Apply ethical principles like timeliness and adhere to the rules of the laboratory.

Lab No	Experiment Title	LO Mapped	Hrs/ Lab
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	-	02
1	Generation & Detection of AM (DSBFC/DSB/SSB) signal	1, 5, 6	02
2	Generation & Detection of FM/PM signal	1, 5, 6	02

Lab No	Experiment Title	LO Mapped	Hrs/ Lab
3	Analyse the output waveforms of each block of AM/FM transmitter /receiver	1, 5, 6	02
4	Verification of sampling theorem.	2, 5, 6	02
5	Generation of PAM modulation and demodulation.	2, 5, 6	02
6	Generation of PWM and PPM modulation and demodulation.	2, 5, 6	02
7	Demonstrate Digital pulse transmission technique (PCM)	3, 5, 6	02
8	Demonstrate Digital pulse transmission technique (DM, ADM)	3, 5, 6	02
9	Observation of TDM/FDM multiplexing and de-multiplexing signals.	1, 5, 6	02
10	Simulate any modulation techniques using MATLAB 1. Simulate AM/FM/PM using MATLAB 2. Simulate Pre-emphasis and De-emphasis circuit 3. Simulate PAM/PWM/PPM using MATLAB 4. Simulate PCM/DM/ADM using MATLAB	4, 5, 6	02
11	Write program in MATLAB to find Gain, Noise Figure and Noise Temperature of multistage amplifier	4, 5.6	02
12	Subject Simulation Project	1 to 6	04
		Total	**28**

References:

[1] Lab manuals [2] www.mathworks.com [3] www.scilab.org [4] www.ni.com/labview

Useful Links:

1. http://ssl-iitg.vlabs.ac.in/Sampling%20and%20signal%20reconstruction%20 (objective).html
2. https://www.vlab.co.in/broad-area-electronics-and-communications

Term work: 1. Term work should consist of a minimum of 8 experiments. 2. Journal must include assignments on content of theory and practical of the course. 3. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. 4. Total 25 Marks (Experiments: 15-marks, Assignments/ Case study/ Project/ demo/ presentation: 10-marks)
Oral/Practical/P&O: **Practical** examination will be based on the experiment list and content of the entire theory syllabus and carries 25-Marks

Course code	Course Name	Credits	Course Category
EXPR42	**PBL Mini Project Lab-II**	**01**	**PBL**

Objectives	
1	To acquaint yourself with the process of identifying the needs and converting it into the problem.
2	To familiarize the process of solving the problem in a group.
3	To acquaint yourself with the process of applying basic engineering fundamentals to attempt solutions to the problems.
4	To inculcate the process of self-learning and research.
Outcome: Learner will be able to…	
1	Identify problems based on societal /research needs.
2	Apply Knowledge and skill to solve societal problems in a group.
3	Develop interpersonal skills to work as member of a group or leader.
4	Draw the proper inference from available results through theoretical/ experimental/simulations
5	Analyze the impact of solutions in societal and environmental context for sustainable development.
6	Use standard norms of engineering practices
7	Excel in written and oral communication.
8	Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
9	Demonstrate project management principles during project work.
Guidelines for Mini Project	
1	Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
2	Students should do surveys and identify needs, which shall be converted into problem statements for mini projects in consultation with faculty supervisor/internal committee of faculties.
3	Students shall submit an implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of mini projects.
4	A logbook to be prepared by each group, wherein the group can record weekly work

	progress, guide/supervisor can verify and record notes/comments.
5	Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning.
6	Students in a group shall understand problems effectively, propose multiple solutions and select the best possible solution in consultation with the guide/ supervisor.
7	Students shall convert the best solution into a working model using various components of their domain areas and demonstrate.
8	The solution to be validated with proper justification and report to be compiled in standard format of the college.
9	With the focus on self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that a single project of appropriate level and quality be carried out in two semesters by all the groups of the students. i.e. Mini Project 1 in semester III and IV.
10	However, based on the individual students or group capability, with the mentor's recommendations, if the proposed Mini Project adhering to the qualitative aspects mentioned above gets completed in odd semester, then that group can be allowed to work on the extension of the Mini Project with suitable improvements/modifications or completely new project ideas in even semester. This policy can be adopted on a case-by-case basis. **Note: Project Should More Towards Societal Based And Health Care Based.**

Term Work:

The review/ progress monitoring committee shall be constituted by senior faculty members. The progress of mini project to be evaluated on continuous basis, minimum two
reviews in each semester. Assessment also considers peer review and ethics observed by faculties and participation involvement.

In continuous assessment focus shall also be on each individual student, log book maintained and weekly meeting based on the same.

	Distribution of Term work marks for both semesters shall be as below:	**Practical Marks**
1	Marks awarded by guide/supervisor based on implementation	10
2	Peer assessment by team members	05
3	Marks awarded by review committee	05
4	Quality of Project report	05

Review / progress monitoring committee may consider following points for assessment based on either one year or half year project as mentioned in general guidelines

One-year project:

1	In the first semester the entire theoretical solution shall be ready, including components/system selection and cost analysis. Two reviews will be conducted based on the presentation given by the student group. • First shall be for finalization of problem • Second shall be on finalization of the proposed solution of the problem.
2	In the second semester expected work shall be procurement of component's/systems, building of working prototype, testing and validation of results based on work completed in an earlier semester. • First review is based on readiness of building working prototypes to be conducted. • Second review shall be based on poster presentation cum demonstration of working model in last month of the said semester.
Half-year project:	
1	In this case in one semester students' group shall complete project in all aspects including, • Identification of need/problem • Proposed final solution • Procurement of components/systems • Building prototype and testing
2	Continuous assessment will be weekly based on a logbook. Two presentations will be conducted for review before a panel. • First shall be for finalization of problem and proposed solution • Second shall be for implementation and testing of solutions.
Assessment criteria of Mini Project:	
Mini Project shall be assessed based on following criteria;	
1	Quality of survey/ need identification
2	Clarity of Problem definition based on need.
3	Innovativeness in solutions
4	Feasibility of proposed problem solutions and selection of best solution
5	Cost effectiveness
6	Societal impact
7	Innovativeness
8	Cost effectiveness and Societal impact
9	Full functioning of working model as per stated requirements
10	Effective use of skill sets
11	Effective use of standard engineering norms
12	Contribution of an individuals as member or leader
13	Clarity in written and oral communication

