Bharati Vidyapeeth

(Deemed to be University)

Pune, India

College of Engineering, Pune

Programme Number:

Sr. no	Programme Name	Programme Code
1	B.Tech (Chemical Engg)	01
2	B.Tech (Civil Engg)	02
3	B.Tech (Computer Engg)	03
4	B.Tech (Computer Science & Engg)	04
5	B.Tech (Computer Science & Engg) (AIML)	05
6	B.Tech (Computer Science & Business Systems)	06
7	B.Tech (Electrical & Computer Engg)	07
8	B.Tech (Electronics & Communication Engg)	08
9	B.Tech (Electronics & Telecommunication Engg)	09
10	B.Tech (Information Technology)	10
11	B.Tech (Mechanical Engg)	11
12	B.Tech (Robotics & Automation Engg)	12
13	Engineering Science	13
14	Architecture	14

A. COURSE CODE AND DEFINITION

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
TW	Term Work
O	Oral
SEE	Semester End Examination
MJ	Major (Core) Courses
MI	Minor Courses
GE	General Elective Courses
OE	Open Elective Courses
SE	Skill Enhancement Courses
AE	Ability Enhancement Courses

VE	Vocational Enhancement Courses
VS	Vocational Skill Courses
VA	Value Added Courses
CC	Co-curricular Courses
ID	Inter-disciplinary Courses
MD	Multidisciplinary Courses
RP	Research / Project Courses
PC	Practical Courses
BS	Basic Science
ES	Engineering Science

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE
B. Tech. (E & Tc): Semester –I (NEP 2020 COURSE)

Sr. No	Category	Subject Code	Subject	Teaching Scheme			Examination Scheme-Marks						Credits			
				L	P	T	ESE	Internal Assessment	TW	PR	OR	Total	Th	TW/Pr/Or	Tut	Total
1.	BS	BM1113101	Engineering Mathematics- I	3	-	1	60	40	-	-	-	100	3	0	1	4
2.	BS	BP1113102	Engineering Physics	3	2	-	60	40	50	-	-	150	3	1	0	4
3.	ES	ET1107103	Electrical Technology	4	2	-	60	40	25	-	-	125	4	1	0	5
4.	ES	ES1104104	Computer Programming-I	3	2	-	60	40	25	-	-	125	3	1	0	4
5.	MJ	MJ1109105	Elementary Electronics	4	2	-	60	40	50	-		150	4	1	0	5
6.	AE	UH1113106	Universal Human Values	-	2	-	-	-	50	-	-	50	0	1	0	1
7.	SE	SE1109107	Skill-based Course-I Fundamentals of MATLAB Programming	-	4	-	-	-	25	-	25	50	0	2	0	2
			Total	**17**	**14**	**1**	**300**	**200**	**225**	**0**	**25**	**750**	**17**	**7**	**1**	**25**

B. Tech. (E & Tc): Semester – II (NEP 2020 COURSE)

Sr. No	Category	Subject Code	Subject	Teaching Scheme			Examination Scheme-Marks						Credits			
				L	P	T	ESE	Internal Assessment	TW	PR	OR	Total	Th	TW/Pr/Or	Tut	Total
1.	BS	BM1113201	Engineering Mathematics- II	3	-	1	60	40	-	-	-	100	3	0	1	4
2.	BS	BC1113202	Engineering Chemistry	3	2	-	60	40	50	-	-	150	3	1	0	4
3.	ES	ES1104203	Computer Programming-II	3	2	-	60	40	25	-	-	125	3	1	0	4
4.	ES	ES1111204	Computer-Aided Engineering Graphics	4	2	-	60	40	50	-	-	150	4	1	0	5
5.	MJ	MJ1109205	Digital Electronics	4	2	-	60	40	25	-	-	125	4	1	0	5
6.	AE	AE1113206	Communication Skills	-	2	-	-	-	50	-	-	50	0	1	0	1
7.	SE	SE1109207	Skill-based Course - II Electronics Workshop	-	4	-	-	-	25	-	25	50	0	2	0	2
			Total	**17**	**14**	**1**	**300**	**200**	**225**	**0**	**25**	**750**	**17**	**7**	**1**	**25**

B. Tech. (E & Tc): Semester – III (NEP 2020 COURSE)

Sr. No	Category	Subject Code	Subject	Teaching Scheme			Examination Scheme-Marks						Credits			
				L	P	T	ESE	Internal Assessment	TW	PR	OR	Total	Th	TW/Pr/Or	Tut	Total
1.	MJ	MJ1109301	Data Structure and Algorithms	3	2	-	60	40	25	-	25	150	3	1	0	4
2.	MJ	MJ1109302	Semiconductor Devices and Circuits	3	2	-	60	40	25	25	-	150	3	1	0	4
3.	MJ	MJ1109303	Signals and Systems	3	-	1	60	40				100	3	0	1	4
4.	MJ	MJ1109304	Network Analysis	3	-	-	60	40	-	-	-	100	3	0	0	3
5.	ID	ID1109305	Database Management Systems	3	2		60	40	25	-	25	150	3	1	0	4
6.	SE	SE1109306	Skill-based Course –III- EDA Tool Practices		2				25	-	25	50	0	1	0	1
			Total	**15**	**8**	**1**	**300**	**200**	**100**	**25**	**75**	**700**	**15**	**4**	**1**	**20**
7.	AE	AE1109307	MOOC-I*	-		-		-	-	-	-	-	-	-	-	2
8.	VA	VA1109308	Value Added Course*	2	-	-	-	100	-	-	-	-	-	-	-	2

* Indicate this is mandatory but the credits will not be considered in SGPA/CGPA

B. Tech. (E & Tc): Semester – IV (NEP 2020 COURSE)

Sr. No	Category	Subject Code	Subject	Teaching Scheme			Examination Scheme-Marks						Credits			
				L	P	T	ESE	Internal Assessment	TW	PR	OR	Total	Th	TW/Pr/Or	Tut	Total
1.	MJ	MJ1109401	Electromagnetics and Transmission Lines	3		1	60	40				100	3	0	1	4
2.	MJ	MJ1109402	Sensors and Control Systems	3	-	-	60	40	-		-	100	3	0	0	3
3.	MJ	MJ1109403	Integrated Circuits and Applications	3	2	-	60	40	25	25	-	150	3	1	0	4
4.	MJ	MJ1109404	Analog Communication	3	2	-	60	40	25	-	25	150	3	1	0	4
5.	ID	ID1109405	Introduction to Data Science	3	2		60	40	25	-	25	150	3	1	0	4
7.	SE	SE1109406	Skill-based Course -IV Microcontroller Programming		2				25	-	25	50	0	1	0	1
			Total	**15**	**8**	**1**	**300**	**200**	**100**	**25**	**75**	**700**	**15**	**4**	**1**	**20**
8.	SA	SA1109408	Social Activity*	-		-		-	-	-	-	-	-	-	-	2
9.	AC	AC1113407	Indian Knowledge System*	2	-	-	-	100	-	-	-	-	-	-	-	2

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COLLEGE OFENGINEERING, PUNE
B. Tech. (E & Tc): Semester – V (NEP 2023COURSE)

Sr. No.	Subject	Teaching Scheme			Examination Scheme-Marks						Credits			
		L	P	T	ESE	Internal Assessment	TW	PR	OR	Total	Th	PR/OR	Tut	Total
1.	Digital Communication	3	2	-	60	40	25	-	25	150	3	1	0	4
2.	Embedded Systems	3	2	-	60	40	25	25	-	150	3	1	0	4
3.	Power Electronics	3	2	-	60	40	25	-	25	150	3	1	0	4
4.	Data Communication andNetworking	3	0	-	60	40	-	-	-	100	3	0	0	3
5.	Microwave Theory and Antenna	3	-	1	60	40	-	-	-	100	3	0	1	4
6.	Skill-based Course –V Hardware Description Language	-	2	-	-	-	25	-	25	50	0	1	0	1
7.	Environmental Studies	4	-	-	60	40	-	-	-	100	4	-	-	4
	Total	**19**	**08**	**01**	**360**	**240**	**100**	**25**	**75**	**800**	**19**	**04**	**01**	**24**

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B. Tech. (E & Tc): Semester – VI (NEP 2023COURSE)

Sr. No	Subject	Teaching Scheme			Examination Scheme-Marks						Credits			
		L	P	T	ESE	Internal Assessment	TW	PR	OR	Total	Th	PR/OR	Tut	Total
1.	Digital Signal Processing	3	2	-	60	40	25	-	25	150	3	1	0	4
2.	Information Theory and Coding	3	-	-	60	40	-	-	-	100	3	0	0	3
3.	Digital CMOS Design	3	2	-	60	40	25	25	-	150	3	1	0	4
4.	Fiber Optic Communication	3	2	-	60	40	25	-	-	125	3	1	0	**4**
5.	PEC-I	3	-	-	60	40	-	-	-	100	3	0	0	3
6.	Professional Skills	-	2	-	-	-	25	-	-	25	-	1	-	**1**
7.	Skill-based Course –VI-Mini Project	-	2	-	-	-	25	-	25	50	0	1	0	1
	Total	**15**	**10**	-	**300**	**200**	**125**	**25**	**50**	**700**	**15**	**05**	**0**	**20**
8.	**Value Added Course- II	2	-	-	-	100	-	-	-	100	02	-	-	2
9.	**MOOC – II	-	-	-	-	-	-	-	-	-	-	-	-	2

Program Elective Course (PEC) List

Sr. No	PEC-I
1	Sensors & Instrumentation
2	Internet of Things
3	Operating Systems
4	Digital Control System

****indicate this is mandatory but the credits will not be considered in SGPA/CGPA**

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B. Tech. Sem. I: Electronics & Telecommunication Engineering **SUBJECT: - Engineering Mathematics-I**			
Designation of Course	**Engineering Mathematics-I(Common for all Branches)**		
Teaching Scheme:	**Examination Scheme:**		**Credits Allotted**
Theory:- 03 Hours/ Week	End Semester Examination	60 Marks	Theory: 03 Tutorial: 01 Practical: 00
Practical :- 00 Hours/ Week	Internal Assessment	40 Marks	
Tutorial :- 01 Hours/ Week	Term Work	00 Marks	
	Oral/Practical Examination	00 Marks	
	Total	100 Marks	04

Course Prerequisites:-	The students should have knowledge of Algebra of matrices and its Determinants, Maxima and Minima of single variable functions.
Course Objective	On completion of the course – 1. Fundamental theorems, concepts in Matrices, Demoivr's theorem and its applications in engineering. 2. Various techniques in Calculus, Explanation of functions and Infinite series. 3. Partial differentiation, maxima, minima and its applications in engineering.
Course Outcomes:-	After completion of the course students will be able to 1. Understand rank of matrix and apply it to solve system of linear equations 2. Understand the DeMoiver's theorem, hyperbolic functions and apply it in engineering problems. 3. Understand the Leibnitz's rule and apply it to find nth derivative of a function. 4. Understand fundamental concepts of convergence, divergence of infinite series and its tests. 5. Understand the concept of partial differentiation and apply it to find total derivative. 6. Evaluate the maxima and minima of any two variables functions..

Unit I:Matrices **(06 Hrs)**
Rank, Normal form, System of Linear Equations, Linear Dependence and Independence, Linear and Orthogonal Transformations, Eigen values, Eigen Vectors, Cayley – Hamilton Theorem.

Unit II: Complex Numbers and Applications: **(06 Hrs)**
Definition, Cartesian, Polar and Exponential Forms, Argand's Diagram, De'Moivre's theorem and its application to find roots of algebraic equations., Hyperbolic Functions, Logarithm of Complex Numbers, Separation into Real and Imaginary parts, Application to problems in Engineering.

Unit III: Differential Calculus: **(06 Hrs)**
Successive Differentiation, nth Derivatives of Standard Functions, Leibnitz's Theorem,.
Expansion of Functions: Taylor's Series and Maclaurin's Series

Unit IV: Differential Calculus: **(06 Hrs)**
Indeterminate Forms, L' Hospital's Rule, Evaluation of Limits.
Infinite Series: Infinite Sequences, Infinite Series, Alternating Series,Tests for Convergence, Absolute and Conditional Convergence, Power series, Range of Convergence

Unit V: Partial Differentiation and Applications: **(06 Hrs)**
Partial Derivatives, Euler's Theoremon Homogeneous Functions, Implicit functions, Total Derivatives, Change of Independent Variables, Errors and Approximations.

Unit VI: Jacobian: **(06 Hrs)**
Jacobians and their applications, Chain Rule, Functional Dependence.
Maxima and Minima: Maxima and Minima of Functions of two variables, Lagrange's method ofundeterminedmultipliers.

PBL: Project Base Learning (Topics)

1	Echelonform
2	Normalform
3	Linearandorthogonaltransformation
4	Eigenvaluesandeigenvectors
5	Arganddiagram
6	De Movre'stheorem
7	Hyperbolicandlogarithmicfunctions
8	Leibnitztheorem
9	Taylor'stheorem
10	L'Hospitalrule
11	Testsforconvergence
12	Eulertheoremforhomogeneousfunctions
13	Totalderivative
14	Maximaandminimafortwovariablefunction
15	Langrageundeterminedmultipliers

Textbooks

1. Applied Mathematics (Volumes I and II) by P. N. Wartikar& J. N. Wartikar (Pune Vidyarthi GrihaPrakashan, Pune),7th Edition, 1988, Reprint 2010.

Reference Books

1.Higher Engineering Mathematics by B.S. Grewal (Khanna Publication, Delhi), 42th

Edition, 2012

2. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill), Edition, 2008
3. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.), 8th Edition, 1999, Reprint 2010
4. Advanced Engineering Mathematics, 7e, by Peter V.O'Neil (Thomson Learning), Edition 2007
5. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education), 2nd, Edition, 2002

Unit Test –

Unit Test - I	**Unit I, II, III**
Unit Test - II	**Unit IV, V, VI**

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B. Tech. Sem. I: Electronics & Telecommunication Engineering **SUBJECT: - Engineering Physics**			
Designation of Course	**Engineering Physics (Common for all Branches)**		
Teaching Scheme:	**Examination Scheme:**		**Credits Allotted**
Theory:- 03 Hours/ Week	End Semester Examination	60 Marks	Theory: 03 Tutorial: 00 Practical: 01
Practical :- 02 Hours/ Week	Internal Assessment	40 Marks	
Tutorial :- 00 Hours/ Week	Term Work	50 Marks	
	Oral/Practical Examination	00 Marks	
	Total	150 Marks	04

Course Prerequisites:-	Students are expected to have a basic understanding of physics and calculus.
Course Objective	To impart knowledge of basic concepts in physics relevant to engineering applications in a broader sense with a view to lay foundation for the engineers.
Course Outcomes:-	After completion of the course students will be able to 1. Analyze the properties of charged particles to develop modern instruments such as electron microscopy. 2. Understand the problems associated with architectural acoustics and give their remedies and use ultrasonic as a tool in industry for non destructive testing. 3. Apply quantum physics problems to micro level phenomena and solid state physics. 4. Understand the wave nature of light and apply it to measure stress, pressure and dimension etc. 5. Apply the principles of lasers and fiber optics for applications in the field of engineering. 6. Rememberproperties of solid matter and connect to applications in the field of engineering.

Unit I:Modern Physics (6 Hrs)

Motion of a charged particle in electric and magnetic fields, Electrostatic and Magnetostatic focussing, Electron microscopy, interaction of electron beam with the material, Wavelength and resolution, transmission electron microscope (TEM), scanning electron microscope (SEM), Separation of isotopes by Bainbridge mass spectrograph, cathode ray tube (CRT), CRT in cathode ray oscilloscope (CRO).

Unit II. Architectural Acoustics (6Hrs)

Elementary acoustics, Reverberation and reverberation time, Sabine's formula (without Derivation), Intensity level, Sound intensity level, Loudness, Sound absorption, Sound absorption coefficient, different types of noise and their remedies, basic requirement for

acoustically good hall, factors affecting the architectural acoustics and their remedies, introduction to ultrasonics, Production of ultrasonics by magnetostriction and piezoelectric methods, applications (thickness measurement, flaw detection).

Unit III: Quantum mechanics (6hrs)

Dual nature of matter, concept of wave packet, group and phase velocity and relation between them, physical significance of wave function, Schrodinger's time dependant and time independent wave equation, Application of Schrodinger's time independent wave equation to the problems of Particle in a rigid box, concept of tunnelling at potential barrier (no derivation-only conceptual discussion).

Unit IV: Optics – I (Interference and Diffraction) (6 Hrs)

INTERFERENCE: Interference due to thin film of uniform thickness and nonuniform thickness, engineering applications of interference (optical flatness, non-reflecting coatings).
DIFFRACTION: Diffraction at a single slit (Geometrical method), Conditions for maximum and minimum, Diffraction at a circular aperture (Result only), Plane diffraction grating, Conditions for principal maxima and minima.

Unit V: Optics – II (Polarisation and Lasers) (6 Hrs)

POLARISATION: Introduction, Double refraction and Huygen's theory, Positive and negative crystals, Nicol prism.
LASERS: Lasers introduction, Characteristics of Lasers, Working principle and components of He-Ne Laser, Nd -YAG Laser, Semiconductor diode Laser, Applications in the field optical fiber (Principle, Acceptance angle and acceptance cone, Numerical aperture, Types of optical fibers, Fiber optic communication).

Unit VI. Solid State Physics (6Hrs)

Origin of band gap, Energy bands in solids, Fermi-Dirac probability function and position of Fermi level in intrinsic semi-conductors (with derivation) and in extrinsic semi-conductors, Formation and band structure of p-n junction, Hall effect and Hall coefficient.
Introductions of nanoparticles, properties of nanoparticles (Optical, electrical, Magnetic, structural, mechanical), synthesis of nanoparticles (Physical and chemical), quantum dots – wide band semiconductors, direct/indirect band gap semiconductors.

PBL : Project Based Learning (topics)

Sr. No.	Topic
1.	Tesla Coil
2.	Thin film interference in soap film-formation of colors
3.	LiFi- wireless data transfer system using light

4.	Need of medium for propagation of sound wave
5.	Possible effects of electromagnetic fields (emf) on human health
6.	Design and simulation of automatic solar powered time regulated water pumping
7.	Solar technology: an alternative source of energy for national development
8	Measurement and effect of environmental noise in the college
1.	Electronic eye (Laser Security) as auto-switch/security system
2.	Electric power generation by road
3.	Design and construction of distance measuring instrument using LASER
4.	Design and construction of remote control devices – electronic bell, Fan etc
5.	Absorption coefficient of sound absorbing materials
6.	Velocity determination of O-ray and E-ray in double refracting materials
7.	Velocity determination of O-ray and E-ray in double refracting materials
8.	The design and construction of the hearing aid device
9.	Study of Quantum confinement effect
10.	Wind turbines - a source of electricity
11.	Measurement of gravitational constant ‘g’

Practical (Any Eight of the Following)

1. Determination of radius of planoconvex lens/wavelength of light/Flatness testing by Newton’s rings
2. Determination of wavelength of light using diffraction grating
3. Determination of frequency of ac voltage by CRO.
4. Determination of refractive index for O-ray and E-ray
5. Determination of divergence of a laser beam
6. Particle size by semiconductor laser

7. Determination of wavelength of laser by diffraction grating
8. To study Hall effect and determine the Hall voltage
9. Calculation of conductivity by four probe method
10. Study of solar cell characteristics and calculation of fill factor
11. Determination of band gap of semiconductor
12. Synthesis of metal oxide nanoparticles (ZnO/ZnS/silver/Gold)
13. Measurement of average SPL across spherical wavefront and behaviour with the distance
14. Determination of velocity of sound in liquid by ultrasonic interferometer
15. Study of B-H curve of a sample.
16. Determination of Plank's constant.

Text Books

1. A Textbook of Engineering Physics, M N Avadhanulu, P G Kshirsagar and TVS Arun Murthy, S. Chand Publishing (2018)
2. Engineering Physics, R K Gaur and S L Gupta, Dhanpat Rai Publishing Co Pvt Ltd (2015)
3. Concepts of Modern Physics, Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, McGraw Hill Education (2017)

Reference Books

1. Fundamentals of Physics, Jearl Walker, David Halliday and Robert Resnick, John Wiley and Sons (2013)
2. Optics, Francis Jenkins and Harvey White, Tata Mcgraw Hill (2017)
3. Principles of Physics, John W. Jewett,Cengage publishing (2013)
4. Introduction to Solid State Physics, C. Kittel, Wiley and Sons (2004)
5. Principles of Solid State Physics, H. V. Keer, New Age International (1993)
6. Laser and Non-Linear Optics, B. B. Laud, New Age International Private Limited (2011)
7. Nanotechnology: Principles and Practices, Dr. S. K. Kulkarni, Capital Publishing Company (2014)
8. Science of Engineering Materials- C.M. Srivastava and C. Srinivasan, New Age International Pvt. Ltd. (1997)

Unit Test –

Unit Test - I	**Unit I, II, III**
Unit Test - II	**Unit IV, V, VI**

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B. Tech. Sem. I: Electronics & Telecommunication Engineering **SUBJECT: - Electrical Technology**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04 Hrs / Week	**End Semester Examination:** 60 Marks	**Theory:**04 Credits
Practical: 02 Hrs / Week	**Continuous Assessment:** 40 Marks	**Practical:**01 credit
	TW: 25Marks	**Total:**05 Credits

Course Pre-requisites:

The students should have basic knowledge of

1.	Mathematics, Physics and Chemistry.

Course Objectives:

	The course introduces fundamental concepts of DC and AC circuits, electromagnetism, transformer, electrical wiring, illumination and Tariff system.

Course Outcomes: After learning this course the students will be able to

1.	Apply knowledge of basic concepts of work, power,and energy for energy conversion and calculate current in electrical networks using Kirchoff's laws.
2.	Analyze the response of electrical DC circuits using network theorems.
3.	Define and understand basic terms of single-phaseA.C.circuits and supply systems.
4.	Define and understand the basic terms of three phase A.C. circuit and the measurement of three-phase power.
5.	Discuss and apply fundamental concepts of magnetic circuitsand electro-mechanics for the operation of single-phasetransformers.
6.	Explain the layout of the distribution system, illumination, types of wiring, earthing system and Tariff system.

UNIT - I	**Introduction**	**(08 Hrs)**
	Concept of EMF, Potential difference, voltage, current, resistance. Fundamental linear, passive and active elements, voltage sources and current sources, ideal and practical sources, concept of dependent and independent sources, Kirchhoff-s laws and applications to network solutions using mesh and nodal analysis,	

	Batteries: Principle, types, construction and working.	
UNIT - II	**DC Circuits**	**(08 Hrs)**
	Current-voltage relations of the electric network by mathematical equations to analyze the network (Superposition theorem, Thevenin's theorem, Norton's Theorem, Maximum Power Transfer theorem), Simplifications of networks using series-parallel, Star/Delta transformation.	
UNIT - III	**Single-phaseAC Circuit**	**(08 Hrs)**
	Sinusoidal AC waveform definitions, form factor, peak factor, study of R-L, R-C,RLC series circuit, R-L-C parallel circuit, resonance, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive and apparent power, power factor. (Simple numerical problems).	
UNIT - IV	**Three-phase AC circuit**	**(08 Hrs)**
	Three-phase system-its necessity and advantages, meaning of phase sequence, line and phase voltage/current relations, star and delta connections, balanced supply and balanced load, three-phase power and its measurement (simple numerical problems).	
UNIT - V	**Electro-Mechanics**	**(08 Hrs)**
	Electricity and Magnetism, magnetic field and Faraday's law, self and mutual inductance, Magnetic circuit, Magnetic material and B-H Curve, Single phase transformer, principle of operation, EMF equation, voltage ratio, current ratio, kVA rating, losses in transformer, efficiency and regulation, Determination of efficiency & regulation by direct load test.	
UNIT - VI	**Electrical Wiring and Components**	**(08 Hrs)**
	The basic layout of the distribution system, Types of wiring system & wiring accessories, Types of lamps (Incandescent, Fluorescent, Sodium Vapour, LED),Necessity of earthing, Types of earthing, Tariff –introduction and types.	
Term Work:		
The term work shall consist of a record of a minimum of eight experiments.		
1. Familiarization with electrical Elements, sources, and measuring devices related to electrical circuits. 2. Study of residential electricity bills. 3. Verification of the Superposition theorem 4. Verification of Thevenin's theorem 5. Verification of Norton's theorem 6. Verification of Kirchhoff's laws		

7. Verification of Maximum power transfer theorem
8. Study of R-L, R-C series, and parallel circuits.
9. Study of R-L-C series circuits for $X_L > X_C$, $X_L < X_C$ & $X_L = X_C$
10. Verification of the relation between voltage and current in three-phase balanced star and delta-connected loads.
11. Demonstration of measurement of electrical quantities in DC and AC systems.
12. Determination of efficiency & regulation of single-phase transformer by direct load test.

Text Books:

1. Electric Machinery,(Sixth Edition) A.E. Fitzgerald, KingselyJr Charles, D. Umans Stephen, Tata McGraw Hill.
2. A Textbook of Electrical Technology,(vol. I& II),B. L. Theraja, Chand and Company Ltd., New Delhi.
3. Basic Electrical Engineering, V. K. Mehta, S. Chand and Company Ltd., New Delhi.
4. Theory and problems of Basic Electrical Engineering, (SecondEdition), J. Nagrath and Kothari, Prentice Hall of India Pvt. Ltd.

Reference Books:

1. Basic of Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press.
2. Introduction to Electrodynamics, D. J. Griffiths, (Fourth Edition), Cambridge University Press.
3. Engineering Circuit Analysis, William H. Hayt& Jack E. Kemmerly, McGraw-Hill Book Company Inc.
4. Fundamentals of Electrical and Electronics Engineering,Smarjith Ghosh, Prentice Hall (India) Pvt. Ltd.
5. Edward Hughes – "Electrical Technology"- Seventh Edition, Pearson Education Publication
6. H. Cotton – "Elements of Electrical Technology", C.B.S. Publications
7. John Omalley Shawn – "Basic circuits analysis" McGraw Hill Publications
8. Vincent Del Toro – "Principles of Electrical Engineering", PHI Publications

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

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B. Tech. Sem. I: Electronics & Telecommunication Engineering

SUBJECT: - COMPUTERPROGRAMMING - I

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03	End Semester Examination: 60 Marks	Theory Credits: 03
Practical: 02	Continuous Assessment: 40 Marks	Practical Credits: 01
Tutorial: 00	TW: 25 Marks	Total Credits: -04

Course Pre-requisites:

The students should have knowledge of

1.	Flowchart

Course Objectives:

- A student will gain a thorough understanding of the fundamentals of C programming.
- A student will be able to code, compile, and test C programs.
- A Student will be able to solve problems using C language

Course Outcomes: After learning this course students will be able to

1	Apply the basic concepts of programming using C language.
2	Write basic programs using conditional statements.
3	Use 2 D Array in programming
4	Create functions and Pass parameters.
5	Construct structures using Pointers.
6	Apply basic concepts of graphics using C language.

UNIT – I	**Introduction Basic of C**	**(06 Hours)**
	Structure of a C program, identifiers, basic data types and sizes. Constants, variables, arithmetic, relational and logical operators, Sample programs.	
UNIT – II	**Conditional Statements and Loops**	**(06 Hours)**
	Decision making within a program, conditions, if statement, if-else statement, loops: while loop, do while for loop. Nested loops, switch statements, sample programs.	

UNIT - III	**Arrays & Strings**	**(07 Hours)**
	Arrays - concepts, declaration, definition, accessing elements, storing elements, Strings and string manipulations, 1-D arrays, 2-D arrays, string manipulations.	
UNIT -IV	**Functions & Pointers**	**(05 Hours)**
	Basics, parameter passing, storage classes- extern, auto, register, static, scope rules, user-defined functions, recursive functions, example c programs. Passing arrays & strings to functions.	
UNIT -V	**Pointers and Structures**	**(07 Hours)**
	Derived types- structures- declaration, definition, and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures.	
UNIT -VI	**Basic of Graphics**	**(05 Hours)**
	Introduction, what is computer Graphics? Area of Computer Graphics. Graphics programming, C Graphical functions, simple programs.	

Term Work: Any 8 of the below-given list

1.
- Write a C program to take user input and print it on the screen.
- Write a C program to perform the addition or subtraction of two numbers.
- Write a C program to find whether the number is Odd or Even.
- Write a C program to find out Prime numbers.
- Write a C program to find out the Fibonacci series.

2.
- Write C programs to print different patterns.
- Write a C program to do factorial using recursion.
- Write a C program to find out Armstrong's number

3.
- Write a C program to sort the array in Ascending & Descending order.
- Write C programs to perform operations on 2-D arrays.
- Write a C program to perform different operations on strings.

4.

- Use of Pointers
- Write a C program to swap numbers using pointers.

5. Write a C program to show the use of pointers in arrays.

6. Write a C program to use functions using pointers.

7. Write a C program to create a student mark sheet using structures.

8. Write a C program to show the use of structure using pointers.

9. Write a program showing functions of Graphics programming

10. Mini Project.

Textbooks:

1.Programming in ANSI C – E Balagurusamy (5th Edition-TMH)

2.C Graphics & Projects – By B M Havaldar

Reference Books:

1. Let Us C- Yashwant Kanitkar

2. Computer Graphics – By Hearn & Baker

3. The C Programming Language. 2nd Edition By Brian Kernighan and Dennis Ritchie

Bharati Vidyapeeth
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College of Engineering, Pune

B. Tech. Sem. I: Electronics & Telecommunication Engineering **SUBJECT: - Elementary Electronics**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination: 60 Marks	Credits: 04
Practical: 02	Internal Assessment: 40 Marks	
	TW : 50 Marks	Credits: 01
		Total Credit: 05

Course Pre-requisites: Physics, Chemistry, Mathematics (Higher Secondary Level)

Course Objectives:

1.	To introduce the construction, working, ratings and application of passive devices.
2.	To introduce types of Voltage and current sources.
3.	To introduce the construction, working and ratings of PN junction diode and diode circuits.
4.	To introduce the methods of analysis of BJT biasing circuits.
5.	To introduce methods to analyze JFET & MOSFET circuits.
6.	To introduce the construction, working and ratings of optoelectronic devices like LDR, LED, phototransistor and photovoltaic cell.

Course Learning Outcomes: After learning this course students will be able to

1	Identify and analyze circuits using passive devices.
2	Analyze the voltage sources and current sources.
3	Analyze the diode circuits.
4	Analyze the BJT biasing circuits.
5	Analyze the JFET & MOSFET circuits.
6	Identify and use optoelectronic devices based on their types and ratings and plot their characteristic curves.

UNIT – I	**Passive Electronic Components.**	**(08 Hours)**
	Introduction to the concept of active and passive electronic devices, Types of resistors, construction, ratings and typical applications, Types of capacitors, construction, ratings and typical applications, Types of inductors, construction, ratings and typical	

	applications, Types of transformers, construction, ratings and typical applications, Construction of relays, types and ratings, Analysis of series and parallel resistors and capacitor circuits	
UNIT – II	**Sources**	**(08 Hours)**
	Types of voltage and current sources (AC and DC), Concept of ideal and non-ideal voltage source, Concept of ideal and non-ideal current source, Series and parallel combinations of sources, Loading effect, Dependent voltage and current sources, Electrochemical cells and batteries, Types and characteristics, Regulation concept (Line regulation, load regulation, temperature stability factor)	
UNIT - III	**PN junction diode and diode circuits**	**(08 Hours)**
	Classification of material based on band gap theory, Types of semiconductors (p-type and n-type),pn junction diode and its characteristics, Concept of DC and AC load line and ratings of pn junction diode. Analysis of Rectifier circuits (HWR, FWR, Bridge, Dual Complementary), Clippers, Clampers, Voltage Multipliers, Special diodes (zener diodes, Schottky diodes, Gold-diffused diodes).	
UNIT - IV	**BJT and BJT biasing**	**(08 Hours)**
	Introduction to BJT (npn and pnp) and its construction and working mechanism, BJT configurations (CE,CC,CB) and their input and output characteristics, Types and ratings of BJT Need of biasing circuits, Analysis of BJT biasing circuits like fixed bias, collector to base bias, voltage divider bias, Concept of DC load line.	
UNIT -V	**FET and MOSFET**	**(08 Hours)**
	Construction and working mechanism of FET ,Input and output characteristics of FET, Construction and working of DMOSFET and EMOSFET, Characteristics of DMOSFET and EMOSFET, Configurations (CS, CD, CG) EMOSFET biasing (negotiated bias/Voltage divide bias, drain feedback biasing), DC load line, MOSFET as switch.	

UNIT - VI	**Opto-Electronics**	**(08 Hours)**
	Construction and working of LDR and its characteristics, simple application , Construction and working of LED and its characteristics and ratings, Photo-transistor and its characteristics , Introduction to the concept of electrical isolation and its importance , Construction of opto-isolator(opto-coupler) and its ratings , Construction and working of photovoltaic cell and its characteristics and ratings	

List of Experiments: (Any 8 Experiments from following list)

1. Study of resistors, capacitors, inductors and relays.
2. Plot V-I Characteristics of PN Junction Diode
3. Plot V-I Characteristics of Zener Diode
4. To study different types of Diode Clipper circuits and diode Clamper circuits
5. Plot Input and Output Characteristics of BJT in CE Configuration.
6. Plot Transfer and output characteristics of FET
7. Plot Transfer and output characteristics of MOSFET
8. Plot characteristics and response of LDR
9. Plot characteristics of Opto-isolator

Textbooks/Reference Books

1. Passive Components for Circuit Design, Ian Sinclair,1st Edition 2000, ISBN: 9780750649339, Newnes
2. Grob's Basic Electronics, Mitchel Schultz,11th Edition,2010, ISBN-13: 978-0-07-351085-9, McGraw Hill
3. Fundamentals of Electronic Devices and Circuits, David A. Bell, 5th Edition,2008, ISBN:0195425235, 9780195425239, Oxford University Press.
4. Microelectronics Circuits, Adel S. Sedra & Kenneth C. Smith,7th Edition, 2015, ISBN 978–0–19–933913–6, Oxford University Press

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B. Tech. Sem. I: Electronics & Telecommunication Engineering **SUBJECT: - Universal Human Values**			
Designation of Course	**Universal Human Values (Common for all Branches)**		
Teaching Scheme:	**Examination Scheme:**		**Credits Allotted**
Theory:- 00 Hours/ Week	End Semester Examination	00	Theory: 00 Tutorial: 00 Practical: 01
Practical :- 02 Hours/ Week	Internal Assessment	00	
Tutorial :- 00 Hours/ Week	Term Work	50 Marks	
	Oral/Practical Examination	00 Marks	
	Total	50 Marks	01

Course Prerequisites:-	During the Induction Program, students would get an initial exposure to human values through Universal Human Values. This exposure is to be augmented by this compulsory full semester foundation course.
Course Objective	Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence Strengthening of self-reflection. Development of commitment and courage to act
Course Outcomes:-	After completion of the course students will be able to 1. Create more awareness of themselves, and their surroundings (family, society, nature); 2. Understand the Human being is coexisting with self and body and able to recognize its different needs and fulfillment 3. Develop more responsible life with human relationships, while keeping in mind the human nature 4. Understand to imbibe sensitive approach towards society and understand the dimensions of harmony in the society 5. Understand the recycle structure of the nature and able to recognize the participation 6. Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Unit I: Introductions, Aspirations and Concerns (4Hrs)
Getting to know each other, Self-exploration, Individual academic, career Expectations of family, peers, society, and nation fixing one's goals Basic human aspirations Need for a holistic perspective, Role of UHV

Unit II. Self-Management, Health (4Hrs)

Self-confidence, peer pressure, time management, anger, stress Personality development, Self-improvement Harmony in the human being. Health issues, healthy diet, healthy lifestyle Hostel life Harmony of the self and Body Mental and physical health

Unit III: Relationships (4Hrs)

Home sickness, gratitude towards parents, teachers and others Ragging and interaction Competition and cooperation Peer pressure. Harmony in relationship Feelings of trust, respect, gratitude, glory, love

Unit IV: Society (4 Hrs)

Participation in society. Harmony in the society Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals .Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family

Unit V: Natural Environment (4 Hrs)

Participation in nature Harmony in nature/existence Understanding the harmony in the Nature Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self regulation in nature

Unit VI. Self-evaluation Strategy (4 Hrs)

Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers. At the level of society: as mutually enriching institutions and organizations review role of education Need for a holistic perspective

Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004. 3. The Story of Stuff (Book).
3. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi 5. Small is Beautiful - E. F Schumacher.
4. Slow is Beautiful - Cecile Andrews
5. Economy of Permanence - J C Kumarappa 8. Bharat Mein Angreji Raj - PanditSunderlal 9. Rediscovering India - by Dharampal
6. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi 11. India Wins Freedom - Maulana Abdul Kalam Azad
7. Vivekananda - Romain Rolland (English)

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B. Tech. Sem. I: Electronics & Telecommunication Engineering
SUBJECT: -Fundamentals of MATLAB Programming

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 00	End Semester Examination: 00	Credits: 00
Practical: 04	Internal Assessment: 00	
Tutorial: 00	TW: 50 Marks	Credit: 02
		Total Credit: 02

Course Pre-requisites:

	Mathematics (Class XII) and Linear Algebra and Calculus

Course Objectives:

1.	To teach the basics of MATLAB software and programming.
2.	To teach the students Vectors, Arrays and Strings in programming
3.	To introduce Conditional Statements, Loops and Functions
4.	To teach the students to perform different operations on Matrices in programming.
5.	To introduce MATLAB Simulink.
6.	To introduce MATLAB GUI.

Course Outcomes: After learning this course students will be able to

1	Use MATLAB for basic programming.
2	Use Vectors, Arrays and Stringsin programming.
3	Apply knowledge of conditional statements, loops, and functions in programming.
4	Use different operations of Matrices in programming.
5	Design different models using MATLAB Simulink.
6	Design GUI for different applications.

List of experiments:

1. To study the Basics of MATLAB.
2. Write a program to perform arithmetic and logical operations on scalar data.

3. Write a program to display sine and cos wave of particular amplitude and frequency.
4. Write a program to find addition, subtraction, multiplication, transpose, and magnitude of given vector.
5. Write a program to find mean, standard deviation, and variance of given vector.
6. Write a program to show use of if-then-else statement and while loop.
7. Write a program to import and export data from .csv file.
8. Write a program to display data using string.
9. Write a program to compare two given arrays or array elements.
10. Write a program to find transpose, determinant, concatenation, and inverse of given matrix.
11. Write a program to solve given linear equation.
12. To study basics of Simulink.
13. Develop a model to find square and square root of any number using Simulink.
14. Develop a model to differentiate and integrate sine wave using Simulink.
15. To study basics of GUI.
16. To design GUI for any one of the programs mentioned above.
Text Books:
1. MATLAB for Beginners-A Gentle Approach, Peter I. Kattan, 2010, ResearchGate publication
2. Getting started with MATLAB, RudraPratap, 2010, Oxford university press.
Reference Books:
1. A Guide to MATLAB, Brian R. Hunt, Ronald L. Lipsman, Jonathan M. Rosenberg, 3rd Edition, Cambridge University Press.
2. Introduction to MATLAB for Engineers,WilliamJ.Palm, 3rd Edition, McGraw-Hill Education.

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B. Tech. Sem. II: Electronics & Telecommunication Engineering **SUBJECT: - Engineering Mathematics-II**			
Designation of Course	**Engineering Mathematics-II(Common for all Branches)**		
Teaching Scheme:	**Examination Scheme:**		**Credits Allotted**
Theory:- 03 Hours/ Week	End Semester Examination	60Marks	Theory: 03 Tutorial: 01 Practical: 00
Practical :- 00 Hours/ Week	Internal Assessment	40Marks	
Tutorial :- 01 Hours/ Week	Term Work	00 Marks	
	Oral/Practical Examination	00 Marks	
	Total	100 Marks	04

Course Prerequisites:-	The students should have knowledge of differential calculus
Course Objective	On completion of the course – 1. Fundamental theorems, concepts in Matrices, Demoivre's theorem and its applications in engineering. 2. Various techniques in Calculus, Explanation of functions and Infinite series. 3. Partial differentiation, maxima, minima and its applications in engineering
Course Outcomes:-	After completion of the course students will be able to 1. Solve differential equations by different methods. 2. Apply different laws to solve Simple Harmonic Motion, One–DimensionalConductionof Heat. 3. Solve integralcalculusandFourierseries. 4. Solve integralcalculuswitherrorfunctions. 5. Determinepositioninsolidgeometry 6. Solve multiple integration problems.

Unit I:DifferentialEquation of First Order and First Degree:(06 Hrs)
Definition, Order and Degree of DE, Formation of DE, Solutions ofVariable Separable DE, Exact DE, Linear DE and reducible to these types

Unit II:Applications of Differential Equations: (06 Hrs)
Applications of DE to Orthogonal Trajectories, Newton's Law of Cooling, Kirchoff's Law of Electrical Circuits, Motion under Gravity, Rectilinear Motion, Simple Harmonic Motion, One–Dimensional Conduction of Heat

Unit III: Fourier Series: (06 Hrs)
Definition, Dirichlet's conditions, Fourier Series and Half Range Fourier Series, Harmonic Analysis

Unit IV: Integral Calculus:(06 Hrs)
Reduction formulae, Beta and Gamma functions, Differentiation under the Integral Sign, Error functions

Unit V. Solid Geometry:(06 Hrs)
Cartesian, Spherical Polar and Cylindrical Coordinate Systems, Sphere, Cone and Cylinder

Unit VI:Multiple Integrals and their Application:(06 Hrs)
Double and Triple integrations, Applications to Area, Volume, Mean and Root Mean Square Values

PBL: Project Base Learning (Topics)

1	Formationofdifferentialequation
2	ExactdifferentialEquation
3	Lineardifferentialequation
4	Newton'slawofcooling
5	Newton'ssecondlawofmotion
6	Fourier'slaw
7	Kirchhoff'svoltagelaw
8	Fourierseries
9	Harmonicanalysis
10	Gammaandbetafunction
11	Reduction formulae
12	Locatingpositioninthreedimensionalspace
13	Multipleintegralsapplications
14	Errorfunction
15	Differentiationunderintegralsign

Textbooks

1. Applied Mathematics (Volumes I and II) by P. N. Wartikar& J. N. Wartikar (Pune Vidyarthi GrihaPrakashan, Pune),7th Edition, 1988, Reprint 2010.

Reference Books

1.Higher Engineering Mathematics by B.S. Grewal (Khanna Publication, Delhi), 42th

Edition, 2012

2. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill), Edition, 2008
3. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.), 8th Edition, 1999, Reprint 2010
4. Advanced Engineering Mathematics, 7e, by Peter V.O'Neil (Thomson Learning), Edition 2007
5. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education), 2nd, Edition, 2002

Unit Test –

Unit Test - I	**Unit I, II, III**
Unit Test - II	**Unit IV, V, VI**

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B. Tech. Sem. II: Electronics & Telecommunication Engineering **SUBJECT: - Engineering Chemistry**			
Designation of Course	**Engineering Chemistry (Common for all Branches)**		
Teaching Scheme:	**Examination Scheme:**		**Credits Allotted**
Theory:-03Hours/ Week	End Semester Examination	60 Marks	Theory: 03 Tutorial: 00 Practical: 01
Practical:-02Hours/week	Internal Assessment	40 Marks	
Tutorial:-00 Hours/week	Term Work	50 Marks	
	Oral/Practical Examination	00 Marks	
	Total	150 Marks	04

Course Prerequisites:-	The student should have Basic knowledge of chemistry. Basic knowledge of electrochemistry and chemistry of materials Introductory knowledge of polymers.
Course Objective	The student should acquire the knowledge of 1. To develop the interest among the students regarding chemistry and their applications in engineering. 2. To develop confidence among students about chemistry, how the knowledge of chemistry is applied in technological field. 3. The student should understand the concepts of chemistry to lay the groundwork for subsequent studies in the Engineering field
Course Outcomes:-	After completion of the course students will be able to 1. Understand the different methods of analysis of water,different environmental pollutants and importance of green chemistry 2. Understandthe importance of fuelsand apply itfor various engineering applications. 3. Explain the drawbacks of corrosion and different methods of elimination of corrosion 4. Apply the concept of polymer to study advanced materials. 5. Apply the basic concept of chemistry to explain the chemical properties and processes of materials of nanoscale 6. Understand the instrumental analysis helpful for various engineering applications

Unit I: Water Technology&Green Chemistry (6Hrs)

Introduction, sources and impurities in water, Hardness of water, types, and determination of hardness using EDTA titration, softening of hard water by ion- exchange process. Numerical problems on hardness of water. Major environmental pollutants, Basic principles of green chemistry. Atom economy, Synthesis ofadipic acid, Industrial applications of green chemistry, Numerical problems on Atom economy.

Unit II: Electrochemical energy and solar energy (6Hrs)

Fuels: Introduction, Definition, importance of fuels, calorific value, types, fluidized bed catalytic cracking, knocking(Petrol engine), mechanism and its ill effects, biodiesel, power alcohol, octane and cetane number.Solar Energy: Introduction, construction, working and applications of photovoltaic cell.

Unit III: Corrosion technology and it's control (6hrs)

Introduction, Electrochemical theory of corrosion, Types of corrosion, Differential metal and differential aeration (pitting and water line) caustic embrittlement. Factors affecting the rate of corrosion, Corrosion control: Cathodic protection, sacrificial anode and impressed current methods, Metal coatings, Galvanization and tinning, Anodizing, Anodizingof aluminium, Organic coatings: Paint and varnishes.

Metal finishing: Introduction, Technological importance. Principles of electroplating. Electroplating of chromium. Electro less plating: Introduction, electro less plating of nickel & copper on PCB with applications

Unit IV:Engineering Materials and Technology (6 Hrs)

Polymers: Introduction, classification, Synthesis and applications of Polyurethane, polycarbonates, Conducting Polymers: Synthesis & Mechanism of conduction in poly aniline. Composites: Introduction, constitution, classification. Types: fiber glass, hybrid and reinforced Composites with applications.

Unit V:Nano materials (6Hrs)

Introduction, size dependent properties (Surface area, Electrical, Optical, Catalytic and Thermal properties). Synthesis of nano materials: Top down and bottom up approaches, Synthesis by Sol-gel, precipitation and chemical vapour deposition, Nano scale materials: Fullerenes, Carbon nano tubes and graphenes – properties and applications.

Unit VI: Instrumental methods of analysis (6Hrs)

Introduction, Theory, Instrumentation and applications of colorimetry, pHmetry, conductometry Introduction to spectroscopy, principles and applications of UV/Vis.Spectroscopy

PBL: Project Base Learning (Topics)

Sr. No	Topics
1	Comparison of Hardness, Alkalinity, Dissolved oxygen, Chlorides and COD of water from two different sources
2	Removal of industrial pollutants from wastewater by adsorption on activated charcoal
3	Preparation of biofuels from two natural sources
4	Two synthetic approaches for the production of H_2 as a clean fuel
5	Prevention of corrosion by metal coupling
6	Construction of bio sensor in engineering applications
7	Design and simulation of automatic solar - photo voltaicpanels as renewable energysource.
8	Synthesis of Conjugated Polymers and Molecules Using Sugar Reagents and Solventless Reactions. OR Composite materials and it properties, applications and types

9	To study mechanism of lubrication
10	Electroplating- study on how different metals can be used and the practical applications
11	Prepare Ag- nanoparticles by using sol-gel method
12	Preparation of Ag nanoparticle from two natural sources
13	With the help of green chemistry principles, prepare any organic dye by using Traditional and Green pathway.
14	Prepare epoxy resins by using suitable metho
15	Measurement and effect of waste disposal from laboratories in the college

Practical (Any Eight of the Following)

1. Determination of Hardness of water sample by EDTA method
2. To determine strength of acid by pH – metric Titration
3. To measure the strength of acid by conductometric titration
4. Measurement of Surface tension of a given liquid by Stalgmometer.
5. To determine alkalinity water sample.
6. Estimation of the given amount of copper in the given solution by colorimetry
7. Synthesis of conducting polyaniline from aniline by oxidative polymerization
8. Determination of iron content in the given solution by Mohr's method
9. To determine the strength of given acid solution by titrating it against base solution using indicator
10. Determination of reaction rate, order and molecularity of hydrolysis of ethyl acetate
11. Verification of Beer-Lambert's Law.
12. Determination of Viscosity of Liquids by Ostwald's Viscometer
13. Determination Of Chloride Content Of Water By Argentometry
14. Estimation of copper from brass by iodometry
15. To study set up of Daniel cell.