In **one year, project**, first semester evaluation may be based on the first six criteria and the remaining may be used for the second semester evaluation of performance of students in the mini project.	
In the case of a half **year project** all criteria's in generic may be considered for evaluation of performance of students in a mini project.	
Guidelines for Assessment of Mini Project Practical/Oral Examination:	
1	Report should be prepared as per the guidelines issued by the University of Mumbai.
2	Mini Project shall be assessed through a presentation and demonstration of working model by the student project group to a panel of Internal and External Examiners preferably from industry or research organizations having experience of more than five years approved by head of Institution.
3	Students shall be motivated to participate in poster, project competition on the work in students' competitions.
Mini Project shall be assessed based on following points;	
1	Quality of problem and Clarity
2	Innovativeness in solutions
3	Cost effectiveness and Societal impact
4	Full functioning of working model as per stated requirements
5	Effective use of skill sets
6	Effective use of standard engineering norms
7	Contribution of an individuals as member or leader
8	Clarity in written and oral communication

Project Based Learning Code	**Project Based Learning Course Name**	**Credits (P+TUT)**
EXPR42	**PBL Mini Project Lab-II**	**0+1+0**
PBL Prerequisite:	1. Mini-Project 1- PBL 2. C++ and Java Programming 3. Electronic Devices and Circuit	
PBL Objectives:	1. Become familiar with Raspberry Pi (Rpi) hardware. 2. Setup and Install Raspbian OS on Rpi. 3. Understand how Rpi can be leveraged as an IoT gateway. 4. Become familiar with Linux OS. 5. Setup Rpi as an IoT gateway. 6. Using Python Interface with Arduino using Serial Port Interface.	
PBL Outcomes (PROs):	After successful completion of the course student will be able to: 1. Wire Raspberry Pi and create a fully functional computer. 2. Use Python-based IDE and trace and debug Python code on the device. 3. Measure physical parameter using sensors.	

	4. Implement various communication protocols for wired and wireless communication. 5. Interfaces different motors and create robots.

Experiment No.	Unit No.	Raspberry - Pi	Hrs.	PRO mapped
EX.1.0		**Introduction to Raspberry Pi**	**02**	**3**
	1.1	What is Raspberry PI? Downloading and Installation of NOOBS, First Power- Up & Having a Look around, Introduction to the Shell and Staying updated.		
	1	Familiarization with Raspberry PI and perform necessary software installation. Apparatus Requirement: Hardware: Raspberry PI Board, Memory of 16GB, Power adapter, Memory Writer. Software: NOOBS, Raspbian OS, Win32 disk Imager, SD-Formatter software.		
EX.2.0		**Interfacing with Input / Output Devices using Python**	**04**	**3**
	2.1	Introduction to Python, Connecting to the outside World with GPIO.		
	1	To Interface LED/Buzzer with Raspberry PI and write a program to turn ON LED for 1 sec after every 2 sec. Apparatus Requirement: Raspberry PI with inbuilt Python Package, LED, Buzzer.		
	2	To interface Push Button / Digital Sensor (IR/LDR) with Raspberry PI and write a program to turn ON LED when Push button is pressed or at sensor detection. Apparatus Requirement: Raspberry PI with inbuilt Python Package, Push Button Switch, Digital Sensor (IR/LDR).		
	3.	To interface analog sensor using MCP 3008 analog to digital converter chip. Apparatus Requirement: Raspberry PI with inbuilt Python Package, analog sensor, MCP 3008 chip.		
EX.3.0		**Interfacing Temperature Sensor, Motors, Display Devices.**	**04**	**4**
	3.1	Introduction to Temperature sensor (Analog and Digital), Relays, Motors (DC, Stepper) and Driver circuits.		

	1	To interface DHT11 sensor with Raspberry PI and write a program to print temperature and humidity readings. Apparatus Requirement: Raspberry PI with inbuilt Python Package, DTH11 Sensor.		
	2	To interface motor using relay with Raspberry PI and write a program to turn ON motor when push button is pressed. Apparatus Requirement: Raspberry PI with inbuilt Python Package, Relays, Motor Driver, Motors.		
	3	To interface OLED with Raspberry PI and write a program to print temperature and humidity readings on it. Apparatus Requirement: Raspberry PI with inbuilt Python Package, OLED display device.		
EX.4.0		**Interfacing Communication Devices and Cloud Networking**	**04**	**5**
	4.1	Introduction to Bluetooth, Zigbee, RFID and WIFI, specifications and interfacing methods.		
	1	To interface Bluetooth/Zigbee/RFID/WiFI with Raspberry PI and write a program to send sensor data to smartphone using Bluetooth/Zigbee/RFID/WIFI. (Any one can be used for performing) Apparatus Requirement: Raspberry PI with inbuilt Python Package, Bluetooth/Zigbee/RFID/WIFI.		
	2	Introduction to Cloud computing, different types cloud networks and interconnection using Raspberry PI		
	3	Write a program on Raspberry PI to upload temperature and humidity data from thing speak cloud. Apparatus Requirement: Raspberry PI with inbuilt Python Package, Cloud networks such as thing speak (open source), AWS, Azure, etc. anyone can be used for understanding purpose and building projects.		
EX.5.0		**Understanding of Communication Protocols**	**04**	**6**
	5.1	Introduction to MQTT, IFTTT protocols and configuration steps.		
	1	Write a program on Raspberry PI to publish temperature data to MQTT broker		
	2	Write a program on Raspberry Pi to subscribe to MQTT broker for temperature data and print it.		
	3	Configuration of Webserver using Raspberry PI.		
6.0		**Sample Projects**	**10**	**6**
	1.	MQTT Based Raspberry Pi Home Automation: Controlling Raspberry Pi GPIO using MQTT Cloud		
	2.	License Plate Recognition using Raspberry Pi and		

		OpenCV	
	3.	Real Time Face Recognition with Raspberry Pi and OpenCV	
	4.	Smart Garage Door Opener using Raspberry Pi	
	5.	Remote Controlled Car Using Raspberry Pi and Bluetooth	
	6.	Fingerprint Sensor based door locking system using Raspberry Pi	
	7.	Raspberry Pi Ball Tracking Robot using Processing	
	8.	Web Controlled Home Automation using Raspberry Pi	
	9.	Line Follower Robot using Raspberry Pi	
	10.	Raspberry Pi based Smart Phone Controlled Home Automation	
	11.	Web Controlled Raspberry Pi Surveillance Robotic Car	
	12.	Raspberry Pi Based Weight Sensing Automatic Gate	
	13.	Raspberry Pi Emergency Light with Darkness and AC Power Line Off Detector	
	14.	Detecting Colors using Raspberry Pi and Color Sensor TCS3200	
	15.	Measure Distance using Raspberry Pi and HCSR04 Ultrasonic Sensor	
	16.	Call and Text using Raspberry Pi and GSM Module	
	17.	Raspberry Pi Home Security System with Email Alert	
	18.	Raspberry Pi Based Obstacle Avoiding Robot using Ultrasonic Sensor	
	19.	Web Controlled Notice Board using Raspberry Pi	
	20.	RF Remote Controlled LEDs Using Raspberry Pi	
	21.	RFID and Raspberry Pi Based Attendance System	
	22.	Raspberry Pi Interactive Led-Mirror	
	23.	Garage Door monitor using Raspberry Pi	
	24.	Raspberry Pi Digital Code Lock on Breadboard	
	25.	Electronic Voting Machine using Raspberry Pi	

Total Hrs.	**28**

*** Preferably the Project should be based on Arduino Boards**

Reference Books:	Simon Monk, "Hacking Electronic: Learning Arduino and Raspberry Pi", McGraw-Hill Education TAB; 2nd edition (September 28, 2017) Simon Monk, "Raspberry PI Cookbook Software and Hardware Problems and Solutions" O'Reilly 2nd Edition Simon Monk, Programming the Raspberry Pi, 2nd Edition: Getting Started with Python" The McGraw Hill "DK Workbooks: Raspberry Pi Project Workbook", DK Children; Workbook edition (March 7, 2017) Donald Norris, "Raspberry Pi Electronic Projects for Evil Genius", McGraw-Hill Education TAB; 1 edition (May 20, 2016)
Useful Links:	**Software Tools:** • Raspbian OS: https://www.raspberrypi.org/downloads/ • Win32 Disk Imager: https://sourceforge.net/projects/win32diskimager/ • SD Card Formatter: https://www.sdcard.org/downloads/formatter/ • Arduino IDE: https://www.arduino.cc/en/main/software
Online Repository:	1. GitHub 2. NPTEL Videos on Raspberry Pi and Arduino Programming 3. https://www.electronicsforu.com/raspberry-pi-projects 4. https://circuitdigest.com/simple-raspberry-pi-projects-for-beginners 5. https://www.electronicshub.org/raspberry-pi-projects/ 6. Spoken Tutorial Project-IIT Bombay: https://spoken-tutorial.org/tutorialsearch/?searchFoss=Arduino&search_language=English Teachers are recommended to use a free online simulation platform "Tinker cad" for the simulation of Arduino based circuits before the students implement it in the hardware: ht://www.tinkercad.com/

Note: General Guidelines and assessment criteria will remain same as Mini project-I

Skill Based Learning Code	**Skill Based Learning - V**	**Credits (TH+P+TUT)**
EXXS45	**Python Programming**	**0+1+0**
Skill Prerequisite:	1. Knowledge of some programming language like C++ 2. Knowledge of some programming language like Java	
Skill Objectives:	1. To study List, tuple, set, dictionary, string, array and functions in python programming language. 2. To study List, tuple, set, dictionary, string, array and functions in python programming language. 3. To study data structures and Object-Oriented Programming using Python. 4. To explain concepts of modules, packages and exception handling. 5. To study File handling, django framework and regular expression. 6. To study data visualization using Matplotlib, data analysis using	

	Pandas and Web programming using Flask.
Skill Outcomes:	1. Apply the structure, syntax, and semantics of the Python language. 2. Implement the concept of advanced data types and functions in python 3. Illustrate data structures the concepts of object-oriented programming as used in Python 4. Create Python applications using modules, packages, exception handling, File Handling programs, Matplotlib, data analysis using Pandas and Web programming using Flask. 5. Write accurate documentation for experiments performed. 6. Apply ethical principles like timeliness and adhere to the rules of the laboratory.

Module No	Module Title	SO Mapped	Hrs/ Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	-	02
1	ite python programs to understand Basic data types, Operators, expressions and Input Output Statements Control flow statements: Conditional statements (if, if…else, nested if) Looping in Python (while loop, for loop, nested loops) Decorators, Iterators and Generators. Concepts: 1 Introduction, Features, Python building blocks – Identifiers, Keywords, Indention, Variables and Comments. 2 Basic data types (Numeric, Boolean, Compound) Operators: Arithmetic, comparison, relational, assignment, logical, bitwise, membership, identity operators and operator precedence. 3 Control flow statements: Conditional statements (if, if…else, nested if) Looping in Python (while loop, for loop, nested loops) Loop manipulation using continue, pass, break. Input/output Functions, Decorators, Iterators and Generators.	1, 5, 6	04
2	ite python programs to understand Different List and Tuple operations using Built-in functions Built-in Set and String functions Basic Array operations on 1-D and Multidimensional arrays using Numpy Implementing User defined and Anonymous Functions	2, 5, 6	06

Module No	Module Title	SO Mapped	Hrs/ Module
	Concepts: 1 Lists: a) Defining lists, accessing values in list, deleting values in list, updating lists b) Basic list operations c) Built-in list functions 2 Tuples: a) Accessing values in Tuples, deleting values in Tuples, and updating Tuples b) Basic Tuple operations c) Built-in Tuple functions 3 Dictionaries: a) Accessing values in Dictionary, deleting values in Dictionary, and updating Dictionary b) Basic Dictionary operations c) Built-in Dictionary functions 4 Sets: a) Accessing values in Set, deleting values in Set, updating Sets b) Basic Set operations, c) Built-in Set functions 5 Strings: a) String initialization, Indexing, Slicing, Concatenation, Membership & Immutability b) Built-in String functions 6 Arrays: a) Working with Single dimensional Arrays: Creating, importing, Indexing, Slicing, copying and processing array arrays. b) Working with Multi-dimensional Arrays using Numpy: Mathematical operations, Matrix operations, aggregate and other Built-in functions. 7 Functions: a) Built -in functions in python b) Defining function, calling function, returning values, passing parameters c) Nested and Recursive functions d) Anonymous Functions (Lambda, Map, Reduce, Filter.		
3	ite python programs to understand Classes, Objects, Constructors, Inner class and Static method Different types of Inheritance Polymorphism using Operator overloading, Method overloading, Method overriding, Abstract class, Abstract method and Interfaces in Python. Concepts: Overview of Object-oriented programming, Creating Classes and Objects, Self-Variable, Constructors, Inner class, Static method, Namespaces. Inheritance: Types of Inheritance (Single, Multiple, Multi-level, Hierarchical), Super() method, Constructors in inheritance, operator overloading, Method overloading, Method overriding, Abstract class, Abstract method, Interfaces in Python	3, 5, 6	03