Text Books

1. Engineering Chemistry, Jain P.C & Jain Monica,Dhanpat Rai & Sons, Delhi (1992)
2. Engineering Chemistry, O. G. Palanna, Tata McGraw-Hill Publication, New Delhi
3. A textbook of Engineering Chemistry, S. S. Dara, McGraw-Hill Publication, New Delhi

Reference Books

1. Engineering Chemistry- Fundamentals and applications, Shikha Agarwal,Cambridge Publishers (2015)
2. Polymer Science and technology (2nd Edition), P. Ghosh, Tata McGRAW Hill, (2008)
3. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler,Stanley R. Crouch,Cengage learning (2017)

4. Polymers: Chemistry & Physics of Modern Materials (2nd edition) J.M.G.Cowie, Blackie, Academic & Professional(1994)
5. Integrated design and operation of water treatment facilities, Kawamura, Susumu. John Wiley & Sons(2000)

Unit Test –

Unit Test - I	**Unit I, II, III**
Unit Test - II	**Unit IV, V, VI**

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B. Tech. Sem. II: Electronics & Telecommunication Engineering

SUBJECT: - COMPUTER PROGRAMING- II

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 02	Continuous Assessment: 40 Marks	Credits: 01
Tutorial: 00	TW: 25 Marks	Credits: -04

Course Pre-requisites:

The students should have knowledge of

1.	Basic programming.

Course Objectives:

- This course will introduce the concepts of Python language as a software development tool.
- To gain practical experience in Python programming including fundamental concepts, OOPs, Exception handling, and Graphics.

Course Outcomes: After learning this course students will be able to

1	Apply the basic concepts of Python programming.
2	Write basic programs using control statements.
3	Use exception handling in Python programs.
4	Apply object-oriented programming concepts in Python.
5	Write Python program for simple applications using existing libraries.
6	Write simple graphics programs.

UNIT – I	**Python Basics**	**(06 Hours)**
	Python Introduction, Python Installation, Relational operators, Bit-wise operators, Logical operators Python Data Types - Numbers (Integer, Floating Point, Complex Numbers), Strings, Lists, Tuples, Dictionaries, List comprehensions, Python Control Statements.	
UNIT – II	**Python Core**	**(06 Hours)**

	Python Modules & Functions,Lambda,Scope, Python File Handling, Python Regular Expressions ,Recursion,Flow Control,Immutable and Mutable Objects.	
UNIT - III	**Python Exception Handling**	**(06 Hours)**
	Meaning of Exception, Exception Hierarchy Diagram, Exception Handling -TRY, CATCH, FINALLY, Raising an Exception, User Defined Exceptions.	
UNIT -IV	**OOPS, UML & OOAD**	**(06 Hours)**
	Object Oriented Programming (OOPs) - Class & Object, Abstraction, Inheritance, Polymorphism, Encapsulation, Object Oriented (OO) Modelling, Object Oriented Analysis & Design (OOAD).	
UNIT -V	**Python Multi-Threading**	**(06 Hours)**
	Threads in Python (a) Kernel Threads (b) User Space Threads or User Threads, Advantages of Threading, Thread States: Life Cycle of a Thread, Thread & Threading Modules.	
UNIT -VI	**Python Packages and Graphics**	**(06 Hours)**
	Numpy: Introduction, data-types,arrays, arrays manipulation, ploting, testing and debugging,Sharing Data using Sockets,Simple applications of python, Scipy, TKinter	

Term Work: Any 8 of below given list

1. Evaluate any given expression involving arithmetic operators.
2. Evaluate any given expression involving logical operators.
3. Develop python functions to produce given patterns such as diamond, pyramid, triangles.
4. Usage of different functions present in “math” module.
5. Write a function that takes two numbers as input parameters and returns their least common multiple.
6. Write a function that takes two numbers as input parameters and returns their greatest common divisor.
7. Write a program that takes a sentence as an input and displays the number of words in the sentence.
8. Ways to sort list of dictionaries by values in Python – Using lambda function.
9. Write program using “matplotlib” module.
10. Write program using “NUMPY” module.

11. Write program using “Scipy” module.
12. Write program using “TKinter” module.
Text Books:
1. Sheetal Taneja,Naveen Kumar,Python Programming,A modular approach,Pearson publication
Reference Books:
1. Learning Python 5th Edition, Oreilly Publication
2. Beginning Python: From Novic to professional, by Magnus Lie Hetland, Third Edition, Appress Publication
3. Learning with Python by Allen Downey, Jeffrey Elkner, Chris Meyers, Dreamtech Publication

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B. Tech. Sem. II: Electronics & Telecommunication Engineering **Subject: Computer Aided Engineering Graphics**			
	B. Tech. Chemical, Electronics & Communication, Electronics & Telecommunication, Mechanical, Robotics & Automation Engineering		
Teaching Scheme:	**Examination Scheme:**		**Credits Allotted**
Theory :- 04 Hrs./ Week	End Semester Examination	60 Marks	04
Practical:- 02 Hrs./Week	Unit Test	40 Marks	
	Term Work / ~~Oral~~	50 Marks	01
	Practical Examination	-- Marks	--
	Total	150 Marks	05

Course Prerequisites:-	Basics of Mathematics at Secondary School Level
Course Objectives	To provide knowledge about • Fundamentals of engineering drawing and curves • Isometric views and projection • Projections of points, lines, planes & solids • Use of CAD tools.
Course Outcomes:-	The students must be able to 1. Understand dimensioning methods and drawing of engineering curves. 2. Draw orthographic projections using 1st angle method of projection. 3. Draw Isometric views from given orthographic projections. 4. Draw projection of points, lines and planes. 5. Draw projection of different solids. 6. Draw development of lateral surfaces of solids.

Course Contents

Unit 1	**LinesandDimensioninginEngineeringDrawing and Engineering Curves**	**(08Hrs.)**

Fundamentals of CAD and Engineering Curves

Introduction to Engineering Drawing, Types of lines and Dimensioning, Layout and size of drawingsheets, Scales.

Engineering Curves-Ellipse drawing by Directrix Focus Method, Arc of Circle Method and ConcentricCircle Method,Involutesofacircle,Cycloid,ArchimedeanSpiral,HelixonconeandCylinder.FundamentalsofComp

uterAidedDrafting(CAD)anditsapplications,VarioussoftwareʼsforComputerAidedGraphics/Drafting.AutoCAD initialsettingandAutoCADcommands		
Unit 2	**OrthographicProjections**	**(08Hrs.)**
Basicprinciplesoforthographicprojection(FirstandThird anglemethod).Orthographicprojectionofobjectsbyfirstangleprojectionmethodonly.Procedureforpreparingscaleddrawing,sectionalviewsandtypesofcuttingplanesandtheirrepresentation,hatchingofsections.		
Unit 3	**Sectional OrthographicProjections**	**(08 Hrs.)**
Types of Sections, Sectional orthographicProjection.		
Unit 4	**IsometricProjections**	**(08Hrs.)**
Isometricview,IsometricscaletodrawIsometricprojection,non-isometriclines,andconstructionofisometricviewfromgivenorthographicviewsandtoconstructisometricview.		
Unit 5	**ProjectionsofPoints, Lines, Planes and Solids**	**(08Hrs.)**
Projectionsofpoints,projectionsoflines,linesinclinedtoonereferenceplane,linesinclinedtoboth referenceplanes. (Lines in FirstQuadrantOnly).Projectionofprism,pyramid,coneandcylinderbyrotationmethod.		
Unit 6	**Development of Lateral Surfaces**	**(08Hrs.)**
Developmentofthelateralsurfacesof solidslikeprisms,pyramids,cylindersandcones.		

Project Based Learning

1 To obtain industrial drawings to identify the types of lines, dimensioning methods and method of projection.
2 To develop the model/charts based on engineering curves.
3 To prepare model/chart for identification of engineering curves in nature for industrial, societal, etc. application.
4 To demonstrate different methods of orthographic projection.
5 To demonstrate projection of Points.
6 To demonstrate projection of Lines.
7 To demonstrate projection of Planes.
8 To demonstrate projection of Solids.
9 To demonstrate developments of surfaces for solids.
10 To demonstrate industrial application of development of surfaces such as steam carrying pipes, Ducts of air conditioning systems, etc.
11 To demonstrate Isometric projection method through model of a cube.

Assignments: Minimumfive problemsoneachunitinA3sizeDrawingBook
Term Workshallconsistof**seven**A_2size(594mm×420 mm)sheetsby hand and AutoCAD.

1. Types of lines, Dimensioning practice, 1st and 3rd angle methods symbol.
2. Engineering Curves
3. Orthographic Projections
4. Isometric views

5. ProjectionsofLinesandplanes
6. ProjectionofSolids
7. Development of Lateral surfaces

Text Books/References

1. “ElementaryEngineeringDrawing”,N.D. Bhatt,CharotarPublishinghouse, AnandIndia.
2. “TextBookonEngineeringDrawing”,K. L. Narayana&P .Kannaiah,Scitech Publications, Chennai.
3. “FundamentalsofEngineeringDrawing”, WarrenJ.Luzzader,PrenticeHallofIndia,NewDelhi
4. “EngineeringDrawingandGraphics”, VenugopalK.,NewAgeInternationalpublishers.
5. M.B.ShahandB.C.Rana,"EngineeringDrawing",1st Ed,PearsonEducation,2005.
6. P.S.Gill,"EngineeringDrawing(GeometricalDrawing)",10Edition,S.K.KatariaandSons,2005.

Syllabus for Unit Tests

Unit Test I: Units I, II, and III
Unit Test II: Units IV, V, and VI

Bharati Vidyapeeth
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College of Engineering, Pune

B. Tech. Sem. II: Electronics & Telecommunication Engineering **SUBJECT: - DIGITAL ELECTRONICS**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Lectures: 04 Hours / Week	End Semester Examination: 60 Marks	Theory:4 Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	PR/OR: 1 Credit
	Term Work + Practical: 25Marks	Total:5 Credits

Course Objectives:	
1.	To present the Digital fundamentals, Boolean algebra, and its applications in digital systems
2.	To familiarize with the design of various combinational digital circuits using logic gates
3.	To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits
4.	To understand the various semiconductor memories and related technology
5.	To introduce the electronic circuits involved in the making of logic gates

Course Outcomes:	
	On successful completion of this course, students will be able to:
1.	Demonstrate the knowledge of Boolean algebra including simplification techniques.
2	Characterize Logic families TTL, CMOS, ECL & explain the fundamentals of semiconductor memories.
3	Analyze & design digital combinational circuits such as multiplexers, demultiplexers, encoders, decoders, and arithmetic circuits.
4	Demonstrate the knowledge of operations of basic types of flip-flops, registers, counters & the design of FSM.
5	Understand the characteristics of PLDs, Semiconductor memories and applications.

Unit - I	**Introduction to Digital Systems**: Introduction to Digital Electronics Fundamentals **Number Systems**: Introduction to Number Systems-Decimal, Binary, Octal, Hexadecimal, Conversion of the number system, Representation of Negative Numbers,1's complement and 2's complement. **Binary Arithmetic**: Binary addition, Binary subtraction, Subtraction using 1's complement and 2's complement, Binary multiplication, and division,	**(8hours)**

	Digital Codes: BCD code, Excess-3 code, grey code, Binary to Excess -3 code conversion and vice versa, ASCII code, EBCIDIC code. **Logic Gates**: Logical Operators, Logic Gates-Basic Gates, Active high and Active low concepts, Universal Gates, and realization of other gates using universal gates, Gate Performance Characteristics and Parameters.	
Unit - II	**Boolean Algebra**: Boolean Expressions and Truth Tables, Rules and laws of Boolean algebra, Demorgan's Theorems,and Simplification of Boolean functions by Boolean laws. **Boolean Function minimization Technique**: Introduction:Minterms and sum of minterm form, Maxterm and Product of maxterm form, Reduction technique using Karnaugh maps – 2/3/4/variable K-maps, grouping of variables in K-maps, minimize Boolean expression using K-map and obtain K-map from Boolean expression, Quine Mc Cluskey Method.	**(08hours)**
Unit -III	**Combinational Logic Design:** Introduction to Combinational Circuits, Adders:Half-Adder and Full-Adder, Subtractors- Half and Full Subtractor; Parallel adders: Ripple Carry and Look-Ahead Carry Adders.BCD adder, Parity Checker/Generator, Multiplexer, Demultiplexer, Encoder, Priority Encoder; Decoder, BCD to Seven segment Display, ALU, Code converters, Magnitude comparators	**(08 hours)**
Unit -IV	**Sequential Logic Design**: Introduction to Sequential Circuits: 1 Bit Memory Cell, Latches: SR latch, Gated latch,Flip-Flops: Types of Flip Flops -RS, T, D, JK, Triggering of Flip Flops, Master-Salve JKFlip Flop, excitation table of Flip-flop.	**(08 hours)**
Unit- V	**Shift Registers and Counters**: Data transmission in shift Resister: SISO, SIPO, PISO, PIPO, Bidirectional shift register, universal shift registers. Counters: synchronous counter andasynchronous counter. **Introduction to FSM**: Moore and Mealy State machine, Design of state machines: state table, state assignment, transition/excitation table.	**(08 hours)**

Unit -VI	**Logic Families and Memory Technology:** **Logic Family**: Digital IC specification terminology, Logic families: TTL, CMOS, ECL. **Programmable logic devices**: Study of PROM, PAL, PLAs. Designing combinational circuits using PLDs. **Semiconductor memories:** Classification and characteristics of memory, different types of RAMs, ROMs, and their applications.	**(08 hours)**

List of Experiments:

1.Study of basic gates using TTL, CMOS: 7432, 4011, 4050, 4070,4071,40106
2. Implementation of logic function using Universal gates (NAND, NOR).
3. Implementation of the combinational logic circuit usingthe K map-basedmethod.
4. Design and Implementation of Half and Full Adder, Half and Full Subtractor
5. Design and Implementation of 4-bit parallel Adder / Subtractor using IC 7
6. Design and Implementation of Code Converters (Binary to Gray, Excess 3 to Binary)
7. Design and Implementation of Comparator using IC 7485
8. Implementation of combinational logic using MUX
9. Design Decoder and DEMUX (IC 74138)
10. Design7 segment decoder driver. (IC 7447)
11. Study of Flip Flops (SR FF, D FF, JK FF, T FF)
12. Design Built and test MOD N counter
13. Design Built and test Shift Registers
14. Design and implementation of Johnson Counter
15.Study of Static I/O and TransferCharacteristics of TTL.
16. Study of Static I/O and TransferCharacteristics of CMOS.

Note:
The term work shall be the record of a minimum of eight experiments performed from the above list.

Reference Books:

1.	R.P. Jain, ―Modern digital electronics‖, 3rd edition, 12threprint Tata McGraw Hill Publication
2.	Anand Kumar, ―Fundamentals of digital circuits‖ 1st edition, Prentice Hall of India, 2001.
3	A.P. Malvino, D.P. Leach ‘Digital Principles & Applications’’ –Vith Edition-Tata Mc Graw Hill, Publication.
4	J.F.Wakerly “Digital Design: Principles and Practices”, 3rd edition, 4th reprint, Pearson Education, 2

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B. Tech. Sem. II: Electronics & Telecommunication Engineering **SUBJECT: - Communication Skills**			
Designation of Course	**Communication Skills (Common for all Branches)**		
Teaching Scheme:	**Examination Scheme:**		**Credits Allotted**
Theory:- 00 Hours/ Week	End Semester Examination	00	Theory: 00 Tutorial: 00 Practical: 01
Practical :- 02 Hours/ Week	Internal Assessment	00	
Tutorial :- 00 Hours/ Week	Term Work	50 Marks	
	Oral/Practical Examination	00 Marks	
	Total	50 Marks	01

Course Prerequisites:-	Students should have knowledge of Basic English grammar Students should have basic information of sound system of English language.
Course Objective	The course objective of Communication Skills puts the following class teaching objectives, considering English Language skills as a wheel rolling aspects in today's world, the focus is on honing the skills such as LSRW and presentation skills. It also puts emphasis on technical and professional writing skills. Honing the presentation skills among students through appropriate activities, this will help them in their business ventures.
Course Outcomes:-	After completion of the course students will be able to 1. Understand and construct the error free sentences of English language and do implementation of it in the spoken and written business communication 2. Understand and apply the sounds of English language for correct pronunciation 3. Understand and develop the ability to enhance sound vocabulary for effective communication 4. Understand communication process and principles to do applications in business communication 5. Understand the techniques of writing skills and apply them in appropriate context and domain 6. Create effective business presentation and do effective implementation of it through activities

Unit I:English grammar **(4 Hrs)**

Application of Basic Grammar: Articles, Prepositions, Tenses, Subject-verb agreement, Use of phrases & Clauses in sentences, Common errors

Unit II. Phonetics/study of sounds in English (4 Hrs)
Introduction to phonetics, study of speech organs, study of phonetic script, transcriptions of words, articulation of different sound in English, reducing MTI, stress and intonation

Unit III: Vocabulary Enrichment (4 Hrs)
Ways of word formation, Foreign phrases, One word substitutions, Synonyms & antonyms, Words often confused, Indian English words, Usage of idioms &phrases.GRAS-PT formula

Unit IV: Communication Skills (4 Hrs)
Introduction, forms and function of communication process, non-verbal codes in communication, Importance of listening skills, Listening V/s hearing, Types of listening, Barriers to communication and listening, Importance of LSRW skills in communication

Unit V: Technical Writing Skills (4 Hrs)
The mechanics and principles of written communication, Technical Communication, Need and Importance, technical report writing;, email writing, , notice, agenda, minutes of meeting writing. Use of technology in technical writing

Unit VI.Presentation skills (4Hrs)
Designing effective presentation, understanding theme, developing content and layout of presentation, use of tone and language, technological tools for effective presentation

Reference Books:

1. Business Communication by Meenakshi Raman, Prakash Singh published by Oxford University press, second edition,
2. Spoken English- A manual of Speech and Phonetics by R. K. Bansal, J. B. Harrison published by Orient Blackswan
3. Technical Communication by Meenakshi Raman, Sangeeta Sharma published by Oxford University press
4. Developing Communication Skills by Krishna Mohan, Meera Banerji published by Macmillan India Pvt Ltd

Recommended web-links for enhancing English language and business communication
http://www.bbc.co.uk/worldservice/learningenglish
http://www.englishlearner.com/tests/test.html
http://www.hodu.com/default.html
http://www.communicationskills.co.in/index.html

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B. Tech. Sem. II: Electronics & Telecommunication Engineering
SUBJECT: - SKILL BASE COURSE -I
ELECTRONICS WORKSHOP

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: --	End Semester Examination --00 Marks	
Practical: 04	Continuous Assessment: --- 00 Marks	
Tutorial: --	TW: 50 Marks	Credit:02
	Oral: 00 Marks	
	Practical: -- 00 Marks	
		Total Credit: 02

Course Pre-requisites:

	Elementary Electronics

Course Objectives:

1	To introduce the basic building blocks for PCB artwork design
2	To train the student to create simple PCB artwork design using a PCB design tool
3	To expose the students to the soldering process and tools
4	To train the students to make reliable solder joints
5	To train the students to de-solder the solder joints
6	To teach the art of inspecting solder joints

Course Outcomes: After learning this course students will be able to

1	Demonstrate the knowledge of selecting proper PCB primitives (track width, pad size, hole size, clearance between pads and tracks, footprints)
2	Use PCB design software for simple single-sided PCB artwork design
3	Identify and select appropriate soldering tools for the soldering job
4	Use solder iron for soldering through hole components
5	Use solder iron and de-solder pump /wick for de-soldering through hole components
6	Perform electrical (continuity) and visual inspection for solder joints

List of Experiments:

1. Basic Electronic Components and Electronic Soldering
2. Design a simple (only discrete components) single-sided PCB using PCB design software (PCB artwork design flow)

3. Design a single-sided PCB using PCB design software for a circuit with IC components
4. Design a double-sided PCB using PCB design software
5. Study and use tools like solder iron (types and temperature profile), wire strippers, cutters
6. Study of solder alloys, flux and rosin
7. Demonstrate and perform the operation of Etching & drilling
8. Solder basic electronic components like resistors, capacitors, and IC bases (through hole)on general-purpose PCB.
9. Demonstrate and perform the operation of de-soldering on general-purpose PCB.
10. Demonstrate and perform the operation of electrical continuity test and identification of various electronics components using DMM and CRO and visual inspection for a soldered board
Reference Books:
1. Getting Started with Soldering: A Hands-On Guide to Making Electrical and Mechanical Connections, Marc de Vinck, Maker Media, Inc, 2017
2. Soldering in electronics assembly, MIKE JUDD, Keith Brindley, Newnes,1999
3. Printed Circuits Handbook, Clyde F. Coombs, Jr.,McGraw-Hill, 2008
4. User Manual for the selected PCB Design Software
5. Getting Started with Soldering: A Hands-On Guide to Making Electrical and Mechanical Connections, Marc de Vinck, Maker Media, Inc, 2017

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B. Tech. Sem. III: Electronics & Telecommunication Engineering
COURSE: - Data Structure and Algorithms

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**Credit Allotted**
Lectures : 03 Hours / Week	End Semester Examination: 60 Marks	Theory : 03
Practical : 02 Hours / Week	Internal Assessment: 40 Marks Term Work :25 Marks Oral: 25 Marks	Term Work & Oral : 01
Total : 05 Hours/Week	Total Marks :150 Marks	Total Credits : 04

Course Pre-requisites:

Computer Programming 1,Computer Programming 2

Course Outcomes:

	After successfully completing the course the student will be able to:
CO1	Comprehend fundamental principles of data structures and algorithms for effective problem-solving.
CO2	Execute operations on linear sequential data structures.
CO3	Implement linear linked organization data structures for efficient data representation.
CO4	Implement and analyze a variety of searching and sorting algorithms.
CO5	Execute operations on nonlinear data structures and trees.
CO6	Apply concepts for hashing and file organization for efficient data management.

UNIT - I	**Introduction to data structure and algorithm**	**(08 Hours)**
	Introduction to data structures, Classification of Data Structures, Primitive Data Types, Abstract Data Types abstract data types (ADT), Introduction to algorithms, Importance of Algorithm Analysis, characteristics of algorithms, algorithm design tools: pseudo code and flowchart, relationship among data, Complexity of an Algorithm, Asymptotic Analysis and Notations.	
UNIT - II	**Sequential Organization Data Structures**	**(06 Hours)**
	Stacks: primitive operations, stack as an ADT, realization of stacks using array, stack operations, multi-stack, applications of stack, expression evaluation and conversion, simulating recursion using stack. **Queue:** primitive operations, queues as ADT, realization of queue using array, circular queue, double ended queue, priority queue, applications of queue.	
UNIT -III	**Linked Organization Data Structures**	**(06 Hours)**

	Introduction to linked list, comparison of sequential and linked organizations, comparison of static and dynamic memory allocation, realization of linked lists, dynamic memory management, linked list as ADT, types of linked list, Operation on Linked List like Insertion-Deletion from Linked List, Copying a List into Other List, Merging Two Linked Lists, Splitting a List into Two Lists, Reversing One way linked List, Circular Linked List,, applications of link list.	
UNIT -IV	**Searching and Sorting**	**(06 Hours)**
	Sequential Search, Binary Search, Breadth First Search, Depth First Search, Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer Sort, Merge Sort, Quick Sort, Heap Sort.	
UNIT- V	**Non-Linear Data Structure**	**(06 Hours)**
	Trees: Trees, Properties of Trees, Binary trees, Binary Tree traversal, Tree manipulation algorithms, Expression trees and their usage, binary search trees, AVL Trees, Heaps and their implementation. **Graphs**: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.	
UNIT -VI	**Hashing and File Organization:**	**(04 Hours)**
	Hashing: Introduction, key terms, hash function, Collision Resolution strategies, hash, Table overflow, skip list, comparison of hashing and skip lists. **File:** concept of file, file organization, sequential file organization, and direct access file Organization, indexed sequential file organization.	
Project Based Learning: Maximum 4 students per group , projects based only on the course		
List of Experiments:		
1.	Write a program to implement functions (insert, delete, display) on stack, queue and Circular queue data structure.	
2.	Write a program to convert and solve expression from	
3.	(a)Infix to Prefix (b) Infix to Postfix , Evaluate Postfix expression	
4.	Write a program to implement Singly Linked List manipulation for storing student Information (PRN, Name, Marks). (a) Display data of top rank student. (b) How many students secure first class and above rank?	
5.	Write a program to implement Doubly Linked List manipulation for storing Employee Information (Name, Salary, Age). (a) Display data of employees having a salary of more than 50,000. (b) Display list of employees having age less than 30 and salary greater than 30,000.	
6.	Write a program to implement Binary Search Tree storing city names and Traversal in	

	BST (In-order, Preorder, Post-order).
7.	Write a program to implement Threaded Binary Tree and its Traversals.
8.	Write a program to implement graph traversals: BFS and DFS.
Reference Books:	
1.	1. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++", Prentice Hall of India, , ISBN-81-203-1177-9.
2.	E. Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi, ISBN 16782928
3.	S. Lipschutz, “Data Structures”, McGraw Hill Pub.
4.	Patil V., “Data Structures using C++”, Oxford university press, ISBN 0-19-806623-6
5.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein,“Introduction to Algorithms”.