Module No	Module Title	SO Mapped	Hrs/ Module
4	ite python programs to understand Creating User-defined modules/packages and import them in a program Creating user defined multithreaded application with thread synchronization and deadlocks Creating a menu driven application which should cover all the built-in exceptions in python ıcepts: Modules: Writing modules, importing objects from modules, Python built -in modules (e.g. Numeric and Mathematical module, Functional Programming module, Regular Expression module), Namespace and Scoping. Packages: creating user defined packages and importing packages. Exception handling: Compile time errors, Runtime errors, exceptions, types of exception, try statement, except block, raise statement, Assert statement, User -Defined Exceptions Creating a menu driven application which should cover all the built-in exceptions in python	4, 5, 6	03
5	ite python programs to implement Different types of plots using Matplotlob Basic operations using pandas like series, data frames, indexing, filtering, combining and merging data frames erent Linear algebra functions using Scipy ts: Visualization using Matplotlib: Matplotlib with Numpy, working with plots (line plot, bar graph, histogram, scatter plot, area plot, pie chart etc.), working with multiple figures. Data manipulation and analysis using Pandas: Introduction to Pandas, importing data into Python, series, data frames, indexing data frames, basic operations with data frame, filtering, combining and merging data frames, Removing Duplicates. SciPy: Linear algebra functions using Numpy and Scipy.	4, 5, 6	05
6	ite python programs to understand Different File Handling operations in Python Creating web application using flask web framework to demonstrate functionality of user login and registration (also validating user detail using regular expression)	4, 5, 6	05

Module No	Module Title	SO Mapped	Hrs/ Module
	Server side deployment of flask applications: mod wsgi ıcepts: File Handling: Opening file in different modes, closing a file, writing to a file, accessing file contents using standard library functions, reading from a file – read (), readline (), readlines (), Renaming and Deleting a file, File Exceptions, Pickle in Python. Flask framework and Regular Expressions using python		

Books:	
Text Books	1. Dr. R. Nageswara Rao, "Core Python Programming", Dreamtech Press 2. Beginning Python: Using Python 2.6 and Python 3.1. James Payne, Wrox Publication 3. Anurag Gupta, G. P. Biswas, "Python Programming", McGraw-Hill 4. E. Balagurusamy, "Introduction to computing and problem-solving using python", McGraw Hill Education
Reference Books	1. Eric Matthes, "Python Crash Course A hands-on, Project Based Introduction to programming" No Starch Press; 1 edition (8 December 2015). 2. Paul Barry, "Head First Python" O′Reilly; 2 edition (16 December 2016) 3. Online resources for Flask
Useful Links:	
1. https://python-iitk.vlabs.ac.in/ 2. http://vlabs.iitb.ac.in/vlabs-dev/labs/python-basics/index.html 3. www.nptelvideos.in 4. www.w3schools.com 5. www.tutorialspoint.com 6. https://starcertification.org/Certifications/Certificate/securejava	
Term Work (25 Marks):	
Term Work shall be awarded on the basis of Student's active participation in skill based learning. Presenting/showcasing learned skills through Social /outreach/ extension activities/Events/ Competitions/Trainings/Internships etc. Submission of Report/act/demonstrations/specific participation / Idea creation / scope / creativity / Case study etc. 4. Assessment Rubrics.	

Skill Based Learning Code	Skill Based Learning - VI	Credits (TH+P+TUT)
EXXS46	**(Foreign and Indian Modern Languages-II)**	**0+1+0**
SBL Objectives (SOBs):	1. Acquire reading and writing proficiency in the target language 2. Understand the common heritage of, and diversity among, countries that speak the target language. 3. Communicate and interact effectively with citizens of the target cultures.	
SBL Outcomes(SOs):	Upon completion of the course, the learners will be able to: 1. Demonstrate of communicative proficiency in the target language. 2. Write the target language in formal expository prose that impede communication. 3. Learn through MOOC online courses to adopt hybrid mode of learning	
Guidelines for Skill-Based Learning (SBL):	Each student has to complete any one Foreign and/or Indian Language MOOC course from NPTEL/Coursera/Udemy etc. sites referring the suggestive given list of course but are not limited to the list as it's a learner's choice for the interested course in the given semester time frame.	
Sr. No.	**Suggestive list of Courses**	
1	Introduction to Japanese Language and Culture	
2	German – II & III	
3	The Psychology of Language	
4	Spanish Vocabulary: Meeting People , Cultural Experience, Sports, Travel, and the Home, Careers and Social Events, Spanish Vocabulary Project	
5	A Bridge to the World: Korean Language for Beginners, First Step Korean, Learn to Speak Korean 1, The Korean Alphabet: An Introduction to Hangeul	
6	Complete French Course: Learn French for Beginners	
7	Complete German Course: Learn German for Beginners	
8	Spanish 1-4: Beginner, Elementary, Intermediate and Advanced	
9	Complete Japanese Course: Learn Japanese for Beginners	
10	Complete Korean Course: Learn Korean for Beginners	
11	The Complete Russian Language Course	
12	Spoken Sanskrit: Basic and Intermediate Levels	

13	Applied Linguistics
14	Fundamental Concepts in Sociolinguistics
15	Introduction to Basic Spoken Sanskrit and intermediate level to Basic Spoken Sanskrit

Online Resources:

Sr. No	Suggestive Course Link but are not limited to following recourses only
1	https://onlinecourses.nptel.ac.in/noc22_hs84/preview
2	https://onlinecourses.nptel.ac.in/noc22_hs89/preview
3	https://onlinecourses.nptel.ac.in/noc22_hs123/preview
4	https://www.coursera.org/learn/spanish-vocabulary-meeting-people https://www.coursera.org/learn/spanish-vocabulary-cultural-experience https://www.coursera.org/learn/spanish-vocabulary-sports-travel-home https://www.coursera.org/learn/spanish-vocabulary-careers https://www.coursera.org/learn/spanish-vocabulary-project
5	https://www.coursera.org/learn/korean-beginners https://www.coursera.org/learn/learn-korean https://www.coursera.org/learn/learn-speak-korean1 https://www.coursera.org/learn/the-korean-alphabet-an-introduction-to-hangeul
6	https://www.udemy.com/course/complete-french-course/
7	https://www.udemy.com/course/complete-german-course-learn-german-for-beginners/
8	https://www.udemy.com/course/spanish-101-beginning-spanish-spanish-for-beginners/
9	https://www.udemy.com/course/complete-japanese-course-learn-japanese-for-beginners-lvl-1/
10	https://www.udemy.com/course/complete-korean-course-learn-korean-for-beginners-level-1/
11	https://www.udemy.com/course/the-complete-russian-language-course/
12	https://onlinecourses.nptel.ac.in/noc22_hs114/preview
13	https://onlinecourses.nptel.ac.in/noc22_hs85/preview
14	https://onlinecourses.nptel.ac.in/noc22_hs139/preview

Term Work (25 Marks):
Marks will be awarded based on designed Assessment Rubrics

SOMAIYA
VIDYAVIHAR
K J Somaiya Institute of Technology
(Formerly known as K J Somaiya Institute of Engineering and Information Technology)
An Autonomous Institute Permanently Affiliated to University of Mumbai.

Autonomy Scheme-IIB

Internship Manual

(Prepared based on the Guidelines of AICTE and University of Mumbai)

(with effect from AY 2022-2023)

Academic Year 2023-24

INTERNSHIP MANUAL

AICTE-INTERNSHIP POLICY STATES THAT:

- The rise in global competition has prompted organizations to devise strategies to have a talented and innovative workforce to gain a competitive edge.
- Developing an internship policy is an impactful strategy for creating a future talent pool for the industry.
- The Internship program not only helps fresh pass-outs in gaining professional know-how but also benefits, corporate on fresh perspectives on business issues and even discovering future business leaders.

- Competition in the job sector is rising exponentially and securing entry-level jobs is getting very difficult, as the students passing out from technical institutions lack the experience and skills required by industry.
- The main aim of this initiatives is enhancement of the employability skills of the students passing out from Technical Institutions.

OBJECTIVES & EXPECTED OUTCOMES:

Following are the intended objectives of internship training:

1. Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
2. Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job.
3. Exposure to the current technological developments relevant to the subject area of training.
4. Experience gained from the 'Industrial Internship' in the classroom will be used in classroom discussions.
5. Create conditions conducive to quest for knowledge and its applicability on the job.
6. Learn to apply the Technical knowledge in real industrial situations.
7. Gain experience in writing Technical reports/projects.
8. Expose students to the engineer's responsibilities and ethics.
9. Familiarize yourself with various materials, processes, products and their applications along with relevant aspects of quality control.
10. Promote academic, professional and/or personal development.
11. Expose the students to future employers.
12. Understand the social, economic and administrative considerations that influence the working environment of industrial organizations.
13. Understand the psychology of the workers and their habits, attitudes and approach to problem solving

BENEFITS OF INTERNSHIP:

Benefits to Students:

1. An opportunity to get hired by the Industry/ organization.
2. Practical experience in an organizational setting.
3. Excellent opportunity to see how the theoretical aspects learned in classes are integrated into the practical world. On-floor experience provides much more professional experience which is often worth more than classroom teaching.
4. Helps them decide if the industry and the profession is the best career option to pursue.
5. Opportunity to learn new skills and supplement knowledge.
6. Opportunity to practice communication and teamwork skills.
7. Opportunity to learn strategies like time management, multi-tasking etc in an industrial setup.
8. Opportunity to meet new people and learn networking skills.
9. Makes a valuable addition to their resume.
10. Enhances their candidacy for higher education.
11. Creating networks and social circles and developing relationships with industry people.
12. Provides opportunity to evaluate the organization before committing to a full time position.

Benefits to the Institute:

- Build industrial relations.
- Makes the placement process easier.
- Improve institutional credibility & branding.
- Helps in retention of the students.
- Curriculum revision can be made based on feedback from Industry/ students.
- Improvement in teaching learning process.

Benefits to the Industry:

- Availability of ready to contribute candidates for employment.
- Year round source of highly motivated pre-professionals.
- Students bring new perspectives to problem solving.
- Visibility of the organization is increased on campus.
- Quality candidate's availability for temporary or seasonal positions and projects.
- Freedom for industrial staff to pursue more creative projects.
- Availability of flexible, cost-effective work force not requiring a long-term employer commitment.
- Proven, cost-effective way to recruit and evaluate potential employees.
- Enhancement of employer's image in the community by contributing to the educational enterprise.

STANDARD OPERATING PROCEDURE (SOP) FOR INTERNSHIP:

The general procedure for arranging internship is given below:

Step 1: Request Letter/ Email from the Dean, IIIC/ HOD and/or IIIC members of resp. depts. of the college shall be send to industry to allot various slots of 4-6 weeks during summer vacation as internship periods for the students. Students request letter/profile/ interest areas may be submitted to industries for their willingness for providing the training. (Sample attached)

Step 2: Industry will confirm the training slots and the number of seats allocated for internships via Confirmation Letter/ Email. In case the students arrange the training themselves the confirmation letter will be submitted by the students to Dean, IIIC/ HOD and/or IIIC members of resp. depts. Based on the number of slots agreed to by the Industry, Dean, IIIC/ HOD and/or IIIC members will allocate the students to the Industry. In addition, the internship slots may be conveyed through Telephonic or Written Communication (by Fax, Email, etc.) by the Dean or other members of the IIIC who are particularly looking after the Internship of the students.

Step 3: Students on joining Training at the concerned Industry / Organization, submit the Joining Report/ Letters / Email.

Step 4: Students undergo industrial training at the concerned Industry / Organization. In-between Faculty Member(s) evaluate(s) the performance of students once/twice by visiting the Industry/Organization and Evaluation Report of the students is submitted to Department IIIC Member with the consent of Industry persons/ Trainers.

Step 5: Students will submit a training report after completion of internship.
Step 6: Training Certificate to be obtained from industry.
Step 7: List of students who have completed their internship successfully certificate will be issued by Departments, Sections, Professional bodies, Cells, Committees in collaboration with IIIC cell.
Step 8: In addition to Step 1 to Step 7, Departments, Sections, Professional bodies, Cells, Committees of KJSIT may organize in house / Industry collaborated internship of 1/2/3/4 weeks' duration for students with the same procedure as stated above, with in Principal approval from Principal.

GUIDELINES FOR THE STUDENTS:

Internship/ Placement is a student centric activity. Therefore, the major role is to be played by the students. Deans, IIIC/HOD may also include involvement of the student in the following activities:

- Design and Printing of Internship / Placement Brochure – Soft copy as well as Hard copy.
- Preparing list of potential recruiters' / Internship providers and past recruiters.
- Internship/ Placement Presentation at various organizations, if required.
- For allotment of internship slots all the students will be required to submit "student internship program application" before the prescribed date

SOP FOR INTERNSHIP REPORT:

STUDENT'S DIARY/ DAILY LOG:

The main purpose of writing a daily diary is to cultivate the habit of documenting and to encourage the students to search for details. The students should record in the daily training diary the day to day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students. The diary should also be shown to the Faculty Mentor from time to time. Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed, if any. It will be evaluated on the basis of the following criteria:

- Regularity in maintenance of the diary.
- Adequacy & quality of information recorded.
- Drawings, sketches and data recorded.
- Thought process and recording techniques used.
- Organization of the information.

After completion of Internship, the student should prepare a comprehensive report to indicate what he/she has observed and learnt in the training period. The training report should be signed by the Internship Supervisor (from Industry/Organisation, if applicable), Faculty Incharge and HOD. The Internship report will be evaluated on the basis of following criteria:

- Originality.
- Adequacy and purposeful write-up.