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B. Tech. Sem. III: Electronics & Telecommunication Engineering
COURSE :SEMICONDUCTOR DEVICES AND CIRCUITS

Teaching Scheme	**Examination Scheme**	**Credits Allotted**
Lectures: 03 Hours / Week	End Semester Examination :60 Marks	Theory : 03
Tutorial : 02 Hours / Week	Internal Assessment :40 Marks TW: 25 Marks PR: 25 Marks	Term Work & Practical : 01
Total : 05 Hours/Week	Total :150 Marks	Total Credits : 04

Pre-requisites: ELEMENTARY ELECTRONICS

Course Outcomes: After successfully completing the course, the student will be able to

CO1	Analyze and design BJT amplifiers
CO2	Analyze and design FET & MOSFET amplifiers
CO3	Analyze multistage BJT amplifiers and select appropriate cascade topology
CO4	Identify feedback topology and design BJT feedback amplifiers
CO5	Identify , analyze and design BJT power amplifiers
CO6	Analyze BJT differential amplifiers and current mirrors

UNIT-I	**Basics of BJT Amplifiers and Models**	**(6 Hours)**
	Concept of AC load line, BJT as two-port networks, BJT Models small signal models (h-parameter, Ebers-Moll, hybrid –pi and T), Analysis of CE, CB, CC Amplifiers (Derivation of Zi, Zo, Av, Ai and Ap), Frequency response of BJT amplifiers, Single stage CE voltage amplifier design, Large signal BJT model, BJT as switch, power BJT	
UNIT-II	**JFET and MOSFET Amplifiers and Models**	**(6 Hours)**
	JFET models, Analysis of CS, CD, CG Amplifiers, Frequency response of JFET amplifiers, Single stage CS amplifier design, FET as switch.MOSFET models, Analysis of MOSFET amplifiers, Single stage CS amplifier design, Frequency response of MOSFET amplifiers, MOSFET as switch, Power MOSFET.	
UNIT-III	**Multistage Amplifiers and Coupling Methods**	**(6 Hours)**
	Need of the Multistage amplifiers, Types of Multistage Amplifiers, coupling methods, Frequency response, Parameter evaluation - Ri, Ro, Av, Ai & Bandwidth for general multistage amplifier, Choice of the transistor configuration in cascade amplifier, Analysis & design of direct coupled, RC coupled, analysis of transformer coupled amplifier. Design of Darlington Amplifier, design of Cascode amplifier.	
UNIT-IV	**Feedback in Amplifiers**	**(6 Hours)**

	Types of basic Amplifiers, Concept and types of feedback, Transfer gain with feedback, Negative feedback topologies with their block Schematics, Effect of negative feedback on Input impedance; Output impedance; Gain and Bandwidth, Analysis of one circuit for each feedback topology for input impedance, output impedance, gain and bandwidth.	
UNIT-V	**Power Amplifiers and Their Classification**	**(6 Hours)**
	Need of Power amplifiers, classification; applications; advantages of power amplifiers - Class A, Class B, Class C, class D and Class AB. Operation of - Class A with resistive load; Transformer coupled class A Amplifier; Class B Push – pull; Class AB Complementary symmetry and Quasi – complementary. Efficiency analysis for Class A transformer coupled amplifier, Class B push – pull amplifier. Comparison of efficiencies of other configurations. Distortion in amplifiers; concept of Total Harmonic Distortion (THD).	
UNIT-VI	**Current Mirrors and Differential Amplifiers**	**(6 Hours)**
	Concept of current mirror, Analysis of Widlar current source (BJT), Wilson current mirror (BJT), Limitations of CE amplifier, Split supply biasing, Differential amplifier configurations, Dual Input, balanced output differential amplifier, Dual input, unbalanced output differential amplifier, Single input, balanced output differential amplifier, Single input, unbalanced output differential amplifier, Constant current bias, Differential mode gains, common mode gain, CMRR calculation, Derivation for output voltage, input and output impedances	

List of experiments:

1.	Measure and plot the frequency response of single stage CE voltage amplifier
2.	Measure and plot the frequency response of single stage JFET CS voltage amplifier
3.	Construct BJT switch circuits and compare the performance (power dissipation, transient response)
4.	Construct MOSFET switch circuits and compare the performance (power dissipation, transient response)
5.	To measure the gain and bandwidth of a 2-stage CE RC coupled amplifier
6.	To measure the gain of a direct coupled amplifier.
7.	To measure the gain of a cascade amplifier.
8.	To measure the gain and bandwidth of a voltage series negative feedback amplifier.
9.	To build and test a simple current mirror
10.	Measure THD for audio power amplifier

Project Based Learning: Maximum 4 students per group , projects based only on the course

Reference books:

1.	Fundamentals of Electronic Devices and Circuits, David A. Bell, 5th Edition,2008, ISBN:0195425235, 9780195425239, Oxford University Press
2.	Microelectronics Circuits, Adel S. Sedra & Kenneth C. Smith,7th Edition, 2015, ISBN 9780199339136, Oxford University Press

3.	Millman's Electronic Devices and Circuits (SIE) , Jacob millman, Christos C. Halkias, Satyabrata Jit, 4th Edition,2015 , ISBN 9789339219543**,** McGraw-Hill
4.	Linear Integrated Circuits, D Roy Choudhury, Shail B Jain,6th Edition 2021, ISBN 9788122472127,NEW AGE International Publishers.

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B. Tech. Sem. III: Electronics & Telecommunication Engineering
COURSE: - SIGNALS AND SYSTEMS

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Lectures: 03 Hours / Week	End Semester Examination :60 Marks	Theory : 03
Tutorial: 01 Hours / Week	Internal Assessment :40 Marks	Tutorial : 01
Total : 04 Hours/Week	Total :100 Marks	Total Credit : 04

Course Pre-requisites:

	Engineering Mathematics I, Engineering Mathematics II, MATLAB fundamentals

Course Outcomes: After successfully completing the course, the student will be able to

CO1	Characterize and analyze the properties of signals.
CO2	Classify the systems and analyze in time domain using convolution.
CO3	Apply Fourier transform for analysis of LTI systems.
CO4	Apply Laplace transform for analysis of LTI systems.
CO5	Apply discrete transforms for analysis of LTI systems.
CO6	Evaluate the effects of sampling on signal and describe the auto correlation and cross correlation between signals.

UNIT – I	**Introduction to signals**	**(06 Hours)**
	Definition of signals, classification of signals: continuous time signals & discrete timesignals, even & odd signals, periodic & non-periodic, deterministic & non-deterministic, energy & power, elementary signals: UNIT impulse, UNIT step, UNIT ramp, exponential &sinusoidal, basic operations on signals.	
UNIT – II	**Classification of systems**	**(06 Hours)**
	Definition, Classification of System, System Interconnections, state space analysis, Linear &non -linear, Time-Invariant & Time variant, causal & non-causal, static & dynamic, stable & unstable systems, stability & impulse response of systems to standard signals.	
UNIT - III	**Continuous Time System Analysis**	**(06 Hours)**
	Response of LTI Systems to exponential signals, periodic signals. Derivation Fourier series, Fourier Transforms and properties Duality and Parseval'stheorem, Fourier analysis examples: Output of LTI Systems Described by Differential, convolution with FT , UNIT step response of RC circuit, filtering, FT of Gaussian Pulse.	

UNIT -IV	**Laplace Transform and Application**	**(06 Hours)**
	Laplace transform and properties, Concept of ROC and properties of ROC, pole zero concepts. Transfer function and condition of stability, Application of Laplace transforms to the LTI system analysis, Convolution with LT, Inversion using duality, Laplace Transform of electrical Circuit, example of control system, calculation of harmonic vibration of the beam, Mathematical models of physical system- Electrical & Mechanical System	
UNIT -V	**Discrete Transforms and Applications**	**(06 Hours)**
	Discrete time Fourier series and properties, Z-Transform and properties, Region of Convergence for the Z-Transform, Convolution with ZT, Application of Z-Transformto the LTI system analysis.	
UNIT -VI	**Correlation and Spectral Density**	**(06 Hours)**
	Definition of Correlation and Spectral Density, correlogram, analogy between correlation, covariance and convolution, conceptual basis, auto-correlation, cross correlation, energy/power spectral density, properties of correlation and spectral density, inter relation between correlation and spectral density, Sampling theorem & its proof, aliasing,reconstruction of sampled signals, interpolation.	

Project Based Learning: Maximum 4 students per group , projects based only on the course

Reference Books:

1. Roberts M. J., Signals & Systems, TMH.
2. Oppenheim, Wilsely &Nawab, Signals & Systems, MGH.
3. B.P.Lathi, Signal Processing & Linear Systems, Berkeley Cambridge, 1998 Edition.

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B. Tech. Sem. III: Electronics & Telecommunication Engineering

COURSE: - NETWORK ANALYSIS

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Lectures: 03 Hours / Week	End Semester Examination: 60 Marks	Theory : 03
--	Internal Assessment: 40 Marks	--
Total : 03 Hours/Week	Total :100 Marks	Total Credit : 03

Course Pre-requisites:

	Elementary Electronics, Electrical Technology

Course Outcomes: After successfully completing the course, the student will be able to

CO1	Analyze DC circuits using Mesh Analysis, Node Analysis.
CO2	Analyze Network Theorems.
CO3	Apply graph theory by formulating the network equilibrium equations for circuit analysis.
CO4	Sketch the resonance curves for a given series and parallel resonant circuits.
CO5	Compute two port parameters for a given network
CO6	Design constant-k prototype low pass, high pass, band pass and band stop passive filters.

UNIT – I	**Circuit Analysis**	**(06 Hours)**
	Kirchhoff's Current Law, Kirchhoff's Voltage Law, Source Transformation, Source Shifting, Mesh Analysis, Node Analysis, Super Mesh, Super Node.	
UNIT – II	**Network Theorems**	**(06 Hours)**
	Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem.	
UNIT - III	**Formulation of network equilibrium equations using Graph Theory**	**(06 Hours)**
	Network Graph, tree, co-tree & loop, Incidence Matrix, Tie-set matrix, Cut-set matrix, Formulation of the equilibrium equations in the matrix form, Solution of the resistive and non-resistive networks, Principle of Duality.	
UNIT -IV	**Transient Analysis of the Series Reactive Circuits**	**(06 Hours)**
	Time and frequency domain analysis of linear circuits such as RL, RC and RLC circuits, A procedure for evaluating initial conditions, the step response in RC, RL, RLC circuits using Laplace Transform.	
UNIT -V	**Two Port Networks**	**(06 Hours)**
	Concept of Two port network, Z, Y, H, ABCD and other parameters, Relationships between two-port network parameters, Reciprocity and Symmetry conditions	
UNIT -VI	**Passive Filter Analysis**	**(06 Hours)**

	Filter Fundamentals, Constant K prototype for Low Pass Filter, High Pass Filter, Band Pass Filter and Band Stop Filter,m-derived Low Pass Filter and High Pass Filter, Terminating half sections, Composite filters, Applications of passive filters.	

Project Based Learning: Maximum 4 students per group , projects based only on the course

Reference Books:

1. D. Roy Choudhury, 'Network and Systems', New Age International Publishers, Second Edition.
2. Franklin F. Kuo, 'Network Analysis and Synthesis', John Wiley & Sons (Second Edition)
3. M. E. Van Valkenburg, 'Network Analysis', PHI (3rd Edition)
4. John D. Ryder, 'Networks, Lines and Fields', PHI Learning Pvt. Ltd., Second Edition

Bharati Vidyapeeth
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College of Engineering, Pune

B. Tech. Sem. III: Electronics & Telecommunication Engineering
COURSE: - DATABASE MANAGEMENT SYSTEMS

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	Theory : 03
Practical: 02 Hours / Week	Internal Assessment :40 Marks TW: 25 Marks OR: 25 Marks	Term Work & Oral : 01
Total : 05 Hours/Week	Total :150 Marks	Total Credit : 04

Course Pre-requisites: Computer Programming-II

Course Outcomes: After successfully completing the course, the student will be able to

CO1	Design E-R Model for given requirements and convert the same into database tables.
CO2	Use database techniques such as SQL & PL/SQL.
CO3	Use Algorithms for Decomposition such as 2NF, 3NF, BCNF.
CO4	Use algorithms to solve scheduling conflicts.
CO5	Identify the Pros and cons of Parallel and Distributed Databases
CO6	Use modern database techniques such as NOSQL.

UNIT – I	**Introduction**	**(06 Hours)**
	Introduction to Database Management Systems, Purpose of Database Systems, Database-System Applications, View of Data, Database Languages, Database System Structure, Data Models, Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process, Entity Relationship Model, ER Diagram, Design Issues, Extended E-R Features, converting E-R & EER diagram into tables **,**Introduction to normalization.	
UNIT – II	**Relational Database Design**	**(06 Hours)**
	Relational Model: Basic concepts, Attributes and Domains, CODD's Rules, Relational Integrity: Domain, Referential Integrities, Enterprise Constraints, Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, Algorithms for Decomposition, 2NF, 3NF, BCNF, Modeling Temporal Data	
UNIT - III	**SQL AND PL/SQL**	**(06 Hours)**
	SQL: Characteristics and advantages, SQL Data Types and Literals, DDL, DML, DCL, TCL, SQL Operators, Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updating using Views, Indexes, SQL DML Queries: SELECT Query and clauses, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, Nested Queries, Database Modification using SQL Insert, Update and Delete Queries. PL/SQL: concept of Stored	

	Procedures & Functions, Cursors, Triggers, Assertions, roles and privileges, Embedded SQL, Dynamic SQL	
UNIT -IV	**Database Transactions and Query Processing**	**(06 Hours)**
	Basic concept of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non-recoverable Schedules, Concurrency Control: Need, Locking Methods, Deadlocks, Timestamping Methods, Recovery methods: Shadow-Paging and Log-Based Recovery, Checkpoints, Query Processing, Query Optimization, Performance Tuning	
UNIT -V	**Parallel and Distributed Databases**	**(06 Hours)**
	Introduction to Database Architectures: Multi-user DBMS Architectures, Case study-Oracle Architecture. Parallel Databases: Speedup and Scale up, Architectures of Parallel Databases. Distributed Databases: Architecture of Distributed Databases, Distributed Database Design, Distributed Data Storage, Distributed Transaction: Basics, Failure modes, Commit Protocols, Concurrency Control in Distributed Database . Cloud database examples.	
UNIT -VI	**NoSQL Database**	**(06 Hours)**
	Introduction to NoSQL Database, Types, and examples of NoSQL Database- Key value store, document store, graph, Performance, Structured verses unstructured data, Distributed Database Model, CAP theorem and BASE Properties, Comparative study of SQL and NoSQL, NoSQL Data Models, Case Study-unstructured data from social media. Introduction to Big Data, HADOOP: HDFS, MapReduce, JSON	

Project Based Learning: Maximum 4 students per group , projects based only on the course

List of experiments

1. Write a query to display all the columns from salesman table. First create a Salesman table.
2. Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as Table, View, Index, Sequence, Synonym
3. Design at least 10 SQL queries for suitable database application using SQL DML statements: Insert, Select, Update, Delete with operators, functions, and set operator
4. Design at least 10 SQL queries for suitable database application using SQL DML statements: all types of Join, Sub-Query and View.
5. Unnamed PL/SQL code block: Use of Control structure and Exception handling is mandatory.
6. Write a PL/SQL block of code for the following requirements:

1. Schema: a) Borrower(Rollin, Name, Date of Issue, Name of Book, Status)
2. Fine(Roll.no, Date ,Amt)

a) Accept roll.no & name of book from use.
b) Check the number of days (from date of issue), if days are between 15 to 30 then fine amount will be Rs 5per day.
c) If no. of days>30, per day fine will be Rs 50 per day & for days less than 30, Rs. 5 perday.
d) After submitting the book, status will change from I to R.
e) If condition of fine is true, then details will be stored into fine table

Frame the problem statement for writing PL/SQL block in line with above statement.

7. Cursors: (All types: Implicit, Explicit, Cursor FOR Loop, Parameterized Cursor) Write a PL/SQL block of code using parameterized Cursor, that will merge the data available in the newly created table Rollcall with the data available in the table Rollcall. If the data in the first table already exist in the second table, then that data should

	be skipped. Frame the separate problem statement for writing PL/SQL block to implement all types of Cursors in line with above statement. The problem statement should clearly state the requirements.
8.	. PL/SQL Stored Procedure and Stored Function. Write a Stored Procedure namely proc_Grade for the categorization of student. If marks scored by students in examination is <=1500 and marks>=990 then student will be placed in distinction category if marks scored are between 989 and900 category is first class, if marks 899 and 825 category is Higher Second Class Write a PL/SQL block for using procedure created with above requirement. Stud_Marks(name, total_marks) Result (Roll,Name, Class) Frame the separate problem statement for writing PL/SQL Stored Procedure and function, inline with above statement. The problem statement should clearly state the requirements
9.	PL/SQL Stored Procedure and Stored Function. Write a Stored Procedure namely proc_Grade for the categorization of student. If marks scored by students in examination is <=1500 and marks>=990 then student will be placed in distinction category if marks scored are between 989 and900 category is first class, if marks 899 and 825 category is Higher Second Class Write a PL/SQL block for using procedure created with above requirement. Stud Marks (name, total marks) Result (Roll, Name, Class) Frame the separate problem statement for writing PL/SQL Stored Procedure and function, in line with above statement. The problem statement should clearly state the requirements
10.	Write a program to implement Mogo DB database connectivity with python Implement Database navigation operations (add, delete, edit etc.) using ODBC/JDBC.
11.	Implement MYSQL/Oracle database connectivity with python Implement Database navigation operations (add, delete, edit,) using ODBC/JDBC
Reference Books	
1.	Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition
2.	Connally T, Begg C., "Database Systems", Pearson Education, ISBN 81-7808-861-4
3.	Pramod J. Sadalage and Martin Fowler, “NoSQL Distilled”, Addison Wesley, ISBN10: 0321826620, ISBN-13: 978-0321826626
4.	C J Date, “An Introduction to Database Systems”, Addison-Wesley, ISBN: 0201144719
5.	S.K.Singh, “Database Systems : Concepts, Design and Application”, Pearson, Education, ISBN 978-81-317-6092-5
6.	Kristina Chodorow, Michael Dirolf, “MangoDB: The Definitive Guide” ,O’Reilly Publications, ISBN: 978-1-449-34468-9.
7.	Adam Fowler, “NoSQL For Dummies”, John Wiley & Sons, ISBN-1118905628
8.	Kevin Roebuck, “Storing and Managing Big Data - NoSQL, HADOOP and More”, Emereopty Limited, ISBN: 1743045743, 9781743045749
9.	Joy A. Kreibich, “Using SQLite”, O'REILLY, ISBN: 13:978-93-5110-934-1
10.	Garrett Grolemund, “Hands-on Programming with R”,O'REILLY, ISBN : 13:978-93- 5110-728-6

Bharati Vidyapeeth
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B. Tech. Sem. III : Electronics & Telecommunication Engineering
COURSE: EDA TOOL PRACTICE

Teaching Scheme	**Examination Scheme**	**Credits Allotted**
Lectures : 00 Hours/Week	End Semester Examination :-Marks	Theory : 00
Practical : 02 Hours / Week	TW: 25 Marks OR: 25 Marks	Term Work & Oral : 01
Total : 02 Hours/Week	Total: 50 Marks	Total Credits : 01

Pre-requisites: Elementary Electronics, Digital Electronics

Course Outcomes: After successfully completing the course the student will be able to:

CO1	Perform Transient Analysis of simple circuits using EDA tool.
CO2	Perform AC Analysis of simple circuits using EDA tool.
CO3	Use an EDA tool for simulating basic analog electronic circuits.
CO4	Use an EDA tool for simulating basic digital electronic circuits.
CO5	Use virtual instruments in an EDA tool for analyzing and testing basic electrical and electronic circuits.
CO6	Use EDA tool for troubleshooting basic circuits.

List of experiments:

1. Study of an EDA tool, concept of simulation, different types of analyses, simulation errors.
2. Study and use virtual instruments, signal and power sources.
3. Verify Basic circuit laws and theorems.
4. Construct diode circuits and simulate the same.
5. Construct and analyze BJT biasing circuits.
6. Construct single stage CE amplifier circuit and carry out transient and AC analysis.
7. Implement Boolean equations and implement the same using basic logic gates.
8. Implement circuits with multiplexers and decoders.
9. Troubleshooting a given circuit using EDA tool.

References Books:

1.	Circuit Analysis with Multisim, David Báez-López Félix E. Guerrero-Castro, Morgan & Claypool Publishers.
2.	Advanced Circuit Simulation Using Multisim Workbench, David Báez-López Félix E. Guerrero-Castro, Morgan & Claypool Publishers

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B. Tech. Sem. IV: Electronics & Telecommunication Engineering
COURSE: - Electromagnetics

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	Theory : 03
Tutorial: 01 Hours / Week	Continuous Assessment: 40 Marks	Tutorial : 01
Total : 04 Hours/Week	Total :100 Marks	Total credit : 04

Course Pre-requisites: Engineering Mathematics I, Engineering Mathematics II,

Course Outcomes: After successfully completing the course, the student will be able to

CO1	Analyze the physical concepts of static electric fields
CO2	Analyze the physical concepts of static magnetic fields.
CO3	Apply boundary conditions to the boundaries between various media to interpret behavior of the fields on either side.
CO4	Apply the Maxwell's equations to solve problems in electromagnetic field theory
CO5	Visualize and analyze wave propagation phenomena in media with different interfaces
CO6	Interpret and apply the transmission line equation to solve the problems and determine various parameters with Smith chart

UNIT – I	**Electrostatics**	**(06 Hours)**
	3D Coordinate Geometry, Vector Calculus, Physical significance of Gradient, Divergence, Curl, coulomb's Law, Electric field intensity(E), Displacement Flux Density(D), Gauss's law, Electric potential(V), Potential Gradient, E/D/V due to uniform sources (point charge, infinite line charge, infinite surface charge) Application Case study: electrostatic discharge ,CRO	
UNIT – II	**Magneto statics**	**(06 Hours)**
	Biot–Savart's Law , Ampere's Circuit Law ,Lorentz force equation, magnetic field intensity (H), Magnetic Flux Density(B), H due to straight conductors, circular loop, infinite sheet of current, Maxwell Equations for Magneto Statics, physical interpretation. Application Case study: Magnetic Resonance Imaging (MRI)	
UNIT - III	**Boundary Conditions**	**(06 Hours)**
	Properties of Conductors, Dielectric Materials, Dielectric Polarization ,Boundary conditions (dielectric-dielectric, conductor –dielectric), significance and applications of Poisson's and Laplace's equations Magnetization, magnetic	

	materials, Boundary conditions for Magnetic Fields. Application Case study:magnetic levitation ,RF MEMS	
UNIT -IV	**Time Varying Electromagnetic Fields: Maxwell Equations**	**(06 Hours)**
	Faraday‘s law, Translational and motional e.m.f, Poisson’s and Laplace Equations, , Displacement current density, Time varying Maxwell‘s equations - point form, integral form, Power and Poynting theorem Application Case study: Motors ,Generators	
UNIT -V	**Uniform Plane Wave**	**(06 Hours)**
	Maxwell‘s equation using Phasor notations, Electromagnetic wave equations (Helmholtz equation), Relation between E and H, depth of penetration, concept of polarization, plane waves in free space, plane waves in conductors, plane waves in lossless dielectric , Snell‘s law, Application Case study: Antenna radiation mechanism	
UNIT -VI	**Transmission Line Theory**	**(06 Hours)**
	Transmission Line parameters, skin effect, physical significance of the Transmission line equations, the distortion less line, Reflection on a line not terminated in Z0, open and short circuited lines, reflection coefficient and reflection loss, standing waves, standing wave ratio, Input impedance of dissipation less line, Smith Chart and its applications in solving the Transmission line parameters, Application Case study: twisted pair cable, coaxial cable, waveguide	

List of experiments:

At least 4 Assignments should be conducted using Virtual Electromagnetic Lab,**https://www.ee.iitb.ac.in/course/~vel/**

1. Vector analysis, Electric field Intensity(E): Due to Q, ρL, ρS
2. Gauss's Law, Electric flux Density(D) & Electrical Potential (V) : Due to Q, ρL, ρS ,
3. Electrostatic Boundary Conditions: dielectric-dielectric, conductor –dielectric
4. Poisson's and Laplace's Equation: Capacitance, Energy density.
5. Magnetic field Intensity (H)- Biot -Savart: Due to I dL, K dS, J dV, and Ampere’s circuital law
6. Magnetic Boundary Conditions, Inductance, Force, Torque, Energy density.
7. Faradays Law, Maxwell’s Equations
8. Poynting Theorem, Retarded Magnetic Potential
9. Transmission line: Primary & Secondary Constants , V & I
10 computation Reflection Coefficient, SWR using Smith Chart

Project Based Learning: Maximum 4 students per group, Case studies based only on the course

Reference books

1. M.N.O. Sadiku and S.V. Kulkarni, “Principles of Electromagnetics”, Oxford University Press, India, 2015 (Asian adaptation of 'M.N.O. Sadiku, Elements of Electromagnetics, Sixth International Edition, Oxford University Press'), 6th Edition
2. William H. Hayt and John A. Buck, “Engineering Electromagnetics”, Tata McGraw Hill, 8th Revised Edition.
3. Kraus and Fleish, “Electromagnetics with Applications”, McGraw Hill International Editions, 5th Edition.
4. Jordan and Balmain, “Electromagnetic Waves and Radiating Systems”, PHI, 1964.