- Organization, format, drawings, sketches, style, language etc.
- Variety and relevance of learning experience.
- Practical applications, relationships with basic theory and concepts taught in the course. The industrial training of the students will be evaluated in three stages:
- Evaluation by Industry
- Evaluation by faculty supervisor on the basis of site visit(s).
- Evaluation through seminar presentation/viva-voce at the Institute.

EVALUATION BY INDUSTRY:
The industry will evaluate the students based on the Punctuality, eagerness to learn, Maintenance of Daily Diary and skill test in addition to any remarks.

EVALUATION THROUGH SEMINAR PRESENTATION/VIVA-VOCE AT THE INSTITUTE:
The student will give a seminar based on his/her internship/ training report, as decided by the institute.

The evaluation will be based on the following criteria:
- Quality of content presented.
- Proper planning for presentation.
- Effectiveness of presentation.
- Depth of knowledge and skills.
- Attendance record, daily diary, departmental reports shall also be analyzed along with the Internship Report. Seminar presentation will enable sharing knowledge & experience amongst students & teachers and build communication skills and confidence in students.

EXAMINATION AND EVALUATION FOR AWARD OF INTERNSHIP COMPLETION CERTIFICATE

Internship Completion certificate will be awarded to graduating students on completion of minimum 5 Internship modules from Semester 2 to Semester 8 as per the internship policy document.

COMPLIANCES FOR INTERNSHIP COMPLETION CERTIFICATION:

1. Completion of 1 internship module will reflect addition of 2 credits so total credits earned will be 2 credits x 7 internship modules = 14 credits across Semester 2 to Semester 8.
   Mandatory to complete minimum 5 internship modules across Semester 2 to Semester 8 for award of Internship Certificate.
2. On completion of 5 Internship modules credit earned = 10
3. On completion of 6 Internship modules credit earned = 12
4. On completion of 7 Internship modules credit earned =14
5. No credits will be awarded AND / OR No Internship Completion Certificate will be issued for less than 10 credits earned throughout the degree.

6. Internship evaluation will be as per Internship module assessment process defined in Internship Manual course contents, for every individual student across Semester 2 to Semester 8.
7. Departments will submit Internship completion report and credits assigned sheet of every student signed by Department internship coordinator, Class teachers and Head of the Department to Exam Cell during 8th Semester ESE time duration of respective batch to generate the internship completion certificate along with the regular grade sheet.
8. No further queries will be entertained if not meeting above compliances and not following the internship modules designed under the guidelines of AICTE Internship policy.

Internship Scheme & Structure under KJSIT Autonomy Scheme-II wef 2022-23 for Bachelor of FY/SY/TY/LY (CE/IT/AIDS/EX Technology) Semester- II-VIII

Note:

As per guidelines and suggestions by AICTE-Internship policy

- 1 Credit = 40 - 45 hours of Internship
- Total 600-700 hour of spending under Internship module courses to be completed for award of Internship Completion Certification along with regular passing grade sheet. (e.g. Total 15 weeks of 5 days/week of 8 hrs/day spent=600hrs for complete degree duration)
- Total weeks of Internship shall be considered based on Hrs spent/Day
- For Internship course, no load to be allotted for mentors in faculty load distribution sheet.

Internship Modules & Contents Across Semester - II to Semester - VII

FY: (Semester II)			
Internship Code	**Course Name**	**Hours/Duration**	**Credits**
INT21	Internship-I	80-120 hrs (2-3 Weeks) Winter Vacation **After SEM-I** **& during** **SEM-II of FY**	02
Prerequisite:	**Fundamental knowledge of Engineering and Technology**		
Internship Objectives:	1. To get acquainted with institute level technical activities and initiatives. 2. To participate in department/Institute level technical learning and training initiatives through Professional cells/clubs/committees/bodies.		

Internship Outcomes:	**pon completion of the course, students will be able to:** 1. Get practical experience of institutional setting. 2. Meet and interact with new people and learn networking, innovation and entrepreneurial skills. 3. Promote academic, professional and/or personal development.
Activity- Inter/Intra Institutional Activities	**Supporting Activities to be completed under Internship**
	• Attending Industry Workshops organised by departments
	• Working in consultancy or research project initiated by department
	• Technical festival (participation)
	• Working in IIC Cell, Entrepreneurship Cell, NISP, IPR cell and/or any other technical professional body/cell/committee/club of the institute
	• Activities related to Incubation or Innovation
	• Learning in departmental Labs, Tinkering Lab
Term Work Assessment: **Duration to be considered for assessment:** Week Ends/ Semester Break/End of Semester (After ESE & Before Next Term Start)	
Guidelines:	1. Batch wise Faculty Supervisor who is the proctor (mentor) of the batch will be allotted as in-charge for the course, at start of the Academic year. 2. Students will submit the participation certificate of the activities to the faculty mentors. 3. For working in cells related activities, Cell coordinator will submit list of actively involved & participated students of each department, semester wise to all department HODs, verified and authenticated by Dean Students Welfare. 4. HODs will circulate the student list to all faculty mentors for consideration of Hours spends under mentioned department activities. 5. For department Lab learning, FY HOD will circulate Term End report to all faculty mentors with list of student's undergone innovative learning, verified by department academic coordinator. **6.** Students will submit evaluation sheet by attaching Xerox copies of Internship & other participation certificates & faculty mentor will verify the Xerox from original copy for assessment purpose.
TW Marks (25) & Certificate :	**Assessment & evaluation based on rubrics:** Hours Spent for Internship: max 20 marks Achievement/Recognition: max 05 marks

	& Internship and Activity Completion/Participation Certificates and Evaluating Report

SY (Semester III)			
Internship Code	**Internship Name**	**Hours/Duration**	**Credits**
INT32	Internship-II	80-120 hrs (2 -3 Weeks) Summer Vacation **After SEM-II** **& during** **SEM-III of SY**	02
Prerequisite:	**Fundamental knowledge of program specific tools, instruments, devices and programming languages etc.**		
Internship Objectives:	1. To get the exposure to Innovation/IPR/ Entrepreneurship/ Startup initiatives 2. To participate & experience Incubation, Innovation & Business development culture		
Internship Outcomes:	**on completion of the course, students will be able to:** 1. Learn innovation and entrepreneurial skills to supplement engineering knowledge. 2. Integrate theoretical aspects learned in classes with the practical world 3. Develop an innovative idea to be processed as a start-up		
Activity- Innovation/ I IPR/ Entrepreneurship	**Supporting Activities to be completed under Internship**		
	1. Participation in Innovation related competitions e.g. Hackathons etc.		
	2. Awareness & knowledge sessions about Development of new product/Business Plan/Registration of Start-up		
	3. Participation in all activities of IIC Cell, E-Cell, NISP, IPR Cell like • IPR workshop/ • Leadership Talk • Idea Design • Innovation/Business Competition		
Term Work Assessment: **Duration to be considered for assessment:** Week Ends/ Semester Break/End of Semester (After ESE & Before Next Term Start)			

Guidelines:	1. Batch wise Faculty Supervisor who is the proctor (mentor) of the batch will be allotted as in-charge for the course, at start of the Academic year. 2. Students will submit the participation certificate of the activities to the faculty mentors. 3. For working in cells related activities, Cell coordinator will submit list of actively involved & participated students of each department, semester wise to all department HODs, verified and authenticated by Dean Students Welfare. 4. HODs will circulate the student list to all faculty mentors for consideration of Hours spends under mentioned department activities. Department IIIC Cell coordinator will collect, maintain each student proofs/reports from all faculty mentors, department internship analysis report will be prepared & submitted to Dean, IIIC for AICTE-CII survey data Students will submit evaluation sheet by attaching Xerox copies of all participation/ IPR/ Copyright certificates & faculty mentor will verify it with original copies, for assessment purpose.
TW Marks (25) & Certificate :	**Assessment & evaluation based on rubrics:** Hours Spent for Internship: max 20 marks Achievement/Recognition: max 05 marks **&** Internship and Activity Completion /Participation Certificates and Evaluating Report

SY (Semester IV)			
Internship Code	**Internship Name**	**Hours/Duration**	**Credits**
INT43	Internship-III	80-120 hrs (2 - 3 Weeks) Winter Vacation After **SEM-III & during SEM-IV of SY**	02

Prerequisite:	**Skill sets of engineering and technology specific tools, instruments, devices and programming languages etc.**
Internship Objectives:	**1.** To get the industrial environment expose for creating competent professionals for the industry. 2. To understand the psychology of the workers and their habits, attitudes and approach to problem solving.
Internship Outcomes:	**Upon completion of the course, students will be able to:** 1. Get an expose to work with the future employers. 2. Familiarize with various materials, processes, products and their applications along with relevant aspects of quality control in product development lifecycle.

Activity- Internship	**Supporting Activities to be completed under Internship** Internships in the field of: • Industries • Government Sector • Non-governmental Organization (NGO) • MSMEs • Rural Internship
Term Work Assessment: **Duration to be considered for assessment:** Week Ends/ Semester Break/End of Semester (After ESE & Before Next Term Start)	
Guidelines:	Batch wise Faculty Supervisor who is the proctor (mentor) of the batch will be allotted as in-charge for the course, at start of the Academic year. Students will submit the participation certificate of the activities to the faculty mentors. For working in cells related activities, Cell coordinator will submit list of actively involved & participated students of each department, semester wise to all department HODs, verified and authenticated by Dean Students Welfare. HOD will circulate the student list to all faculty mentors for consideration of Hours spends under mentioned department activities. Department IIIC Cell coordinator will collect, maintain each student proofs/reports from all faculty mentors, department internship analysis report will be prepared & submitted to Dean, IIIC for AICTE-CII survey data Students will submit evaluation sheet by attaching Xerox copies of all participation/ IPR/ Copyright certificates & faculty mentor will verify it with original copies, for assessment purpose.
TW Marks (25) & Certificate :	**Assessment & evaluation based on rubrics:** Hours Spent for Internship: max 20 marks Achievement/Recognition: max 05 marks **&** Internship and Activity Completion/Participation Certificates and Evaluating Report

TY (Semester V)			
Internship Code	**Internship Name**	**Hours/Duration**	**Credits**
INT54	Internship-IV	80-160 hrs (2 - 4 Weeks) Summer Vacation After **SEM-IV & during**	02

		SEM-V of TY	

Prerequisite:	**List of probable industries and organizations offering internships in Engineering and Technology. Awareness about problem areas in rural India**
Internship Objectives:	1. To get the awareness about engineer's responsibilities and ethics. 2. Opportunities to learn understand and sharpen the real time technical / managerial skills required at the job.
Internship Outcomes:	**Upon completion of the course, students will be able to:** **1.** Get an opportunity to practice communication and teamwork skills. 2. Get an opportunity to learn strategies like time management, multi-tasking etc. in an industrial setup.

Activity- Rural Internships &/ Internships	**Supporting Activities to be completed under Internship**
	1. Long Term Goal under Rural Development Internships or
	2. Mandatory internship for developing project with: • Industries • Government Sector • Non-governmental Organization (NGO) • MSMEs

Term Work Assessment:
Duration to be considered for assessment:
Week Ends/ Semester Break/End of Semester (After ESE & Before Next Term Start)

Guidelines:	Batch wise Faculty Supervisor who is the proctor (mentor) of the batch will be allotted as in-charge for the course, at start of the Academic year. Students will submit the participation certificate of the activities to the faculty mentors. For working in cells related activities, Cell coordinator will submit list of actively involved & participated students of each department, semester wise to all department HODs, verified and authenticated by Dean Students Welfare. HOD will circulate the student list to all faculty mentors for consideration of Hours spends under mentioned department activities. Department IIIC Cell coordinator will collect, maintain each student proofs/reports from all faculty mentors, department internship analysis report will be prepared & submitted to Dean, IIIC for AICTE-CII survey data Students will submit evaluation sheet by attaching Xerox copies of all participation/ IPR/ Copyright certificates & faculty mentor will verify it with original copies, for assessment purpose.

TW Marks (25) & Certificate :	**Assessment & evaluation based on rubrics:** Hours Spent for Internship: max 20 marks Achievement/Recognition: max 05 marks **&** Internship and Activity Completion/Participation Certificates and Evaluating Report