B. Tech. Sem. IV: Electronics & Telecommunication Engineering
SUBJECT: - CONTROL SYSTEMS

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	Theory : 03
--	Continuous Assessment: 40 Marks	--
Total : 03 Hours/Week	Total :100 Marks	Total credit : 03

Course Pre-requisites: Engineering Mathematics I, Engineering Mathematics II, MATLAB fundamentals, Signals and Systems

Course Outcomes: After successfully completing the course, the student will be able to

CO1	Identify various control systems and determine the 'Transfer Function' of a system using block diagram reduction techniqueand signal flow graph.
CO2	Determine the time response for different system, the errors in various control systems; evaluate the stability of a systemusing Routh's Stability Criterion and analysis graphical technique such as root locus.
CO3	Demonstrate the knowledge of control actions such as Proportional (P), Integral (I), Derivative (D), PI, PID andcompensators.
CO4	Determine frequency response and different graphical methods like Bode plot and polar plot.
CO5	Calculate the time response for digital control systems and design digital control system.
CO6	Implement the state variables for state variable model for linear as well as digital control systems.

UNIT – I	**Introduction to Control System**	**(06 Hours)**
	Introduction to analog as well as digital control system, Classification of Control System, controlproblem, Feedback and Non-feedback Systems, Transfer Function, Block diagram and signal flow graph analysis, Pulse transfer function, Sampled Signal Flow Graph.	
UNIT – II	**Time Domain Analysis**	**(06 Hours)**
	Time response of first order & second order system using standard test signal, steady state errors and error constants, Root locus techniques- Basic concept, rules of root locus, application of root locus techniques for control system, Hurwitz and Routh stability criteria.	

UNIT - III	**Controllers and Compensators**	**(06 Hours)**
	Effect of Poles and Zeros on the System Stability, Types of Compensators, Lead, Lag, Lead-LagCompensators design, Control actions – On/Off, P, PI, PD, PID.	
UNIT -IV	**Frequency Domain Analysis**	**(06 Hours)**
	Relationship between time & frequency response, Polar plots, Bode plot, stability in frequency domain, Nyquist stability criterion.	
UNIT -V	**Digital control systems**	**(06 Hours)**
	Time Response of discrete time systems: Time response specifications, Steady state error, errorconstants, time response for 1st order and 2nd order systems. Design of sampled data control system: Root locus technique, Bode plot, Nyquist stability Criteria.	
UNIT -VI	**State variable analysis**	**(06 Hours)**
	State variable representation-Conversion of state variable models to transfer functions- Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer Function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.	

Project Based Learning: Maximum 4 students per group , projects based only on the course

Reference Books:

1. I.J. Nagrath, M.Gopal "Control Systems Engineering", 5th Edition, New Age International Publication
2. Schaum's Series book "Feedback Control Systems".
3. Les Fenical "Control Systems", 1st Edition, Cengage Learning India.
4. R. Anandanatarajan, P. Ramesh Babu, "Control Systems Engineering", Scitech Publications
5. Norman S. Nise "Control Systems Engineering", 4th edition, Wiley edition.
6. Samarjeet Ghosh, "Control Systems Theory & Applications", 1st edition, Pearsoneducation.
7. S.K. Bhattacharya, "Control Systems Engineering", 1st edition, Pearson education.

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B. Tech. Sem. IV: Electronics & Telecommunication Engineering
COURSE : INTEGRATED CIRCUITS AND APPLICATIONS

Teaching Scheme	Examination Scheme	Credits Allotted
Lectures : 03 Hours/Week	End Semester Examination:60 Marks	Theory : 03
Practical: 02 Hours/Week	Internal Assessment :40 Marks TW: 25 Marks PR: 25 Marks	Term Work & Practical : 01
Total : 05 Hours/Week	Total :150 Marks	Total Credits : 04

Pre-requisites: ELEMENTARY ELECTRONICS, SEMICONDUCTOR DEVICES AND CIRCUITS

Course Outcomes: After successfully completing the course, the student will be able to:

CO1	Visualize the internal blocks of a typical operational amplifier IC and interpret the operational amplifier IC parameters
CO2	Analyze and design inverting, non-inverting, voltage follower, difference amplifier, instrumentation amplifier circuits usingoperational amplifier IC
CO3	Analyze and design active integrator, differentiator,active filters, log, antilog circuits using operational amplifier IC
CO4	Analyze and design operational amplifier circuits for non-linear applications
CO5	Analyze and design waveformgenerators using operational amplifier IC and IC555
CO6	Design linear power supply using three terminal voltage regulators, identify and select ADC and DAC devices based on specific requirements.

UNIT-I	Limitations of CE amplifiers, Block diagram of OPAMP, Differential amplifier with and without constant current tail (review), Level Shifter, Complementary Symmetry Output power amplifier, Frequency compensation, Ideal and practical characteristics of OPAMP, Parameters of practical OPAMP, Offset voltage balancing.	**(6 Hours)**
UNIT-II	DC and AC inverting amplifier, DC and AC Non-Inverting Amplifier, DC and AC Voltage Follower circuit, Summing Amplifier, Difference Amplifier, 2-opamp and 3-opamp Instrumentation Amplifiers, I-V and V-I converters	**(6Hours)**
UNIT-III	Active Integrator, Active Differentiator, 1st and 2nd order active LPF and HPF, All-pass filter, Bandpass and Band reject filters, notch filter, Log and anti-log amplifiers, V-Iconverter ,I-V converter	**(6 Hours)**
UNIT-IV	Analysis and design of Comparator and Schmitt Trigger circuit, Window detector, Precision rectifiers, Peak detector, Sample and Hold circuit	**(6 Hours)**
UNIT-V	Positive Feedback and Barkhausen criteria, Wein bridge oscillator, RC Phase shift oscillator, Colpitts oscillator, Hartley oscillator, Square wave generator, Triangular wave generator, IC 555 astable and monostable circuits	**(6 Hours)**
UNIT-VI	Three terminal IC voltage regulators, Parameters of DAC, Digital-to-Analog Converters (Binary weighted, R-2R ladder network type), Analog to Digital	**(6 Hours)**

	Converters (Flash, Successive Approximation, Integrating) Parameters of ADC, Introduction to sigma-delta ADC	
List of experiments:		
1	Design, build and test DC inverting, non-inverting and voltage follower circuits.	
2	Design, build and test AC inverting, non-inverting and voltage follower circuits, plot frequency response	
3	Design, build and test inverting, non-inverting summing amplifier circuits	
4	Design, build and test integrator circuit and plot frequency response	
5	Design, build and test differentiator circuit and plot frequency response	
6	Design, build and test 1st order active LPF and HPF and plot frequency responses	
7	Design, build and test Wein bridge oscillator	
8	Design, build and test RC phase shift oscillator	
9	Design, build and test astable multivibrator using IC555	
10	Measure line and load regulation of three terminal regulator	
11	Simulate an ADC and DAC circuits	
Project Based Learning: Maximum 4 students per group , projects based only on the course		
References Books:		
1.	Operational Amplifiers and Linear ICs, David A. Bell, 3rd Edition,2008, ISBN:0195696131, 9780195696131, Oxford University Press.	
2.	Design with Operational Amplifiers and Analog Integrated Circuits, Sergio Franco, 4th Edition, McGraw-Hill.	

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B. Tech. Sem. IV: Electronics & Telecommunication Engineering
COURSE: - ANALOG COMMUNICATION

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Lectures : 03 Hours/Week	End Semester Examination:60 Marks	Theory : 03
Practical : 02 Hours/Week	Internal Assessment :40 Marks TW: 25 Marks PR: 25 Marks	Term Work & Oral : 01
Total : 05 Hours/Week	Total :150 Marks	Total Credits : 04

Course Pre-requisites: Signals and Systems.

Course Outcomes: After successfully completing the course, the student will be able to

CO1	Identify basic components and effect of noise on communication system.
CO2	Analyze DSB-FC modulation and demodulation techniques mathematically.
CO3	Analyze DSB-SC & SSB modulation and demodulation techniques mathematically.
CO4	Analyze frequency modulation and demodulation techniques mathematically.
CO5	Identify components of communication receiver system.
CO6	Use the concepts of sampling for analysis of pulse modulation techniques.

UNIT – I	**Principles of Electronic Communication Systems**	**(06 Hours)**
	Review of signals and systems, RF bands, Block schematic of electronic communication system, base band signals, Necessity of modulation, Types of channels, Noise types -Internal & External, Noise Calculations, Signal to Noise ratio, Noise figure, Noise Temperature	
UNIT – II	**Amplitude Modulation-I**	**(06 Hours)**
	Amplitude Modulation principles, Representation of AM, Frequency spectrum & BW, Modulation index, Percentage modulation, Power relations in AM, DSB-FC Generation-linear and non-linear modulator, Linear modulators- low and high level linear modulators, Non-linear modulators- square law modulator and switching modulator, DSB-FC Demodulation- square law detector and envelope/diode detector.	
UNIT - III	**Amplitude Modulation-II**	**(06 Hours)**
	DSB-SC Principles, DSB-SC Generation Methods: Multiplier modulator, linear modulator, non-linear modulator and switching modulator, DSB-SC Demodulation-synchronous and coherent detection, SSB Principles, SSB Generation Methods: Filter method, phase shift method & the third method, SSB Demodulation, Comparison of AM,DSB-SC and SSB, Independent sideband system (ISB),Vestigial sideband(VSB).	

UNIT -IV	**Frequency Modulation**	**(06 Hours)**
	Angle Modulation, Principles, mathematical analysis of FM, frequency deviation and percentage modulation, modulation index, deviation ratio, Bessel function, BW requirements, Narrow band & wide band FM, Pre-emphasis and de-emphasis, FM modulators - Direct & Indirect modulator, Direct modulator- varactor diode modulator, reactance modulator, Indirect modulator- Armstrong method, FM demodulators - Direct & Indirect detector, Direct detectors- Balanced slope detector, Ratio detector, Indirect detector- phase locked loop.	
UNIT -V	**Radio Receivers**	**(06 Hours)**
	Block diagram of AM receiver- TRF and Super heterodyne receiver, FM receiver, receiver performance and measurement parameters: Sensitivity, Selectivity, fidelity, Image Frequency Rejection, Automatic Gain Control (AGC)- simple and delayed AGC, IF Amplifiers, Tracking- Two point and three point tracking, Mixers-separately excited mixers and self-excited mixers.	
UNIT -VI	**Pulse Modulation**	**(06 Hours)**
	Sampling process, Nyquist criteria, Sampling types :Natural & flat top sampling, aliasing error and aperture effect, Pulse Modulation-PAM modulator & demodulator, PWM modulator & demodulator, PPM modulator& demodulator, Comparison of PAM,PWM and PPM, Multiplexing, TDM- transmitter and receiver, FDM- transmitter and receiver.	

List of experiments:

1. To perform Amplitude Modulation and Demodulation.
2. Write a MATLAB program for generation of AM signal.
3. To perform DSB-SC Modulation & Demodulation.
4. Write a MATLAB program for generation of DSB-SC signal.
5. To perform Frequency Modulation and Demodulation.
6. Write a MATLAB program for generation of FM signal.
7. To perform Sampling and Reconstruction of a signal.
8. To perform Pulse Amplitude Modulation (PAM)
9. To perform Pulse Width Modulation (PWM)
10. To perform Pulse Position Modulation (PPM)

Project Based Learning: Maximum 4 students per group, projects based only on the course

Reference Books

1. Electronics Communication System, George Kennedy, 4th Edition, Tata McGraw Hill Publication.
2. Modern Digital and analog Communication System, B.P.Lathi, Oxford University press.
3. Communication Systems, Simon Haykin, 4th Edition, John Wiley & Sons.
4. Electronics Communications, Dennis Roddy, John Coolen, 4th Edition- Pearson Education.

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B. Tech. Sem. IV: Electronics & Telecommunication Engineering
COURSE: - Introduction to Data science

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Lectures : 03 Hours/Week	End Semester Examination:60 Marks	Theory : 03
Practical : 02 Hours/Week	Internal Assessment :40 Marks TW: 25 Marks PR: 25 Marks	Term Work & Oral : 01
Total : 05 Hours/Week	Total :150 Marks	Total Credits : 04

Course Pre-requisites: Database Management Systems, Computer Programming-II

Course Outcomes: After successfully completing the course, the student will be able to

CO1	Develop a schema design, perform ETL operations with normalized techniques.
CO2	Visualize the data and detect anomalies with the help of statistical methods.
CO3	Implement ANOVA test, Regression & Dimensionality Reduction Techniques
CO4	Model different machine learning algorithms and draw predictive outcomes.
CO5	Develop an interactive and functional Dashboard using Power BI.
CO6	Develop a schema design, perform ETL operations with normalized techniques.

UNIT – I	**Fundamentals of Data Analysis using MySQL**	**(06 Hours)**
	Introduction to Data Science, DBMS approach to analytics, ER Diagram and Schema design, Normalization techniques, data cleaning and transforming – Extract, Transform & Load	
UNIT – II	**Data Analysis and Visualization with Excel, Python**	**(06 Hours)**
	with Excel: Descriptive statistics, Outlier detection, Visualization: Box plot, Line chart, Pie chart, Bar charts, Histogram **With Python:** Pandas and Numpy, Data modeling and transforming, dealing with null values, different data types, preparing data for the model, Visualization with Matplotlib, Seaborn	
UNIT - III	**Advanced Statistics**	**(06 Hours)**
	Analysis of Variance (ANOVA), Regression Analysis: linear regression, multiple linear, and non-linear regression, Dimension Reduction Techniques**.**	

UNIT -IV	**Machine Learning-I**	**(06 Hours)**
	Introduction to Supervised and Unsupervised Learning, Clustering, Decision Trees, Random Forest, Multiple Linear Regression, Logistic Regression, Linear Discriminant Analysis.	
UNIT -V	**Machine Learning-II**	**(06 Hours)**
	Time Series Forecasting: Introduction to Time Series, Correlation, Forecasting, Autoregressive models; Model Validation, Handling Unstructured Data.	
UNIT -VI	**Data visualization using Power BI**	**(06 Hours)**
	Introduction to Power BI, Basic charts and dashboard, Descriptive Statistics, Dimensions and Measures, Visual analytics: Storytelling through data, Dashboard design & principles.	

List of experiments

1. SQL - Northwind Trader Database: Schema Design, Normalization & Cleaning.
2. Northwind Trader Database: Querying.
3. Statistics & Visualization with Excel.
4. Handling data using Python Pandas – Load (Multiple sources such as – Excel, SQL, CSV, URL), Transform.
5. Exploratory Data Analysis & Visualization using Python.
6. Machine Learning [Supervised] – Regression (Linear, Logistic & Multi-Linear.
7. Machine Learning [Supervised] – Classification (Logistic Regression, Decision Tree & Random Forest, KNN, K Mean Clustering, SVM).
8. Machine Learning [Time series] – ECG Analysis.
9. Machine Learning – Titanic Dataset Analysis (EDA)-1 .
10. Machine Learning – Titanic Dataset Analysis (Visualization & Prediction)
11. Power BI – Input & Transforming Data.
12. Power BI – Creating Visuals & Reports.
13. Power BI – Dashboard.

Project Based Learning: Maximum 4 students per group , projects based only on the course

Reference Books

1. Introduction to Machine Learning with Python: A Guide for Data Scientists by Andreas C. Mueller, Sarah Guido, O′Reilly Publication.
2. Practical Statistics for Data Scientists by Peter Bruce, Andrew Bruce,
3. Microsoft Power BI Quick Start Guide: Build dashboards and visualizations
4. Python Machine Learning By Example: The easiest way to get into
5. machine learning, by Yuxi (Hayden) Liu, Packt Publishing
6. Mastering Microsoft Power BI: Expert techniques for effective data analytics and business intelligence, by Brett Powell, Packt Publishing

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B. Tech. Sem IV: Electronics & Telecommunication Engineering
COURSE: Microcontroller Programming

Teaching Scheme	**Examination Scheme**	**Credits Allotted**
Lectures : 0 Hours/Week	End Semester Examination :00 Marks	Theory : 00
Practical : 2 Hours/Week	Internal Assessment :00 Marks TW: 25 Marks OR: 25 Marks	Term Work & Oral : 01
Total : 2 Hours/Week	Total : 50 Marks	Total Credits : 01

Pre-requisites: Digital Electronics, Elementary Electronics

Course Outcomes: After successfully completing the course, the student will be able to:

CO1	Draw 8-bit microcontroller architecture- 8051
CO2	Program 8051 microcontroller using various addressing modes and data transfer instructions
CO3	Perform assembly language programming for 8051
CO4	Analyze the operation of timers and counters for delay generation and event counting.
CO5	Interface the different peripherals with microcontroller.
CO6	Design a microcontroller-based prototype system.

List of experiments:

Programming / interfacing experiments with IDE for 8051

Assembly Language Programming experiments GROUP A (All compulsory)

1.	Study architecture and programmer's model of 8051 micro controller
2.	Identify and study various blocks of 8051 micro controller development board.
3.	Study of Addressing modes and Instruction set of 8051 micro controllers
4.	Study Instruction set of 8051 for Arithmetic and Logical operations a. Write an Assembly language program for Addition Subtraction Multiplication and Division of 2 – 8 bit and16 bit numbers
5.	Study Instruction set of 8051 for Arithmetic /Logical and Program and branching instructions a. Write an Assembly language program for Addition and Subtraction of N - 8 bit numbers. Perform simple logical operations on 16 bit data.
6.	Study Instruction set of 8051 for Data transfer instructions a. Write an Assembly language program for Block of Data transfer between specified memory locations. Consider Overlap and nonoverlap type of data Interfacing experiments using 8051 Trainer kit and interfacing modules or simulation. Implementation in Embedded C /Assembly (Any 4 between 07 to 11)

7.	Study port structure and interfacing concepts of 8051 a. Write an Assembly language program to Interface 7-segment display to show the decimal number from 0 to 9.
8.	Write an Assembly language program to interface LCD and LEDs with port and display information.
9.	Study DAC interfacing concepts of 8051 a. Write an Assembly language program for generation of following waveform with DAC /Simulation 1. Triangular 2. Staircase 3. sine
10.	Study Timers/counters in 8051 microcontrollers. a. Write an Assembly language program to generate pulse and square wave by using on chip timer.
11.	Write an Assembly language program to Interface relay with micro controller and turn it ON and OFF.

Reference Books:

1.The 8051 Microcontroller and Embedded Systems: Using Assembly and C by M.A. MAZIDI

2 The 8051 Micro controller 3rd Edition By Kenneth Ayala

4.Practical Electronics (Volume I): 8085 Microprocessor & 8051 Micro controller Laboratory Manual by Balamurugan A , Veeramanikandasamy T

5. Embedding system building blocks, Labrosse, via CMP publishers.

6. Embedded Systems, Raj Kamal, TMH. 4) Micro Controllers, Ajay V Deshmukh, TMH.

7. Micro Controllers, Ajay V Deshmukh, TMH.

8. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley.

9. Micro controllers, Raj Kamal, Pearson Edition.

10.An Embedded Software Primer, David E. Simon, Pearson Edition.

11.Embedded/Real-Time Systems‘, KVKKF Prasad, Dreamtech, Press

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College of Engineering, Pune

B. Tech Sem V: Electronics & Telecommunication Engineering **Subject: Digital Communication**		
Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 02	Continuous Assessment: 40 Marks	Credit: 01
Tutorial: 00	TW: 25 Marks	Credit: 00
	Oral: 25 Marks	
	Practical: 00	Total Credit: 04

Course Pre-requisites: Analog Communication, Signals & System

Course Outcomes: After learning this course students will be able to

1	Identify key components and performance criteria in digital communication
2	Apply various waveform coding techniques in digital communication systems.
3	Implement line coding and digital multiplexing techniques to optimize signal transmission.
4	Apply digital carrier modulation techniques for efficient signal transmission.
5	Analyze and evaluate multiple access techniques for reliable communication.
6	Evaluate and utilize information theory principles to enhance the performance of communication systems.

UNIT – I	**Fundamentals of Digital Communication System**	**(06 Hours)**
	Introduction to Digital Communication and Analog Communication, Evolution of Communication Systems, Components of a Digital Communication System, Basic Digital Communication Nomenclature, Signal Representation in Digital Communication, Noise and Distortion in Digital and Analog Systems, Bandwidth and Spectrum Efficiency Considerations, Sampling Process, Types of Sampling, Nyquist Theorem & Aliasing, Anti-Aliasing Filters and Their Role	
UNIT –II	**Waveform Coding Techniques**	**(06 Hours)**
	PCM Generation and Reconstruction, Quantization Noise, Non-uniform Quantization and Compounding, PCM with noise: Decoding noise, Error threshold, Delta Modulation, Adaptive Delta Modulation, Delta Sigma Modulation, Differential Pulse Code Modulation, LPC speech synthesis.	

UNIT – III	**Line Coding and Digital Multiplexing**	**(06 Hours)**
	Block diagram of baseband transmitter-receiver system, Line Coding & its properties. NRZ & RZ types, signaling format for unipolar, Polar, bipolar (AMI) & Manchester coding and their power spectra. Digital Multiplexing: Multiplexers and hierarchies, Data Multiplexers, synchronization, Inter Symbol Interference (ISI), Eye Patterns	
UNIT -IV	**Digital Carrier Modulation & Demodulation Techniques**	**(06 Hours)**
	Generation, Detection and applications of the following modulations: Binary ASK, Binary FSK, Binary PSK, Quadrature PSK, QASK, M-ary PSK, M-ary FSK and MSK. Baseband Signal Receivers, Matched Filter	
UNIT -V	**Spread Spectrum and Multiple Access Technologies**	**(06 Hours)**
	Pseudo-noise sequences, A Notion of spread Spectrum, Direct-Sequence Spread Spectrum with Coherent Binary Phase-shift Keying, Frequency Hop Spread Spectrum, TDMA, FDMA, CDMA, OFDM	
UNIT -VI	**Random Signal Theory**	**(06 Hours)**
	Probability, Joint & conditional Probability, Probability mass function, statistical averages, continuous random variables- PDF & Statistical averages, Random Processes, Time Average, Ergodicity, Power Spectral density of Stationary random processes.	