TY (Semester VI)			
Internship Code	**Internship Name**	**Hours/Duration**	**Credits**
INT65	Internship-V	80-160 hrs (2-4 Weeks) Winter Vacation **After SEM-V & during SEM-VI of TY**	02
Prerequisite:	**List of probable industries and organizations offering internships on live projects. Awareness about probable solutions for identified problem areas in rural India**		
Internship Objectives:	1. To understand the social, economic and administrative considerations of working environment in industries, government, NGOs and private organizations. 2. Learn to apply the Technical knowledge for solving real life problems.		
Internship Outcomes:	**pon completion of the course, students will be able to:** **1.** Get an opportunity to get hired by the Industry/ organization. 2. Decide if working in the industry or set up a start-up would be best career option to pursue.		
Activity- Rural Internships & Internships	**Supporting Activities to be completed under Internship**		
	1. Long Term Goal under Rural Development Internships or		
	2. Mandatory internship for developing project with: • Industries • Government Sector • Non-governmental Organization (NGO) • MSMEs		
Term Work Assessment: **Duration to be considered for assessment:** Week Ends/ Semester Break/End of Semester (After ESE & Before Next Term Start)			
Guidelines:	Batch wise Faculty Supervisor who is the proctor (mentor) of the batch will be allotted as in-charge for the course, at start of the Academic year. Students will submit the participation certificate of the activities to the		

	faculty mentors. For working in cells related activities, Cell coordinator will submit list of actively involved & participated students of each department, semester wise to all department HODs, verified and authenticated by Dean Students Welfare. HODs will circulate the student list to all faculty mentors for consideration of Hours spends under mentioned department activities. Department IIIC Cell coordinator will collect, maintain each student proofs/reports from all faculty mentors, department internship analysis report will be prepared & submitted to Dean, IIIC for AICTE-CII survey data Students will submit evaluation sheet by attaching Xerox copies of all participation/ IPR/ Copyright certificates & faculty mentor will verify it with original copies, for assessment purpose.
TW Marks (25) & Certificate :	**Assessment & evaluation based on rubrics:** Hours Spent for Internship: max 20 marks Achievement/Recognition: max 05 marks **&** Internship and Activity Completion/Participation Certificates and Evaluating Report

LY (Semester VII)			
Internship Code	**Internship Name**	**Hours/Duration**	**Credits**
INT76	Internship-VI	80-160 hrs (2-4 Weeks) **Summer Vacation of TY** and during **SEM-VII of LY**	02
Prerequisite:	**In depth knowledge about societal/research/innovation/entrepreneurial problems and appropriate applicable solutions available through use of technology.**		
Internship Objectives:	1. To gain the experience in preparing and writing Technical documentation/ reports for product/projects. 2. To Identify and analyse the societal/research/entrepreneurial problem in detail to define its scope with problem specific data. 3. To develop clarity of presentation based on communication, teamwork and leadership skills.		
Internship Outcomes:	**on completion of the course, students will be able to:** 1. Apply the engineering and technical knowledge for problem identification, analysis, design and developing solutions. 2. Present and demonstrate the real time problem solution across national/international project competitions and conference.		

<table>
<tr><td rowspan="4">Activity-
PBL-Major Project A-Work/
Seminars</td><td>Supporting Activities to be completed under Internship</td></tr>
<tr><td>r Sem VII PBL Course-Major Project-A, selected topic:
1. Review literature through reference papers from reputed conferences/ journals like IEEE, Elsevier, ACM etc. which are not more than 3 years old.</td></tr>
<tr><td>2. Participate in multiple Project Competitions presenting the Project A solution</td></tr>
<tr><td>3. Participation in International Conferences presenting the literature review and/or hypothesis for innovative solution.</td></tr>
<tr><td></td><td>4. Participation at institute annual International Conference on Advances in Science and Technology-ICAST & other Conferences /Journals.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">Term Work Assessment:
Duration to be considered for assessment:
Week Ends/ Semester Break/End of Semester (After ESE & Before Next Term Start)</td></tr>
<tr><td>Guidelines:</td><td>Batch wise Faculty Supervisor who is the proctor (mentor) of the batch will be allotted as in-charge for the course, at start of the Academic year.
Students will submit the participation certificate of the activities to the faculty mentors.
Department IIIC Cell coordinator will collect, maintain each student proofs/reports from all faculty mentors, department internship analysis report will be prepared & submitted to Dean, IIIC for AICTE-CII survey data
Students will submit evaluation sheet by attaching Xerox copies of all participation/ IPR/ Copyright certificates & faculty mentor will verify it with original copies, for assessment purpose.</td></tr>
<tr><td>TW Marks (25)
&
Certificate :</td><td>Assessment & evaluation based on rubrics:
Hours Spent for Internship: max 20 marks
Achievement/Recognition: max 05 marks
&
Certificate Based on:
1.Project Competition certificate,
2. Participation in Conferences/Publications and/or proof of ICAST participation & presentation.</td></tr>
</table>

<table>
<tr><th colspan="4">LY (Semester VIII)</th></tr>
<tr><th>Internship Code</th><th>Internship Name</th><th>Hours/Duration</th><th>Credits</th></tr>
<tr><td>INT87</td><td>Internship-VII</td><td>80-160 hrs
(2-4 Weeks)
Winter Vacation of Sem VII
and during SEM-VIII of LY</td><td>02</td></tr>
<tr><td>Prerequisite:</td><td colspan="3">In depth knowledge about filling IPR/ copywriting a product/solution.</td></tr>
<tr><td>Internship Objectives:</td><td colspan="3">1. To gain the knowledge of filling patent and Copy write.
2. Presenting technology solutions across worldwide problems through competitions and publications.</td></tr>
<tr><td>Internship Outcomes:</td><td colspan="3">Upon completion of the course, students will be able to:
1. National and international recognition through IPR and/or copy writes and paper publications.
2. Convert problem solution as a business plan for entrepreneurial product.</td></tr>
<tr><td rowspan="4">Activity-
PBL Major Project B Work/Conference Presentation</td><td colspan="3">Supporting Activities to be completed under Internship</td></tr>
<tr><td colspan="3">r Sem VIII PBL Course-Major Project-B, selected topic:
1. File for Project solution Copyright and/or File for Project topic IRP/Patent</td></tr>
<tr><td colspan="3">Participate at Institute Annual Project Competition-INTECH</td></tr>
<tr><td colspan="3">3. Publish the project solution at reputed International Journals, preference should be given to UGC care list and/or SCI indexed journals.</td></tr>
<tr><td colspan="4">Term Work Assessment:
Duration to be considered for assessment:
Week Ends and during Semester</td></tr>
<tr><td>Guidelines:</td><td colspan="3">. Batch wise Faculty Supervisor who is the proctor (mentor) of the batch will be allotted as in-charge for the course, at start of the Academic year.
. Students will submit the participation certificate of the activities to the faculty mentors.
. Department IIIC Cell coordinator will collect, maintain each student proofs/reports from all faculty mentors, department internship analysis report will be prepared & submitted to Dean, IIIC for AICTE-CII survey data
. Students will submit evaluation sheet by attaching Xerox copies of all participation/ IPR/ Copyright certificates & faculty mentor will</td></tr>
</table>

	verify it with original copies, for assessment purpose.
TW Marks (25) & Certificate :	**Assessment & evaluation based on rubrics:** Hours Spent for Internship: max 20 marks Achievement/Recognition: max 05 marks **&** **Certificate Based on:** 1.Project Copyright/ Project IRP 2. Project Competition certificate (INTECH) 3.International Journal Publication proof