List of experiments:

1. To perform Sampling and reconstruction of a signal
2. To perform Pulse Code Modulation (PCM).
3. To observe Delta modulated signal with staircase approximation.
4. Comparing the Delta Modulation (DM) system and the Adaptive Delta Modulation (ADM) system
5. To perform Differential Pulse Code Modulation (DPCM).
6. To draw and observe practically Different Data Formats
7. To perform Amplitude Shift Keying (ASK) modulation and demodulation.
8. To perform Binary Phase Shift Keying (BPSK) modulation and demodulation.
9. To perform Binary Frequency Shift Keying (BFSK) modulation and demodulation
10. To perform Quadrature Phase Shift Keying (QPSK) modulation and demodulation.

11. MATLAB simulation of digital modulation techniques and Information Theory
Text Books/ Reference Books:
1. Simon Haykin, “Digital Communication Systems”, John Wiley & Sons, Fourth Edition.
2. A.B Carlson, P B Crully, J C Rutledge, “Communication Systems”, Fourth Edition, McGraw Hill Publication.
3. K. Sam Shanmugam, “Digital and analogue communication systems”, John Wiley.
4. Roberto Togneri, Christopher J.S deSilva “Fundamentals of Information Theory and Coding Design”, CRC Press.
5.Ranjan Bose, “Information Theory Coding and Cryptography” Tata McGraw-Hill

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B. Tech Sem V: Electronics & Telecommunication Engineering
Subject: Embedded Systems

Teaching Scheme:	Examination Scheme:	Credits Allotted:
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 02	Continuous Assessment: 40 Marks	Credit: 01
Tutorial: 00	TW: 25 Marks	
	Practical: 25 Marks	
	Total: 150 Marks	Total Credit: 04

Course Pre-requisites: Digital Electronics

Course Outcomes: After learning this course students will be able to

1	Apply fundamental concepts, architectures, and core components of embedded systems in real World application.
2	Analyze and apply design methodologies using modeling techniques and Embedded C programming.
3	Analyze the architecture and peripheral features of the ARM7-based LPC2148.
4	Implement and demonstrate effective peripheral interfacing on the LPC2148 using Embedded C.
5	Apply the fundamental principles of real-time operating systems, including kernel architecture and task scheduling.
6	Design and develop advanced RTOS applications incorporating multitasking, inter-process communication, and priority management.

UNIT – I	**Introduction to Embedded Systems**	**(06 Hours)**
	Embedded System Definition & Applications: Characteristics, real-world use cases (automotive, healthcare, robotics-industrial), Embedded vs. General-Purpose Computing: Differences and key architectural considerations. Core Components: Hardware: Microcontrollers, microprocessors, memory (RAM, ROM, and Flash), sensors, actuators, and communication interfaces. Software: Embedded firmware, Application software, Editor, Emulator, Assembler, Compiler, Architectural Classifications: Harvard vs. Von Neumann architectures. Embedded System Design Life Cycle: Development process and challenges.	
UNIT – II	**Embedded System Design Methodologies & Programming**	**(06 Hours)**
	Modeling Techniques: Flow graphs, FSM, UML for embedded design, requirement analysis, and use case modeling. Building Process for Embedded Systems: Compilation process (preprocessing, compiling, linking, locating), cross-	

	compilers, linker scripts, embedded file systems. Embedded Programming Fundamentals: Differences between C and Embedded C. Programming structure, data types, constants, variables, bitwise operations. Functions, control structures (if-else, loops) and their role in embedded systems.	
UNIT – III	**ARM7 Processor**	**(06 Hours)**
	Introduction to ARM Processors and Its Versions: ARM7, ARM9 & ARM11 Features, ARM7 Data Flow Model, Programmer's Model, Modes of Operations, Overview of Instruction Set. ARM7 Based LPC2148: Features, Architecture (Block Diagram and Its Description), ADC, DAC, System Control Block -PLL, VPB Divider, Memory Map, GPIO, Pin Connect Block, Timers	
UNIT -IV	**Interfacing with ARM7**	**(06 Hours)**
	Interfacing the peripherals with LPC2148: LED, LCD, GLCD, KEYPAD, GSM and GPS using UART, on-chip ADC using interrupt (VIC), EEPROM using I2C, SDCARD using SPI, on-chip. DAC for waveform generation. Programming in Embedded C.	
UNIT -V	**Real-Time Operating Systems (RTOS) – Fundamentals**	**(06 Hours)**
	Introduction to Operating Systems: Features, functions, kernel architecture. Types of Embedded OS Models: Polled loop systems, interrupt-driven systems, multi-rate systems. Processes & Task Management: Task states, Process/Task Control Block (PCB/TCB), threads. Schedulers & Scheduling Algorithms: Concepts of scheduling, dispatcher, preemptive and non-preemptive scheduling. RTOS Features & Implementations: µC/OS-II, Free RTOS fundamentals.	
UNIT -VI	**RTOS Advanced Concepts & Multitasking**	**(06 Hours)**
	Context Switching & Task Synchronization: Mutex, semaphore, deadlocks. Inter-Process Communication (IPC): Shared memory, mailbox, and message queue. Priority Management & Inversion Handling: Priority ceiling protocol, priority inheritance protocol. RTOS-Based System Design: Case studies in automotive, healthcare, and industrial automation. Practical RTOS Applications: Implementing scheduling, task management, and resource sharing in real-time embedded systems.	

List of Experiments :

1. To implement a basic LED blinking program using LPC2148.
2. To develop a buzzer control application that triggers sound alerts based on input conditions using LPC2148.

3. To design and simulate an LCD/GLCD interfacing application that displays alphanumeric data on LPC2148.
4. To configure and simulate the internal ADC of LPC2148 for reading analog sensor data using interrupt-driven programming.
5. To establish UART-based serial communication between LPC2148 and a GSM/GPS module for data exchange.
6. To simulate SD card interfacing using the SPI protocol on LPC2148 for data storage operations.
7. To implement I2C communication for reading from and writing to an EEPROM connected to LPC2148.
8. To develop a seven-segment display application that shows numeric values using LPC2148.
9. To generate PWM signals on LPC2148 for controlling the speed and direction of a DC motor.
10. To implement a simple RTOS-based application on LPC2148 demonstrating task scheduling and inter-task communication using μC/OS-II.
Text Books/ Reference Books:
1. Andrew Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide Designing and Optimizing System Software", ELSEVIER
2. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M", Newness, ELSEVIER
3. Rajkamal, "Embedded System-Architecture, Programming and Design", TMH Publications, Edition 2003

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B. Tech Sem V: Electronics & Telecommunication Engineering
Subject: Power Electronics

Teaching Scheme:	Examination Scheme:	Credits Allotted:
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 02	Continuous Assessment: 40 Marks	
Tutorial: 00	TW: 25 Marks	Credit: 00
	Oral: 25 Marks	Credit: 01
	Practical: 00	Total Credit: 04

Course Pre-requisites: Elementary Electronics, Electrical Technology, Signals & Systems, Semiconductor Devices & Circuits

Course Outcomes: After learning this course students will be able to

1	Evaluate the constructions, switching characteristics and selection of power devices and thyristors.
2	Design and analyze controlled rectifiers (AC-DC) and voltage controllers (AC-AC)
3	Design and analyze different types of inverters (DC-AC)
4	Identify and differentiate between different types of Choppers (DC-DC)
5	Design and analyze different types of motors
6	Evaluate the applications of power electronics devices in industry.

UNIT – I	**Introduction to Power Devices**	**(06 Hours)**
	Introduction to Power Electronics, Introduction to Uncontrolled Device: Power diode, Power Transistor, Power MOSFET, IGBT. Introduction to Controlled Device: SCR: Construction, Operation, VI characteristics, Two transistor analogy, Turn on methods, Gate Characteristics, Ratings. TRIAC: Construction, Operation. GTO: Construction, Operation, Turn off mechanism, Applications.	
UNIT – II	**Rectifiers and AC voltage controller**	**(06 Hours)**
	Controlled Rectifiers: line, load & forced commutation, Single phase (half and	

	full) with R & RL and Three phase (half and full) Controlled rectifiers. Voltage Controller: Single phase AC voltage controller for R & R-L loads, three phase AC voltage controller for R load	
UNIT -III	**Inverters**	**(06 Hours)**
	Classification, Series Inverter, Parallel Inverter, Bridge Inverter, Three phase bridge inverter, PWM Techniques, Harmonic reduction	
UNIT -IV	**Choppers**	**(06 Hours)**
	Introduction, Classification, step-down Chopper, Step-up Chopper, Types of Choppers (class A, B, C, D, E), Chopper control techniques, Thyristor chopper Circuits (Voltage commutated, current commutated & Load commutated)	
UNIT -V	**Introduction to Motors**	**(06 Hours)**
	DC motors, AC Motors, Special Purpose Motors, Induction Motor, Universal Motor, Stepper Motor, Servomotors, BLDC Motors etc. (Qualitative analysis only)	
UNIT -VI	**Applications and Emerging Trends**	**(06 Hours)**
	Power electronics in telecommunication systems: Power supplies for base stations, RF amplifiers. Role in renewable energy systems: Solar inverters, wind energy conversion. Introduction to advanced topics: Resonant converters, multilevel inverters. Protection circuits: Overvoltage, overcurrent, and thermal protection in power electronic systems	

List of experiments:

1. To study the SCR V-I characteristics and find latching current, holding current
2. To study the characteristics of IGBT.
3. To study the characteristics of MOSFET.
4. To draw V-I characteristics of TRIAC for different values of gate current.
5. To Study triggering circuits.
6. To study single phase AC voltage regulator
7. To study Single Phase Half controlled bridge converter with R and RL and active (RLE) load.
8. To study Single Phase full controlled bridge converter with R and RL and active (RLE) load.
9. To study the chopper using MOSFET

10. To Study Series, Parallel and Bedford inverter
11. Simulation of Converter / Chopper using MATLAB/ Lab View/ Multisim.
12. Simulation of PWM Inverter using MATLAB/ Lab View/ Multisim.
Text Books / Reference Books:
1. M. H. Rashid, “Power Electronics circuits devices and applications”, PHI 3rd edition, 2004 edition, New Delhi.
2. M. D. Singh & K B Khanchandani, “Power Electronics”, TMH, New Delhi.
3. Deodatta Shingare “Industrial and Power Electronics”, EP Publication, Maharashtra.
4. P.C. Sen, “Modern Power Electronics”, S Chand & Co New Delhi.
5. Ned Mohan, T. Undeland & W. Robbins, “Power Electronics Converters applications and design” 2nd edition, John Willey & sons
6. B. L. Thareja& A. K. Tahreja, “Electrical Technology” Volume 1 & 2, S.Chand Publications
7. H. Cotton, “Electrical Technology”, CBS.
8. Nagrath Kothari, “Electrical Machines”, TMH.

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B. Tech Sem V: Electronics & Telecommunication Engineering **Course: Data Communication and Networking**		
Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 00	Continuous Assessment: 40 Marks	
Tutorial: 00	TW: 00	
	Oral: 00	
	Practical: 00	Total Credit: 03

Course Pre-requisites: Analog Communications

Course Outcomes: After learning this course students will be able to

1	Identify different types of network topologies, addressing schemes and the protocol stacks
2	Compare various transmission media and broadband technologies
3	Implement and evaluate flow control, error control, and medium access control techniques for efficient data transmission.
4	Identify network layer addressing and routing schemes.
5	Compare and distinguish between connection-oriented and connectionless transport protocols.
6	Implement application layer protocols in networking.

UNIT – I	**Fundamentals of Data Communication**	**(06 Hours)**
	Components of data communication: Transmitter, Receiver, Medium, Message, Protocol. Standards, Standard organizations, Basic block diagram of data communication system. Need of computer networks, Network criteria, advantages of networking Network types, Network topologies, ISO-OSI model, TCP/IP protocol, Comparison of OSI and TCP/IP.	
UNIT – II	**Physical Layer**	**(06 Hours)**
	Transmission medium: classification based on electromagnetic wave spectrum. Guided Media -Twisted pair (UTP, STP) cable -connector, Coaxial cable, Fiber-optic cable, twisted pair. Unguided Media-Radio waves, microwaves, Infrared and their applications Multiplexing: Basic concept, Time - Division Multiplexing, Frequency- Division Multiplexing, Wavelength- Division Multiplexing, types of Time - Division	

	Multiplexing, Code Division Multiple Access (CDMA), Orthogonal Frequency Division Multiplexing (OFDM). Switching: Circuit-switched networks, Packet switched networks -Datagram approach, virtual circuit approach. Modems: classifications: Broadband modem, DSL-ADSL.	
UNIT - III	**Data Link Layer**	**(06 Hours)**
	Design issues, Data link services: Flow control, Error control. Flow control: Framing, Flow and Error control, Noiseless and Noisy Channels – Stop and wait Protocol. Sliding window Protocol: One bit window protocol, Go Back N ARQ Protocol, Selective ARQ, Piggybacking. High Level Data Link Control (HDLC), Medium Access Control Protocols, Random Access- ALOHA, Slotted ALOHA, CSMA, CSMA/CD. CSMA/CA, Controlled Access- Reservation Polling, token passing, Wired LANs: Ethernet: Ethernet Protocol: IEEE802, Ethernet Evolution, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet. Characteristics, Addressing, Access Method, Efficiency, Implementation.	
UNIT -IV	**Network Layer**	**(06 Hours)**
	Design issues, Packet Switching, Network devices: Repeater, Hub, Bridge, Switches, Router, Gateway. Network layer Logical addressing: Principles of Internetworking, requirements, IPv4 packet, IPv4 Addresses: addressing, classful and classless addressing. Need for IPv6, IPv6 Datagram format, comparison with IPv4, IPv6 addresses, DHCP, Network address translation (NAT). Network layer-Multicast Routing Protocols: Unicast, Multicast and Broadcast routing and applications. Routing protocols: Distance Vector routing and link state routing, DSARIP, OSPF, BGP and EIGRP. Subnetting, super netting, VLSM. Overview of ICMP, ARP, RARP.	
UNIT -V	**Transport Layer**	**(06 Hours)**
	Connectionless and Connection–oriented services at transport layer. Congestion Control and Quality of Service. Congestion control in TCP. Transport Layer Services: Process to process delivery, UDP,RTP and SCTP- ports, Packet format, operation, Advantages and Application. TCP and UDP checksum calculation. TCP Segment, TCP three-way handshake, User datagram Protocol (UDP), Datagram.	

UNIT -VI	Application Layer	(06 Hours)
	Introduction to Application layer Protocols: HTTP, FTP, DNS, SMTP, TELNET, SSH, DHCP and SNMP, Remote Logging, Electronic Mail, and File Transfer. Network Security: Cryptography, Block diagram of symmetric and asymmetric Cryptography. Symmetric key Algorithms (DES, AES), Public key Algorithms-RSA, Digital Signatures, IPSec, Firewall.	

Reference Books:

1. Data Communications and Networking – Behrouz A. Forouzan, Fifth Edition TMH.
2. Computer Networks - Andrew S Tanenbaum, 5th Edition, Pearson Education, 2013.
3. J J. F. Kurose and K. W. Ross," Computer Networking: A Top-Down Approach", Addison
4. Wesley, 5th Edition, 2010
5. Alberto Leon Garcia, "Communication Networks", McGraw Hill Education, Second Edition,
6. Fourth Edition, 2008.
7. An Engineering Approach to Computer Networks- S.Keshav, 2nd Edition, Pearson Education, 2015.
8. Understanding communications and Networks, 3rd Edition, W.A.Shay, Cengage Learning

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B. Tech Sem V: Electronics & Telecommunication Engineering
Subject: Microwave Theory and Antenna

Teaching Scheme:	Examination Scheme:	Credits Allotted:
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 00	Internal Assessment: 40 Marks	
Tutorial: 01		Credits: 01
		Total Credit: 04

Course Pre-requisites: Engineering Mathematics-I and II, Engineering Physics, Electromagnetics and Transmission Lines

Course Outcomes: After learning this course students will be able to

1	Analyze different modes in a waveguide.
2	Identify the passive devices based on microwave system requirements.
3	Identify the operations of Microwave sources and active devices.
4	Classify the antennas and calculate fundamental parameters of antenna.
5	Identify the radiation pattern of wire antennas.
6	Apply modern antenna technologies for real-world applications.

UNIT I	**MICROWAVE WAVEGUIDES**	**(06 Hours)**
	Concept of Modes in Waveguide (TE, TM), Analysis of TE and TM Modes in Rectangular Waveguide, Modes in Co-axial cable, Excitation of modes in Rectangular Waveguide, Power Transmission and losses in Waveguide, Microwave cavity resonator: Rectangular, circular and semicircular.	
UNIT II	**MICROWAVE PASSIVE DEVICES**	**(06 Hours)**
	Structure, S-matrix and Working of Microwave Passive Devices: **Waveguide Tees**: E-Plane tee and H-plane tee, Magic Tees (Hybrid Tees); Hybrid Rings (Rat-Race Circuits), Two-Hole Directional Couplers, Circulators and Isolators.	
UNIT III	**MICROWAVE SOURCES AND ACTIVE DEVICES**	**(06 Hours)**
	Construction and operation of Microwave Tubes: Two cavity Klystron, Reflex Klystron, Travelling Wave Tube (TWT), Magnetron. **Construction and Operation of Active Microwave Devices:** Gunn Diode, Tunnel Diodes, Schottky Diode, PIN Diode, Microwave Transistors.	

UNIT IV	**ANTENNA FUNDAMENTALS**	**(06Hours)**
	Definition and need of Antenna, General classification of antennas, **Definition and significance of antenna parameters:** Radiation Pattern, Radiation Power Density, Radiation Intensity, Beam width, Directivity, Antenna Efficiency, Gain, Beam Efficiency, Bandwidth, Polarization, Input Impedance, Antenna Radiation Efficiency, Antenna Vector Effective Length and Equivalent Areas, Antenna Temperature, Near field & Far-Field. **Friis' Transmission Equation.**	
UNIT -V	**WIRE ANTENNAS**	**(06 Hours)**
	Study of Radiation pattern: Half wave Dipole Antenna, Short Dipole, Monopole, Loop Antenna, Helical Antenna, Slot Antenna, Yagi-Uda Antenna.	
UNIT VI	**MODERN ANTENNA APPLICATIONS AND CASE STUDIES**	**(06 Hours)**
	Applications of Antennas in Modern Technology: IoT and Wireless Sensor Networks: Low-power, miniaturized antennas, Satellite Communications: Phased array and high-gain antennas, Biomedical Applications: Body-worn and implantable antennas. **Case Studies on Antenna Implementations:** Case Study 1: Automotive Radar Antennas – Self-driving Cars and Collision Avoidance, Case Study 2: Patch Antennas for Wearable Healthcare Monitoring. Case study 3: Antenna for wireless LAN 802.11	

List of suggested tutorials:

1. Study of the Klystron Tube.
2. Study of Gunn Diode
3. Numerical problems based on TE modes.
4. Numerical problems based on TM modes.
5. Study of passive microwave devices such as Waveguide Tees, Directional coupler,Circulator, Isolator and derive S-matrix.
6. Study of active microwave devices
7. Numerical problems based on Antenna parameters
8. Design of Simple Dipole Antenna
9. Design of Simple Monopole Antenna
10. Plot Radiation Pattern of simple Antenna structures

Text Books/Reference Books:

1. Samuel Y Liao, "Microwave Devices & Circuits", Prentice Hall of India,3rd Edition, 2006.
2. D.M.Pozar, "Microwave Engineering", John Wiley & sons, Inc, 3rd Edition, 2006.
3. Robert. E.Collin, "Foundation of Microwave Engg", Willey India. 2nd Edition
4. Annapurna Das and Sisir K Das, "Microwave Engineering", Tata Mc Graw3. Hill Inc., 1st Edition ,2004.
5. C.A Balanis , “Antenna theory and Design”, John willy & sons.
6. K.D.Prasad, “Antenna and Wave Propagation”, Satya Prakashan, New Delhi.
7. R. E. Collin, "Antennas and Radio Wave Propagation", McGraw-Hill.,
8. F. B. Gross, "Smart Antennas for Wireless Communications", McGraw-Hill., 2005
9. W. L. Stutzman, and G. A. Thiele, "Antenna Theory and Design", 2nd Ed., John Wiley & Sons. 1998.
10. Phased Array Antenna Handbook" – Robert J. Mailloux
11. RF and Microwave Wireless Systems" – Kai Chang
12. "5G NR: The Next Generation Wireless Access Technology" – Erik Dahlman, Stefan Parkvall, Johan Sköld
13. "Wearable Antennas and Body-Centric Communication" – Albert Sabban
14. "Automotive Radar Sensors in Autonomous Vehicles" – Gregory L. Charvat

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B. Tech Sem V: Electronics & Telecommunication Engineering
Subject: Skill-based Course V Hardware Description Language

Teaching Scheme:	Examination Scheme:	Credits Allotted:
Theory: 00	End Semester Examination: 00	Credits: 00
Practical: 02	Continuous Assessment: 00	
Tutorial: 00	TW: 25 Marks	Credit: 00
	Oral: 25 Marks	Credit: 01
	Practical: 00	Total Credit: 01

Course Pre-requisites: Digital circuit, Basic Electronics.

Course Outcomes: After learning this course students will be able to

1	Demonstrate knowledge of the syntax, semantics, and features of HDL.
2	Design circuits using logic gates and implement them with HDL program.
3	Design and implement combinational and sequential circuits using HDL
4	Create and use testbenches to verify the functionality and timing simulations of digital designs through simulation
5	Use synthesis tools to convert HDL models into gate-level implementations and prepare them for FPGA or ASIC deployment.
6	Apply skills for careers in digital design, embedded systems and VLSI design.

List of experiments:

1. Introduction to HDL tools and design of various Gates.
2. Write HDL program for Half adder, Full adder, half subtractor, Full subtractor using Data flow and Behavioral style.
3. Write HDL program for Full adder using half adder using Structure modeling style.
4. Write HDL program for 4-bit parallel adder using Component Instantiation statement (Structure modeling style).
5. Write HDL program for 4:1 Mux, 8:1 Mux and 16:1 Multiplexer.

6. Write HDL program for 1:4 Demux and 1: 8 Demultiplexer.
7. Write HDL program for 4:2 and 8: 3 Encoder and 2:4 and 3:8 Decoder.
8. Write HDL program for D-FF, T-FF, SR-FF and JK-Flip flop with Behavioral modeling Style using Process and Wait Statement.
9. Implementation all logic gates using FPGA kit
Text Books/ Reference Books:
1. Merrick, Russell. Getting Started with FPGAs: Digital Circuit Design, Verilog, and VHDL for Beginners. No Starch Press, 2023.
2. LaMeres, Brock J. Introduction to logic circuits & logic design with VHDL. Springer Nature, 2023.
3. Zwoliński, Mark. Digital system design with VHDL. Pearson education, 2004.
4. Palnitkar, Samir. Verilog HDL: a guide to digital design and synthesis. Prentice Hall Professional, 2003.
5. Cavanagh, Joseph. Digital design and Verilog HDL fundamentals. CRC press, 2017.
6. Roy, Shirshendu. Advanced Digital System Design: A Practical Guide to Verilog Based FPGA and ASIC Implementation. Springer Nature, 2023.

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B. Tech Sem V: Electronics & Telecommunication Engineering **Subject: Environmental Studies**		
Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 04	End Semester Examination: 40	Credits: 04
Practical: 00	Continuous Assessment: 10	
Tutorial: 00	TW: 00 Marks	Credit: 00
	Oral: 00 Marks	Credit: 04

Course Pre-requisites: Environmental Studies

Course Outcomes: After learning this course students will be able to

1	Get acquainted with the scope and multidisciplinary nature of environmental science with the overall aim of sustainable development.
2	Understand the importance of ecosystems in the view of its conservation.
3	Know the values of natural resources with associated problems for sustainable lifestyles.
4	Familiarize the basics of Biodiversity and concerned issues in the context of Western Ghats.
5	Make aware of the pollution issues with its mitigation measures.

UNIT I	**NATURE OF ENVIRONMENTAL SCIENCE, ECOSYSTEM, NATURAL RESOURCES AND BIODIVERSITY CONSERVATION**	**(15 Hours)**
	a) Nature of Environmental Science: • Definition, scope, and importance • Multidisciplinary nature of environmental studies • Sustainable Development Goals (SDGs) , Concept of sustainable development **b) Ecosystem:** • Structure and function of an ecosystem, • Energy flow in the ecosystem, Food chains, food webs , ecological pyramids • Ecological succession. Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems Degradation of ecosystems and its impacts. **c) Natural Resources:** • Classification of natural resources • Forest resources: Use and over-exploitation, deforestation, forests and tribal people. • Water resources: Use of surface and groundwater, Water scarcity and	

	stress • Water conservation: rainwater harvesting, watershed management • Soil and Mineral resources: Soil as a resource and its degradation, Environmental effects of extracting and using mineral resources. • Energy resources: Growing energy needs, Energy crisis, use of alternate energy sources, Role of Indian traditions and culture in conservation of the environment **d) Biodiversity and its conservation:** • Types: genetic, species, and ecosystem diversity, • Bio-geographical classification of India, • Value of biodiversity: • India as a mega- diversity nation. Hot-spots of biodiversity, Western Ghats as a biodiversity region. • Threats to biodiversity habitat loss, poaching of wildlife, man- wildlife, Conflicts, Endangered and endemic species of India. • Conservation of biodiversity: In-situ and Ex-situ conservation	
UNIT II	**ENVIRONMENTAL POLLUTION, CLIMATE CHANGE AND ENVIRONMENTAL LEGISLATION**	**(10 Hours)**
	a) Environmental Pollution: • Air pollution: Causes, effects and control measures • Water pollution: Causes, effects and control measures, Marine pollution, • Soil pollution: Causes, effects and control measures, • Noise pollution: Causes, effects and control measures • Solid waste Management: Causes, effects and control **b) Climate change: Causes, effects and mitigation** • Greenhouse gases, phenomenon of greenhouse effect and climate change, • Impacts of climate change: on life, on ocean and land systems; Sea level rise, On forests and natural ecosystems; On agriculture, on Human health • Mitigation of climate change: IPCC, Carbon foot print, Green House Gas (GHG) reduction, net zero targets for the future • Energy efficiency measures; Renewable energy sources for carbon reduction **c) Environmental legislation:** Constitutional provisions- Article 48A, Article 51A (g), Environmental Protection Act.,	

	Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act,	
	NATURE VISITS / FIELD WORK /FIELD TOUR/ INDUSTRIAL VISITS / CAMPUS ENVIRONMENTAL MANAGEMENT ACTIVITIES	**(05 Hours)**

Text Books/Reference Books:

1. Environmental Studies E-Text Book (Marathi and English Medium) Shivaji University, Kolhapur
2. Environmental Studies – UGC- Text Book for Undergraduate Courses for all Branches of Higher Education – Erach Bharucha, Bharti Vidyapeeth Institute of Environment Education and Research, Pune
3. A Textbook of Environmental Studies, January 2006 Ahmed Khan ABD Publishers
4. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36-37.
5. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
6. Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.
7. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
8. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. Environment. 8th edition. John Wiley & Sons.
9. Rosencranz, A., Divan, S., & Noble, M. L. 2001. Environmental law and policy in India. Tripathi 1992.
10. Sengupta, R. 2003. Ecology and economics: An approach to sustainable development. OUP.
11. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014.Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
12. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.
13. World Commission on Environment and Development. 1987. Our Common Future. Oxford University Press.

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B. Tech Sem VI: Electronics & Telecommunication Engineering **Subject: Digital Signal Processing**		
Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 02	Continuous Assessment: 40 Marks	
Tutorial: 00	TW: 25 Marks	Credit: 00
	Oral: 25 Marks	Credit: 01
	Practical: 00	Total Credit: 04

Course Pre-requisites: Signal and System

Course Outcomes: After learning this course students will be able to

1	Highlightening the advantages of digital signal processing over analog signal processing.
2	Analyse the digital signals using various digital transforms signal.
3	Design a Finite Impulse Response (FIR) Filter given the specifications.
4	Design a Infinite Impulse Response (IIR) Filter given the specifications.
5	Apply the role of DSP in algorithms in different areas
6	Exploring the key features & functionalities of a DSP Processor.

UNIT – I	**Introduction to DSP**	**(06 Hours)**
	Basic elements of DSP and its requirement, Advantages of digital over analog signal processing, Discrete systems: attributes, Frequency analysis, Inverse Systems, Relation between DFT and Z-Transform, DFT and Fourier –Transform, Introduction to DFT, IDFT and FFT system.	
UNIT – II	**Introduction to The Discrete Fourier Transform**	**(06Hours)**
	Overview of Frequency Analysis of signals, DFT, IDFT, Properties of DFT- Circular convolution, overlap save & overlap-add algorithm, DIT -FFT & DIF -FFT algorithm and implementation.	
UNIT -III	**FIR Filter Design**	**(06 Hours)**

	Introduction of FIR filter, Characteristics of FIR filter, properties of FIR filter, frequency sampling, Linear phase filter – Windowing techniques – rectangular, triangular, Blackman, Hamming, Hanning and Kaiser windows, Realization of FIR by direct form structures, cascade, parallel form.	
UNIT -IV	**IIR Filter Design**	**(06 Hours)**
	Introduction of IIR filter, Design of Discrete-Time IIR filters from continuous-time filters approximation by Impulse invariant technique, Bilinear transformation and Derivative approximation methods. Realization of IIR by direct form structures, cascade & parallel form.	
UNIT -V	**Adaptive Filter and algorithms**	**(06 Hours)**
	Introduction of adaptive signal processing, Introduction of multirate signal processing. Least Mean Square (LMS) algorithm, Introduction Particle Swarm Optimization (PSO) algorithm, Hybrid algorithm.	
UNIT -VI	**Architecture of DSP Processors & applications**	**(06 Hours)**
	Need for special purpose DSP Processors, Features of DSP Processors: Harvard and Modified Harvard Architectures, pipelining, Multiplier-accumulator (MAC) hardware and architectures of fixed and floating point (TMSC6000) DSP processors. Applications of DSP: DTMF, Spectral Analysis, Musical Sound Processing, Case study on applications of DSP.	

List of experiments:

1. Study of signal processing in MATLAB.
2. Study of discrete time signal processing.
3. Write a program to perform circular convolution of two sequences using DFT.
4. To plot magnitude and phase Spectra of DFT of a given sequence.
5. To plot magnitude and phase Spectra of IDFT of a given sequence.
6. To implement filter using overlap add and overlap save method

7. To design FIR Filter for given specifications using hamming and Gaussian window and plot them in the same filter design tool.
8. Design of FIR filters using Kaiser Window method.
9. Design low pass butter worth digital filter with given specification using impulse invariance method.
10. To do Spectral Analysis of a real signal.
11. To implement an FIR Filter on a DSP Processor
Text Books/ Reference Books:
1. "Digital Signal Processing: Principles, Algorithm & Application", 4th edition, Proakis, Manolakis, Pearson
2. Digital Signal Processing – A computer based Approach, S.K.Mitra, Tata McGraw Hill,6th edition
3. E. C. Ifleachor and B. W. Jervis, "Digital Signal Processing- A Practical Approach", Second Edition, Pearson education.
4. A.V. Oppenheins and R.W. Schalfer , "Discrete Time Signal Processing", PHI

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B. Tech Sem V: Electronics & Telecommunication Engineering
Subject: Information Theory and Coding

Teaching Scheme:	Examination Scheme:	Credits Allotted:
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 00	Continuous Assessment: 40 Marks	
Tutorial: 00	TW: - 00	Credit: 00
	Oral: - 00	Credit: 00
	Practical: - 00	Total Credit: 03

Course Pre-requisites: Digital Communication, Analog Communication, Signals and Systems

Course Outcomes: After learning this course students will be able to

1	Evaluate the performance of source coding techniques in terms of average code length and efficiency.
2	Compute mutual information and entropy functions to quantify the information transfer through a communication channel.
3	Classify error-correcting codes and analyze their error detection and correction capabilities.
4	Construct and decode cyclic codes using generator polynomials and syndrome-based methods
5	Design convolutional coding schemes and represent them using code trees, state diagrams, and trellis diagrams.
6	Assess information-theoretic security methods for secure communication applications in modern networks.

UNIT – I	**Source Coding**	**(06 Hours)**
	Introduction, Historical Perspective of Information Theory, Information: Definition and physical significance, Properties of Information, Entropy, Properties of Entropy, Some Source Coding Algorithms: Huffman Coding, Shannon-Fano Coding. Average Code length, Efficiency, Source Coding Theorem, Lempel-Ziv Coding.	
UNIT – II	**Mutual Information And Channel Capacity**	**(06 Hours)**
	Discrete Memoryless Channel, Channel Matrix, Mutual information, Conditional Entropy, Joint Entropy. Physical Significance of Mutual Information, Properties of Mutual Information, Differential entropy and mutual information. Channel Capacity Theorem, Channel Coding Theorem, Muroga's Method for channel capacity.	

UNIT - III	**Linear Block Codes**	**(06 Hours)**
	Introduction: Need of Error Control Coding, Classification of Error Correcting Codes, Error Detection and Error Correction Techniques, Systematic and nonsystematic Codes, Code rate. Linear Block Codes, Generator and Parity Check Matrices, Syndrome: definition and properties, Syndrome decoding	
UNIT -IV	**Cyclic Codes**	**(06 Hours)**
	Cyclic Codes: Properties and significance, Generator Polynomial and its properties, Parity Check Polynomial, Syndrome Polynomial and its properties, Encoding and Decoding of Cyclic Codes using shift register.	
UNIT -V	**Convolutional Codes**	**(06 Hours)**
	Introduction, Encoding of Convolutional Codes, Code Tree, State diagram and Trellis Diagram, Transform Domain Approach, Maximum Likelihood Decoding-Viterbi Algorithm, Sequential Decoding.	
UNIT -VI	**Applications of Information Theory and Coding in Modern Communication Systems**	**(06 Hours)**
	Basics of cryptographic security using information theory, Rate-Distortion Theory for Lossy Compression, One-time pad and Shannon's perfect secrecy theorem, Error control coding in secure communications, Case study: LDPC and Turbo codes in wireless networks, Applications in multimedia compression (JPEG, MP3, H.264)	

Text Books/ Reference Books:

1. Simon Haykin, ' Communication Systems' 4th edition, John Wiley & Sons
2. David J.C. MacKay, "Information Theory, Inference, and Learning Algorithms", Cambridge University Press.
3. T. M. Cover and J. A. Thomas, Elements of Information Theory, 2nd Ed., Wiley.
4. D. J. C. MacKay, Information Theory, Inference, and Learning Algorithms, Cambridge University Press
5. R. E. Blahut, Algebraic Codes for Data Transmission, Cambridge University Press.
6. Andrea Goldsmith, "Wireless Communications", Cambridge University Press.
7. Ranjan Bose, "Information Theory Coding and Cryptography" Tata McGraw-Hill.
8. K. Sam Shanmugam, "Digital and analog communication systems", John Wiley.
9. Thomas M. Cover, Joy A. Thomas," Elements of Information Theory, 2nd Edition", Wiley Publication.
10. Roberto Togneri, Christopher J.S deSilva "Fundamentals of Information Theory and Coding Design", CRC Press
11. Steven Roman," Introduction to Coding and Information Theory", Springer New York.

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B. Tech Sem VI: Electronics & Telecommunication Engineering **Subject: Digital CMOS Design**		
Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 02	Internal Assessment: 40 Marks	
Tutorial: 00	TW: 25 Marks	Credits: 01
	Practical: 25 Marks	
		Total Credit: 04

Course Pre-requisites: Elementary Electronics, Digital Electronics, Semiconductor Devices and Circuits

Course Outcomes: After learning this course students will be able to

1	Identify the characteristics of CMOS transistors.
2	Use CMOS Fabrication Process.
3	Design Inverter with delay constraints.
4	Design combinational logic circuits using CMOS technology.
5	Design sequential logic circuits using CMOS technology.
6	Apply the knowledge of advanced techniques in CMOS Design

UNIT – I	**Introduction to CMOS Technology**	**(06 Hours)**
	Introduction to CMOS (Complementary Metal-Oxide-Semiconductor) Technology, Electrical characteristics of MOSFETs (threshold voltage, subthreshold behavior, ON/OFF states), Comparison of CMOS with Bipolar Junction Transistor (BJT), CMOS inverter: operation and voltage transfer characteristics	
UNIT – II	**CMOS Fabrication**	**(06 Hours)**
	Overview of fabrication processing, MOSFET fabrication steps, CMOS fabrication techniques, n-Well CMOS fabrication process, Twin-Tub (Twin-Well) CMOS Fabrication, CMOS Fabrication Practical Aspects	
UNIT - III	**MOS INVERTERS: Switching Characteristics and Interconnect Effects**	**(06 Hours)**
	Introduction, Delay-Time Definitions Calculation of Delay times, Inverter design with delay constraints, Estimation of Interconnect parasitics, Calculation of	

	Interconnect Delay	
UNIT -IV	**Combinational CMOS Logic Design**	**(06 Hours)**
	Combinational Logic Design Using CMOS: CMOS logic gates: AND, OR, NAND, NOR XOR, XNOR gates**, Complex CMOS Gates:** Design of complex logic functions with multiple inputs, Use of transmission gates for logic design.	
UNIT-V	**Sequential CMOS Logic Design**	**(06 Hours)**
	Introduction to flip-flops and latches, SR latch, D flip-flop, T flip-flop, JK flip-flop design in CMOS, Timing diagrams and setup/hold time considerations.	
UNIT -VI	**Advanced CMOS Technologies**	**(06 Hours)**
	Introduction to FinFETs and their advantages over traditional CMOS, Scaling challenges in CMOS and the role of FinFET in advanced nodes, Silicon-on-insulator (SOI) technology, Carbon nanotubes and graphene in future CMOS circuits, Quantum-dot-based logic devices.	

List of Experiments

1. To Study about Microwind tool and λ (Lambda) Rules for Layout Generation
2. To generate layout for CMOS Inverter and simulate it.
3. To generate layout for CMOS NAND and simulate it.
4. To generate layout for CMOS NOR and simulate it.
5. To generate layout for CMOS TG and simulate it.
6. To implement layout for Boolean function F= (A.B +C.D)'
7. Design and implementation of half adder
8. Design and implementation of D latch
9. Design and implementation of SRAM Cell
10. Design and implementation of Counter
11. Design and implementation of Ring Oscillator

Text Books/Reference Books

1. Sung-Mo Kang & Yusuf Leblebici, "CMOS Digital Integrated Circuits – Analysis and Design", 3rd Edition, Tata McGraw-Hill, New Delhi, 2003.
2. Neil Weste and David Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Addison-Wesley, 2010
3. John P.Uyemura, "CMOS Logic Circuit Design", Springer International Edition.2005.Logic Circuit Design", Springer International Edition.2005
4. W.Wolf, Modern VLSI Design: System on Chip, Third Edition, Pearson, 2002
5. J. P. Uyemura, "Introduction to VLSI circuits and Systems," John Wiley, New Delhi, 2002.
6. Jan M. Rabaey et al, "Digital Integrated Circuits: A Design Perspective," Second Edition, PHI, 2003
7. Donald A. Neamen et al, "Semiconductor Physics and Devices," 4th edition, McGraw Hill, 2017

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B. Tech Sem VI: Electronics & Telecommunication Engineering **Subject: Fiber Optic Communication**		
Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 02	Continuous Assessment: 40 Marks	
Tutorial: 00	TW: 25 Marks	Credit: 01
	Oral: 00	Credit: 00
	Practical: 00	Total Credit: 04

Course Pre-requisites: Digital communication, Electromagnetic and Transmission Lines

Course Outcomes: After learning this course students will be able to

1	Design the components and measurement equipment in optical fiber networks.
2	Calculate the important parameters associated with optical components used in fiber optic telecommunication systems
3	Compare and contrast the performance of major components in optical link
4	Evaluate the performance viability of optical links using the power and rise time budget analysis
5	Design digital optical links by proper selection of components and check its viability using simulation tools
6	Compile technical information related to state of art components, standards, simulation tools and current technological trends by accessing the online resources to update their domain knowledge

UNIT – I	**Basics of Optical Fiber Communication System**	**(06 Hours)**
	Introduction to fiber optic communication system, Ray theory of Transmission: Total internal reflection, acceptance angle, numerical aperture, Electromagnetic mode theory for optical propagation: Phase and group velocity, propagation modes and modes on fiber, Types of fiber, cables used on optical fiber communication	
UNIT – II	**Optical Fiber for Telecommunication**	**(06 Hours)**

	Attenuation in optical fiber: Absorption, scattering, radiative losses, attenuation characteristics, Signal distortion in optical Fiber: intermodal dispersion, intramodal dispersion, Special Fibers, Fiber non-linearities	
UNIT -III	**Optical Sources and Transmitters**	**(06 Hours)**
	Introduction, LED Structures: PN junction LED, surface emitting LED, Edge emitting LED, LASER: Types of LASERs, Modulation of optical source, splicing of fibers, Optical fiber connectors, power launching and coupling	
UNIT -IV	**Optical Detectors and Receivers**	**(06 Hours)**
	Introduction of optical detectors: optical communication bands, characteristics, Semiconductor photodetectors: PIN diode, avalanche photodiode, Optical Receiver: block diagram, structures, noise in optical receiver, Photo Transistors: structure, characteristics	
UNIT -V	**Optical Link Design and Optical measurements**	**(06 Hours)**
	Introduction of point-to-point optical fiber communication links: Power loss, Optical link power budget, Analog links: CNR, photodetector noise, intensity noise, Optical Fiber Measurement: Attenuation measurement, Optical Time Domain Reflectometer (OTDR), Optical Fiber Transducer	
UNIT -VI	**Advanced Optical Communication System**	**(06 Hours)**
	Introduction, Wavelength Division Multiplexing: Operation, types of WDM, Fiber Optic Couplers: Characteristics, classification, Isolators, Splitter, multiplexing methods, Introduction of optical amplifiers, Switches and modulators	

List of Experiments:

1. To determine the refractive index of a thin glass plate.
2. To find Newton's Rings-Refractive index of liquid
3. To determine the wavelength of a laser using the Michelson interferometer
4. To calculate the beam divergence and spot size of the given laser beam
5. To calculate Newton's Rings-Wavelength of light
6. To verify the Brewster's law and to find the Brewster's angle
7. To find the numerical aperture of a given optic fiber and hence to find its acceptance angle

8. To measure Numerical aperture and attenuation constant of optical fiber
Text Books/ Reference Books:
1. Optical Fiber Communication – John M. Senior – Pearson Education – Second Edition. 2007
2. Optical Fiber Communication – Gerd Keiser – Mc Graw Hill – Third Edition. 2000
3. R.P. Khare, “Fiber Optics and Optoelectronics”, Oxford University Press, 2007.
4. J.Gower, “Optical Communication System”, Prentice Hall of India, 2001
5. Rajiv Ramaswami, “Optical Networks “, Second Edition, Elsevier, 2004.
6. Govind P. Agrawal, “Fiber-optic communication systems”, third edition, John Wiley & sons, 2004

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B. Tech Sem VI: Electronics & Telecommunication Engineering (2023) **Course: Sensors And Instrumentation (PEC-1)**		
Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical:00	Continuous Assessment: 40 Marks	
Tutorial: 00	TW: 00	Credit: 00
	Oral: 00	
	Practical: 00	Total Credit: 03

Course Pre-requisites: Elementary Electronics, Integrated Circuits and Applications, Signals and Systems

Course Outcomes: After learning this course students will be able to

1	Identify key components and performance criteria in digital communication
2	Apply various waveform coding techniques in digital communication systems.
3	Implement line coding and digital multiplexing techniques to optimize signal transmission.
4	Apply digital carrier modulation techniques for efficient signal transmission.
5	Analyze and evaluate multiple access techniques for reliable communication.
6	Evaluate and utilize information theory principles to enhance the performance of communication systems.

UNIT – I	**Fundamentals of Sensors**	**(06 Hours)**
	Measurement Systems Overview • Definition of measurement and instrumentation • Generalized measurement system: sensor, signal conditioning, display/data processing • Calibration basics and uncertainty **Basic Sensor Principles** • Terminology: accuracy, precision, resolution, sensitivity, repeatability • Classification of sensors: active vs. passive, contact vs. non-contact **Mathematical Representation of Sensor Characteristics** • Transfer function of a sensor • Static and dynamic sensor characteristics Equation for sensitivity	
UNIT – II	**Sensor Characteristics and Errors**	**(06 Hours)**
	Static Characteristics	

	• Sensitivity, linearity, range, offset, hysteresis • Methods of measuring linearity and hysteresis **Dynamic Characteristics** • Time constant, response time, frequency response • First-order and second-order system behaviour in sensors **Error Analysis** • Sources of error (systematic vs. random) • Error minimization techniques (shielding, grounding, filtering) **Calibration and Standardization** • Calibration methods and instruments Traceability to standards (NIST, ISO, etc.)	
UNIT – III	**Sensor Technologies**	**(06 Hours)**
	Resistive Sensors • Potentiometers, strain gauges, RTDs (Resistance Temperature Detectors) • Working principles and typical applications **Capacitive and Inductive Sensors** • Capacitive humidity and proximity sensors • Inductive displacement sensors (LVDT, RVDT) **Thermal Sensors** • Thermocouples, thermistors, IR sensors • Signal conditioning for temperature measurement **Optical and Magnetic Sensors** • Photodiodes, phototransistors, fiber-optic sensors Hall-effect sensors, magnetoresistance sensors	
UNIT -IV	**Signal Conditioning for Sensors**	**(06 Hours)**
	Signal Amplification and Filtering • Instrumentation amplifiers, differential amplifiers • Active and passive filters (low-pass, high-pass, band-pass) **Bridge Circuits** • Wheatstone bridge for strain gauges and RTDs • Balancing, offset compensation, and sensitivity enhancement **Analog-to-Digital Conversion (ADC)** • Sampling, quantization, resolution • Types of ADC (Successive Approximation, Flash, Sigma-Delta) **Noise Reduction and Shielding** • Ground loops, electromagnetic interference (EMI) Proper grounding, shielding techniques	
UNIT -V	**Data Acquisition and Interfacing**	**(06 Hours)**

	Data Acquisition Systems (DAQ) • Components: sensors, DAQ hardware, software interface • Key specifications: sampling rate, resolution, channel count **Communication Protocols** • Serial (UART, RS-232/485) and parallel interfaces • I^2C, SPI, CAN for sensor interfacing **Computer-Based Instrumentation** • LabVIEW and/or MATLAB data acquisition toolboxes • Virtual instrumentation concepts **Microcontroller/Embedded System Interfaces** • Analog input pins, digital input/outputs Interfacing techniques and example code snippets	
UNIT -VI	**Case Studies and Emerging Trends**	**(06 Hours)**
	Industrial Applications • Process control, automation, predictive maintenance • Smart sensors in Industry 4.0 **Healthcare and Biomedical Instrumentation** • Biomedical sensors (ECG, SpO_2, blood pressure sensors) • Wearable technology and IoT in healthcare **Automotive Sensors** • Engine management (temperature, pressure, O_2 sensors) • Safety systems (airbag accelerometers, ABS speed sensors) **Advanced and Emerging Technologies** • MEMS sensors, nano-sensors • Wireless sensor networks, IoT-based sensors	

Reference Books:

1. D. Patranabis, *Sensors and Transducers*, PHI Learning.2003, 2nd Edition, ISBN : 9788120321984
2. Ernest O. Doebelin and Dhanesh N. Manik, *Measurement Systems: Application and Design*, McGraw Hill, 6th Edition ,2017, ISBN-10:9780070699687
3. John Turner and Martyn Hill, *Instrumentation for Engineers and Scientists*, Oxford University Press,1999, ISBN-10: 0198565178
4. R.K. Rajput, *Sensors and Instrumentation*, S. Chand Publishing, 2009, Revised Edition, ISBN: 9788121929172
5. A.K. Sawhney, *A Course in Electrical and Electronic Measurements and Instrumentation*, Dhanpat Rai & Co., 2021, ISBN: 9788177001006

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B. Tech Sem VI: Electronics & Telecommunication Engineering **Subject: Internet Of Things (PEC 1)**		
Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 00	Internal Assessment: 40 Marks	
Tutorial: 00		
		Total Credit: 03

Course Pre-requisites: Control System and Applications, Embedded systems

Course Outcomes:

1	Design IoT systems' fundamental concepts, architecture, and components
2	Analyze the functionality and suitability of IoT hardware components
3	Evaluate various IoT communication protocols and networking technologies to determine their applicability.
4	Assess the role of data management, cloud integration, and analytics in designing efficient IoT ecosystems.
5	Identify security vulnerabilities and privacy challenges in IoT systems and propose strategies to mitigate them
6	Identify emerging trends in IoT, such as 5G, AI integration, and Industry 4.0, and their impact on future technological advancements.

UNIT – I	**Introduction to IoT**	**(06 Hours)**
	Definition, history, and evolution of IoT Characteristics and key components of IoT systems IoT reference architecture: Physical, Network, and Application layers Applications in E&TC: Smart homes, wearable devices, industrial automation, telemedicine Benefits, challenges, and societal impact of IoT Case studies: IoT in smart cities and healthcare	
UNIT – II	**IoT Hardware Components**	**(06 Hours)**

	Overview of IoT hardware platforms: Microcontrollers (Arduino, Raspberry Pi, ESP32) Types of sensors: Temperature, humidity, pressure, motion, light, and gas sensors Actuators: Relays, motors, solenoids, and their applications Power management techniques for IoT devices Embedded systems design considerations for IoT Comparison of hardware platforms for different use cases	
UNIT - III	**IoT Communication Protocols and Networking**	**(06 Hours)**
	Wired protocols: UART, SPI, I2C Wireless protocols: Wi-Fi, Bluetooth, Zigbee, LoRa, NB-IoT IoT-specific protocols: MQTT, CoAP, HTTP/REST, AMQP Comparison of protocols based on bandwidth, range, and power efficiency Network topologies: Star, Mesh, and Hybrid Role of IPv6 and 6LoWPAN in IoT networking Challenges in IoT connectivity and scalability	
UNIT -IV	**IoT Data Management and Cloud Integration**	**(06 Hours)**
	Data lifecycle in IoT: Acquisition, processing, storage, and analysis Edge computing vs. cloud computing: Concepts and trade-offs IoT cloud platforms: AWS IoT, Google Cloud IoT, Microsoft Azure IoT Data visualization and real-time analytics in IoT Role of APIs and web services in IoT ecosystems Case studies: IoT data management in industrial and consumer applications	
UNIT -V	**IoT Security and Privacy**	**(06 Hours)**
	Security vulnerabilities in IoT systems Encryption and secure communication: TLS/SSL, DTLS Authentication mechanisms and access control Privacy issues and ethical considerations in IoT Case studies: IoT security breaches and lessons learned Standards and regulations for IoT security (e.g., GDPR, NIST)	
UNIT -VI	**Emerging Trends and Future of IoT**	**(06 Hours)**

	IoT and Industry 4.0: Automation and smart manufacturing Integration of IoT with AI, Machine Learning, and Blockchain Impact of 5G on IoT: Low latency and massive connectivity Future trends: Quantum IoT, Green IoT, and autonomous systems Socio-economic implications of widespread IoT adoption	

Text Books/Reference Books

1. Enabling the Internet of Things: Fundamentals, Design, and Applications, Muhammad Azhar Iqbal et al., IEEE Press Wiley 2021
2. Vijay Madisetti and Arshdeep Bahga, Internet of Things: A Hands-on Approach, Universities Press, 2014.
3. Internet of Things, Architectures, Protocols and Standards, Simone Cirani, Wiley 2019
4. Internet of Things with ESP8266, Marco Schwartz, Packt Publishing, 2016
5. Raj Kamal, Internet of Things: Architecture and Design Principles, McGraw Hill Education, 2017.

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B. Tech Sem VI: Electronics & Telecommunication (NEP 2020 COURSE)

Subject: Operating System PEC-1

Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 00	Continuous Assessment: 40 Marks	
Tutorial: 00	TW: 00	Credit: 00
	Oral: 00	Credit: 00
	Practical: 00	Total Credit: 03

Course Pre-requisites: Computer Programming

Course Outcomes: After learning this course students will be able to

1	Demonstrate a thorough understanding of different types of operating systems and their structures
2	Apply various process management techniques such as scheduling algorithms
3	Apply synchronization techniques to solve classical synchronization problems and demonstrate how modern operating systems handle concurrency using synchronization primitives.
4	Analyze deadlock conditions and apply suitable techniques for deadlock prevention, avoidance, detection, and recovery in operating systems.
5	Evaluate and implement different memory management techniques
6	Analyze functioning of I/O management and file system organization.

UNIT – I	**Introduction to Operating Systems**	**(06 Hours)**
	Basics and Evolution of Operating Systems. Operating System Structures: Layered, Monolithic, Microkernel, Hybrid Models. System Calls: Definition, Types (Process Control, File Management, Device Management, etc.) Types of Operating Systems: Batch SystemsMultiprogramming and Multitasking Systems, Time-sharing, Distributed and Clustered Systems,Real-Time and Embedded Systems. Virtualization in Operating Systems: Virtual Machines	
UNIT – II	**Process Management**	**(06 Hours)**
	Processes and Threads: Process Concept, Process Life Cycle, Process Control Block (PCB), Types of Schedulers (Long-term, Short-term, Medium-term), Context Switching. Scheduling Algorithms: FCFS, SJF, Priority Scheduling,	

	Round Robin, and Multilevel Queue Scheduling with comparison. Process Synchronization: Critical Section Problem and its Solutions using Mutex and Semaphore. Inter-process Communication (IPC): Shared Memory and Message Passing. Introduction to Threads: User-level vs Kernel-level Threads, Multithreading Models.	
UNIT - III	**Concurrency and Synchronization**	**(06 Hours)**
	Introduction to Concurrency: Concept of Concurrency, Need for Concurrency in Modern Operating Systems. Process Synchronization: Critical Section Problem. Classical Synchronization Problems: Producer-Consumer Problem, Readers-Writers Problem, and Dining Philosophers Problem. Synchronization Techniques: Hardware-based solutions (Test and Set Lock, Disable Interrupts), Software Solutions (Peterson's Algorithm), and Operating System-provided Synchronization Tools (Semaphores, Mutexes, Monitors, Condition Variables). Case Study: Synchronization in Linux (brief overview of Linux Synchronization Primitives such as Spinlocks, Mutexes, and Semaphores).	
UNIT -IV	**Deadlocks**	**(06 Hours)**
	Deadlock Concept: Definition, Examples, and Real-life Scenarios of Deadlock. Necessary Conditions for Deadlock: Mutual Exclusion, Hold and Wait, No Preemption, and Circular Wait. Resource Allocation Graph: Representation and Analysis of Deadlock Situations. Methods for Handling Deadlocks: Deadlock Prevention Techniques, Deadlock Avoidance using Banker's Algorithm, Deadlock Detection, and Recovery from Deadlock. Case Study: Deadlock Handling in Modern Operating Systems (Brief overview of how Linux/Windows deals with deadlocks).	
UNIT -V	**Memory Management**	**(06 Hours)**
	Basics of Memory Management: Concept of Logical and Physical Address Space, Address Binding, and Memory Allocation Techniques. Contiguous Memory Allocation: Fixed and Variable Partitioning. Paging, Segmentation. Virtual Memory, Demand Paging, Page Fault Handling, and Performance Considerations. Page Replacement Algorithms: Optimal, FIFO, LRU, and LRU Approximation. Case Study: Memory Management in Linux and Windows, including concepts like Cache Memory, Translation Lookaside Buffer (TLB), and Memory Protection.	
UNIT -VI	**Input and Output, File System**	**(06 Hours)**
	I/O management & Disk scheduling: I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, DiskScheduling (FCFS), RAID, Disk Cache.File Management: Concepts, File Organization, File Directories, File Sharing, Record Blocking, Allocation methods,Free Space management	

Text Books/ Reference Books:

1. Dhamdhere D., "Systems Programming and Operating Systems", 2nd Edition, 'TMH
2. Operating System Concepts" (10th Edition, 2018) by Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Wiley Publication.
3. Modern Operating Systems" (4th Edition, 2014) by Andrew S. Tanenbaum, Pearson Publication
4. Operating Systems: Internals and Design Principles" (9th Edition, 2017) by William Stallings, Pearson Publication
5. Linux Operating System" (1st Edition, 2019) by Kaiwan N. Billimoria, Packt Publishing
6. **Real-Time Systems"** (2nd Edition, 2000) by Jane W. S. Liu, Prentice Hall Publication
7. **VxWorks Real-Time Operating System"** by William Stallings, Pearson Publication
8. **File Systems: Design and Implementation"** (1st Edition, 2001) by S. V. Subrahmanya , Pearson Publication
9. **Understanding the Linux Kernel"** (3rd Edition, 2005) by Daniel P. Bovet and Marco Cesati, O'Reilly Media Publication.

Bharati Vidyapeeth
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B. Tech Sem VI: Electronics & Telecommunication Engineering **Subject: Digital Control System (PEC 1)**		
Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 3
Practical: 00	Continuous Assessment: 40 Marks	
Tutorial: 00	TW: 00	Credit: 0
	Oral: 00	Credit: 0
	Practical: 00	Total Credit: 03

Course Pre-requisites: Signals & Systems, Control Systems

Course Outcomes: After learning this course students will be able to

1	Describe z-domain description of digital control systems
2	Model the digital control devices and systems
3	Design the digital control algorithms with root locus and frequency plots
4	Analyze the state variables of digital control systems
5	Introduce neural networks for control
6	Describe fuzzy control concepts and design fuzzy logic controller

UNIT – I	**Introduction to digital controls systems**	**(06 Hours)**
	Review of digital control system, sampling as impulse modulation, sampled spectra, aliasing, filtering, choice of sampling rate, discretization. Stability on the z-plane and the Jury stability, z-domain description of sampled continuous- time plants, z-domain description of systems with dead time	
UNIT – II	**Models of Digital Control Devices and Systems**	**(06 Hours)**
	Implementation of digital controllers, tunable PID controller, digital temperature control systems, digital position control system, digital position control system, stepping motors and their control, PLC	
UNIT – III	**Design of Digital Control Algorithms**	**(06 Hours)**

	Introduction, z-plane specifications of control system design, digital compensator design using frequency plots, digital compensator design using root locus, z-plane synthesis	
UNIT -IV	**State variable Analysis of Digital Control System**	**(06 Hours)**
	Introduction, state descriptions of digital processors, state descriptions of sampled continuous time plants, state descriptions of systems with dead time, solution of state difference equations, controllability and observability, multivariable systems	
UNIT -V	**Fundamentals of fuzzy**	**(06 Hours)**
	Introduction, fuzzy quantification of knowledge fuzzy logic, fuzzy operations, fuzzy relations	
UNIT -VI	**Fuzzy Control**	**(06 Hours)**
	Introduction, Fuzzy inference, Mamdani rules, Design of fuzzy logic controller, examples, introduction to genetic algorithm	

Text Books/ Reference Books:

1. 'Digital Control and State Variable Methods' by M Gopal, 2nd Edition, TMH publication
2. 'Neural Networks for Control' by W. Thomas Miller, Richard S. Sutton, Paul J. Werbos, MIT press

Programme: B. Tech. (Common for All) Sem –VI (2023 course)

COURSE: PROFESSIONAL SKILLS		
Teaching Scheme:	**Examination Scheme:**	**Credits:**
Practical:- 2 Hours/ Week	Semester End Examination: 00 Term work Internal Assessment: 25 Marks	Credits:1

Course Pre-requisites: The students should have knowledge of	
1	Basic mathematical concepts, reasoning skills, and comprehension abilities.
2	Fundamentals of communication processes and soft skills.
3	Basic understanding of leadership qualities, ethics, etiquettes, and values.
Course Objective:	
	This course is structured to provide students with a well-rounded foundation in quantitative aptitude, logical and verbal reasoning, professional communication, employment skills, leadership development, and business ethics. By integrating these components, students will be better equipped to excel in recruitment processes and succeed in their professional careers.
Course Outcomes: The student will be able to	
1	Apply shortcut techniques to solve quantitative aptitude questions efficiently in recruitment and competitive exams.
2	Utilize logical reasoning methods and mnemonics to enhance problem-solving skills in placement tests.
3	Improve verbal communication skills, including vocabulary, sentence patterns, and reading comprehension, for effective professional interactions.
4	Develop proficiency in job application writing, resume building, and interview skills to enhance employability..
5	Understand and apply soft skills, leadership qualities, and professional ethics in the workplace.
6	Demonstrate appropriate corporate etiquette, business ethics, and values in professional settings.

Course Content:

Unit-I	• **QUANTITATIVE APTITUDE** : • Number System, Percentage, Profit and Loss, Simple & Compound Interest • Ratio, Proportion, and Average • Mixture and Allegation • Time, Speed & Distance, Time & Work • Permutation & Combination, Probability • Pipes and Cisterns	**(4 Hours)**

Unit-II	**LOGICAL REASONING :** • Coding-Decoding, Number Series, Blood Relation, Directions • Cubes & Dices, Data Interpretation, Data Sufficiency • Set Theory & Syllogisms, Matching, Selection & Arrangement • Clocks & Calendars, Visual Reasoning • Input-Output & Flow Charts	**(4 Hours)**
Unit-III	**VERBAL REASONING:** • Sentence Patterns, Sentence Correction, Spotting Errors • Vocabulary, Antonyms & Synonyms, Analogy • Phrasal Verbs, Idiomatic Expressions • Reading Comprehension, Cloze Test • Sentence Rearrangement and Theme Detection	**(4 Hours)**
Unit-IV	**HONING EMPLOYBILITY AND PRESENTATION SKILLS:** • Job Application Letters: Layout, Structure, Covering Letter • Resume & CV Building: Structure, Effective Writing Tips • Group Discussion: Skills, Strategies, and Evaluation • Interview Skills: Telephonic & Face-to-Face Interviews • Body Language, Grooming & Etiquette for GD & PI • Extempore Speaking Techniques • Presentation Skills: Structure, Layout, Flow, and PPT Creation	**(4 Hours)**
Unit-V	**SOFT SKILLS AND LEADERSHIP DEVELOPMENT:** • Soft Skills: Definition, Importance, and Differences from Hard Skills • Life Skills & Personal Development • Team Building & Conflict Resolution • Problem-Solving, Time & Stress Management • Pareto Principle (80/20 Rule), Time Management Matrix • Leadership Skills: Importance, Types, Attributes of a Good Leader • Motivational Theories and Emotional Intelligence in Professional Life	**(4 Hours)**
Unit-VI	**BUSINESS ETHICS ,ETIQUETTES AND VALUES:** • Ethics & Values in the Business World • Respect for Individuality and Workplace Diversity • Key Features of Corporate Etiquette • Corporate Grooming & Dressing • Social & Office Etiquette • Importance of Professional Behavior in the Workplace • Corporate Social Responsibility (CSR): Need and Importance .	**(4 Hours)**
Reference Books:		

1	Quantitative Aptitude by R. S. Agarwal published by S. Chand
2	The Book of Numbers by Shakuntala Devi
3	A Modern Approach To Logical Reasoning by R. S. Agarwal published by S. Chand
4	A New Approach to Reasoning Verbal & Non-Verbal by Indu Sijwali
5	Business Communication by Meenakshi Raman, Prakash Singh published by Oxford University press, second edition
6	Communication Skills by Sanjay Kumar, Pushp Lata, published by Oxford University press, second edition
7	Technical Communication by Meenakshi Raman, Sangeeta Sharma published by Oxford University press
8	Developing Communication Skills by Krishna Mohan, Meera Banerji published by Macmillan India Pvt Ltd
9	Soft Skills by Meenkashi Raman, published by Cengage publishers
10	Soft Skills by Dr. K Alex published by Oxford University press
11	Soft skills for Managers by Dr. T. Kalyana Chakravarthi and Dr. T. Latha Chakravarthi published by biztantra

Term Work Assignments

Unit-I: QUANTITATIVE APTITUDE

1. Solve 20 practice problems on Number System, Percentage, and Profit & Loss.
2. Create a comparative analysis of Simple Interest vs. Compound Interest with real-world examples.

Unit-II: LOGICAL REASONING

1. Solve a set of logical reasoning problems covering Coding-Decoding, Blood Relations, and Directions.
2. Prepare a case study on how logical reasoning skills are used in competitive exams and corporate assessments.

Unit-III: VERBAL REASONING

1. Identify and correct errors in 10 sentences focusing on sentence structure and grammatical mistakes.
2. Develop a vocabulary list with antonyms, synonyms, and phrasal verbs commonly used in professional settings.

Unit-IV: HONING EMPLOYABILITY AND PRESENTATION SKILLS

1. Draft a job application letter along with a structured resume tailored for a technical position.
2. Participate in a mock group discussion and receive peer and instructor feedback.
3. Conduct a mock interview (telephonic & face-to-face) and submit an evaluation report

Unit-V: SOFT SKILLS AND LEADERSHIP DEVELOPMENT (Term Work Assignments)

1. Conduct a self-assessment on personal soft skills and identify areas for improvement.
2. Develop a time management plan using the Pareto Principle (80/20 Rule) and Time Management Matrix.
3. Prepare a report on different leadership styles and their impact in the corporate world.

Unit-VI: BUSINESS ETHICS, ETIQUETTES, AND VALUES

1. Write a report on corporate ethics and how companies implement ethical policies.
2. Conduct a role-play activity demonstrating appropriate corporate etiquette in business interactions.
3. Prepare a presentation on the significance of Corporate Social Responsibility (CSR).

Bharati Vidyapeeth
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B. Tech Sem VI: Electronics & Telecommunication Engineering
COURSE: MINI-PROJECT

Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 00	End Semester Examination:	Credits: 00
Practical: 02	Continuous Assessment:	
Tutorial: 00	TW: 25 Marks	Credit: 00
	Oral: 25 Marks	Credit: 01
	Practical: 00	Total Credit: 01

Course Pre-requisites: EDATP, PCB Workshop, Integrated Circuits and Applications, Microcontroller Programming, Embedded Systems

Course Outcomes: After learning this course students will be able to

1	Design PCB artwork
2	Implement electronic hardware
3	Test and trouble-shoot the implemented hardware
4	Design the enclosure and front panel for the implemented hardware
5	Plan the budget for the project
6	Plan and execute an electronic project as a teamwork

Syllabus

Domains for projects may be from among the following, but **not** limited to:

- Instrumentation and Control Systems
- Electronic Communication systems
- Biomedical Electronics
- Power Electronics
- Audio , Video Systems
- Embedded systems
- Mechatronic systems
- FPGA based system

Guidelines

- Project group shall consist of not more than three students per group

- Project design ideas can be adapted from authentic sources like electronic design magazines (Everyday Electronics/Elektor Electronics/Electronics for you/Circuit cellar/ Nuts &Volts)
- Application notes from component manufacturers may also be consulted.
- Hardware component is mandatory.
- Layout versus schematic verification is mandatory.

Project Report

A project report with following contents shall be prepared:

1. Title
2. Specifications
3. Block diagram
4. Circuit diagram
5. Component selection
6. Simulation results
7. PCB artwork
8. Layout versus schematic verification report
9. Testing procedures
10. Enclosure design
11. Test results
12. Conclusion

Assessment:

Assessed via rubrics

Rubrics for Mini-Project:

Criterion	A	B	C	D	E
1. Understanding of Concepts & Needs	Demonstrates minimal grasp of electronics fundamentals and project requirements; unclear problem definition.	Shows partial understanding of concepts, but analysis is superficial; problem definition is incomplete.	Applies fundamental principles with reasonable clarity; identifies most requirements with minor omissions.	Exhibits strong grasp of theory, thorough analysis of requirements; minor gaps in depth or detail.	Displays comprehensive understanding of electronics/engineering fundamentals and systematically addresses all requirements.
2. Design & Implementation	Provides rudimentary or incomplete designs; no coherent PCB or enclosure approach; major deficiencies in implementation.	Develops basic design with some functionality; schematic or PCB is partially correct; limited enclosure or front-panel work.	Shows clear design approach; PCB and enclosure are functional with a few improvements needed; overall solution workable.	Produces an efficient, well-organized PCB and enclosure design; implements hardware effectively with only minor refinements.	Delivers a robust, optimized design solution (PCB, enclosure, etc.) with professional-grade implementation and attention to detail.
3. Testing & Analysis	Little to no testing performed; troubleshooting relies on guesswork.	Conducts minimal or ad-hoc testing; identifies some issues, but diagnosis is not systematic.	Performs structured testing with standard instruments/software; resolves most issues reasonably.	Deploys thorough testing plans, uses appropriate instruments; solves complex issues with systematic	Demonstrates advanced testing protocols, systematically documents results; interprets data meticulously to refine final solution.

				troubleshooting.	
4. Budget & Project Management	No clear budget planning; project milestones or deliverables not tracked.	Basic budgeting done but lacks detail; project management is sporadic or reactive.	Budgeting is reasonably accurate; basic schedule and milestones are managed; occasional delays or shortfalls.	Presents a detailed, realistic budget with documented trade-offs; effective scheduling, mostly meets deadlines.	Optimizes budget allocation with professional cost–benefit insight; demonstrates exemplary project planning and on-time deliverables.
5. Communication & Teamwork	Little collaboration or coordination; minimal documentation; ineffective or unclear communication.	Limited team interaction; documentation is incomplete or unclear in places; communication partially effective.	Acceptable teamwork, with shared responsibilities; documentation covers main points; communication generally clear.	Strong team synergy; well-structured documentation and consistent communication; timely resolution of conflicts.	Exceptional collaboration; comprehensive documentation; professional presentations; all team members contribute significantly and coherently.

Name of candidate:							
PRN:			**A× 2**	**B× 2**	**C× 2**	**D× 2**	**E× 2**
Exam Seat No:							
Day & Date:		**Total Score:**					
Examiner 1 (Name & Signature)		**Examiner 2 (Name & Signature)**					

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B. Tech. (E & Tc)
Value Added Course - Introduction to MATLAB

Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 02	End Semester Examination:	Credits: 02
Practical: 00	Internal Assessment: 100 Marks	
Tutorial: 00		
		Total Credit: 02

Course Outcomes: After learning this course students will be able to

1	Apply the basic concept of MATLAB programming.
2	Use basic commands, variables and operators in programming.
3	Use vectors, arrays and strings in programming.
4	Apply knowledge of conditional statements, loops, and functions in programming.
5	Use different operations of Matrices in programming.
6	Design different models using MATLAB Simulink.

UNIT – I	**Introduction to MATLAB**	**(04 Hours)**
	- Introduction to MATLAB software. - MATLAB windows. - Types of program files- scripts and function files. - MATLAB toolbox.	
UNIT –II	**Commands, Variables and Operators**	**(04 Hours)**
	- Basic commands: for managing a session, input and output commands, plotting commands. - Variables: assigning variables, special variables, constants, use of semicolon. - Operators: arithmetic operators, relational operators, logical operators, bitwise operations and set operations on scalar data.	
UNIT -III	**Vectors, Arrays and Strings**	**(04 Hours)**
	- Vectors: row vectors, column vectors, referencing the elements of a vector, vector operations-addition, subtraction, transpose, dot product, appending and magnitude of a vector. - Arrays-array functions, special arrays, accessing data in cell	

	arrays. - Strings.	
UNIT -IV	**Conditional Statements, Loops and Functions**	**(04 Hours)**
	- Decision making within a program: if statement, if-else statement, nested if statement, switch statement, break statement and continue statement. - Loops: while loop, for loop, nested loop. - Function: local functions, nested functions and anonymous functions.	
UNIT -V	**Operations on Matrix**	**(04 Hours)**
	- Matrix Operations: Creating rows and columns of matrix, referencing the elements of a matrix, deleting a row or a column in a matrix, addition and subtraction of matrices, division of matrices. - Transpose of a matrix, concatenating matrices, matrix multiplication, determinant of a matrix, inverse of a matrix.	
UNIT -VI	**MATLAB Simulink**	**(04 Hours)**
	- Introduction of Simulink, Simulink environment & interface. - Study of Simulink library. - Building models- circuit oriented design and equation oriented design. - Applications.	

Reference Books:

1. MATLAB for Beginners-A Gentle Approach, Peter I. Kattan, 2010, Research Gate publication
2. Getting started with MATLAB, Rudra Pratap, 2010, Oxford university press.
3. Introduction to MATLAB for Engineers, William J.Palm, 3rd Edition, McGraw-Hill Education.

Assessment method :

The internal assess ent worth 100 marks is distributed as follows:

(a) three assignments, each worth 20 marks, and

(b) two case studies, presentations, or quizzes, each worth 20 marks. *

* The subject teachers have the flexibility to choose between conducting two case studies, two presentations, two quizzes, or any combination thereof.