Lokmanya Tilak Jankalyan Shikshan Santha's

Lokmanya Tilak College of Engineering

Sector 4, Vikas Nagar, Koparkhairane, Navi Mumbai 400709

An Autonomous Institute Affiliated to University of Mumbai

Department of Computer Science & Engineering

(Artificial Intelligence & Machine Learning)

Curriculum Structure for First Year Engineering

First Year (BASED ON NEP 2020) w.e.f. **A.Y. 2024-25**

Approved by Board of Studies on 16/10/2024

Approved by Academic Council on 18/10/2024

Lokmanya Tilak Jankalyan Shikshan Sanstha's
Lokmanya Tilak College of Engineering
An Autonomous Institute Affiliated to University of Mumbai
(Approved by AICTE, Accredited by NAAC 'A' Grade & four programs by NBA)
Sector-04, Koparkhairane, Navi Mumbai - 400 709

CURRICULUM STRUCTURE FOR FIRST YEAR ENGINEERING PROGRAM

w.e.f. A.Y. 2024-25

Preamble

Lokmanya Tilak College of Engineering (LTCE) is founded by a Nagpur-based trust known as Lokmanya Tilak Jankalyan Shikshan Sanstha (LTJSS). The Sanstha was established in 1983, by Honourable Dr. Satish Chaturvedi. At present, there are 28 educational institutes run by the Sanstha in Nagpur. The Sanstha derives its philosophy from the magnanimous mathematician, educationist, social reformer Lokmanya Bal Gangadhar Tilak, who dedicated his life for the cause of Swaraj. Lokmanya Tilak College of Engineering was established in 1994, approved by the All-India Council for Technical Education, New Delhi, recognised by the Govt. of Maharashtra, accredited by NAAC with 'A' grade and is affiliated to the University of Mumbai. Within the span of 30 years of its inception, LTCE has grown leaps and bounds in terms of popular courses being offered at U.G., P.G. and Ph.D. level. Four of its branches viz., Computer, Mechanical, Electronics and Telecommunications Engg. and Electrical Engineering have been accredited by NBA. The Institute runs the Under-graduate Programmes in Mechanical Engineering, Computer Engineering, Electronics & Telecommunication Engineering, Electrical Engineering, Computer Science & Engineering (Data Science), Computer Science & Engineering (Artificial Intelligence & Machine Learning) and Computer Science & Engineering (IoT & Cyber Security Including Blockchain Technology). Institute also offers Doctoral Programmes in Mechanical Engineering and Computer Engineering. LTCE stands steadfast in its mission of continuing efforts for the betterment of its students and society.

The National Education Policy 2020, recently implemented by the Government of India, envisions providing quality education to all young people, with the primary goal of nurturing well-rounded, thoughtful, and creative individuals. NEP 2020 also emphasizes the importance of developing character, ethical values, constitutional principles, intellectual curiosity, scientific temper, creativity, and other related virtues. The Government of Maharashtra has instructed autonomous colleges to update their curriculum and begin implementing the National Education Policy (NEP) 2020. We are fully committed to ensuring the effective and meaningful adoption of NEP 2020 in its true essence. At "Lokmanya Tilak College of Engineering", the holistic development of learners has always been our top priority and central focus. LTCE embraced the NEP philosophy as early as 2022 wherein we have introduced the concept of Honors and Minors programs on emerging fields including AI & ML, Data Science, Cyber Security, IoT, Blockchain, etc., as per the guidelines of University of Mumbai and in 2024, we proudly graduated our first batch under this holistic curriculum. The curriculum for 2024-28 is structured in line with the recommendations of NEP 2020, AICTE, and UGC. It now includes courses in emerging technologies and multidisciplinary areas to ensure relevance to industry and practical applications. Greater focus has been placed on experiential learning to move away from rote memorization.

Illustrative Semester wise Credit distribution structure for Four Year UG Engineering Program – One Major, One Minor as per Maharashtra State Govt. resolution:

Semester	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**Total Credits**
Courses									

Basic Science Course	BSC/ESC	6-8	8-10							14-18
Engineering Science Course		8-10	4-6							12-16
Programme Core Course (PCC)	Program Courses		2	8-10	8-10	10-12	8-10	4-6	4-6	44-56
Programme Elective Course (PEC)						4	8	2	6	20
Multidisciplinary Minor (MD M)	Multidisciplinary Courses			2	2	4	2	2	2	14
Open Elective (OE) Other than a particular program				4	2	2				8
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	2	2		2		2			8
Ability Enhancement Course (AEC -01, AEC-02)	Humanities Social Science and Management (HSSM)	2			2					4
Entrepreneurship/Economics/ Management Courses				2	2					4
Indian Knowledge System (IKS)			2							2
Value Education Course (VEC)				2	2					4
Research Methodology	Experiential Learning Courses								4	4
Comm. Engg. Project (CEP)/Field Project (FP)				2						2
Project									4	4
Internship/ OJT								12		12
Co-curricular Courses (CC)	Liberal Learning Courses	2	2							4
Total Credits (Major)		**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**160-176**

Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
2 Hr. Practical (P) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit

Credits for award of Degrees:

a) A total of 160-176 credits for a student are required to be eligible to get an Undergraduate **degree in Engineering (Major).**

b) A student will be eligible to get an Undergraduate **degree** with **additional Minor Specialization**, if the candidate earns an **additional 16 credits.** These could be acquired by completing the respective courses from the pool by the respective Program. (The courses could be through MOOCs also). The candidate will have liberty to go for minor from the discipline itself or from multidisciplinary options too. Even the candidate can go for double minors too.

c) A student will be eligible to get an Undergraduate **degree** with **Honors,** if the candidate earns an **additional 18 credits.** Out of these 18 credits, 15 credits will be against 5 different theory courses (3 credits each) pertaining to the Major Discipline while 3 credits will be

against an advance laboratory practice in the respective discipline of studies. These theory credits could be acquired preferably through MOOCs the title of

d) which will be well declared to the aspirants who will chose the same from the pool of courses.

e) A student will be eligible to get **Undergraduate degree with Honors and Research**, if the candidate, in addition to those **18** credits allotted to the Honors, earns an **additional of 3 credits against an extra research project.** Thus the total credits requirement for the **Degree with Honors and Research** will be **21.** (As regards this extra project work, it is mandatory to be successful in publishing at least one research paper based on the research topic.)

Multiple Exits:

Students will have the flexibility to enter a programme in odd semesters and exit a programme after the successful completion of even semesters as per their future career needs.

• Students exiting the First-Year programme after securing minimum 40 credits will be awarded UG Certificate in the relevant Discipline / Subject provided they secure 8 credits in work-based vocational courses or internship / Apprenticeship offered during summer vacation in addition to 4 credits from skill-based courses earned during the first and second semester.

• Students exiting the Second Year Programme after securing minimum 80 credits will be awarded UG Diploma in the relevant Discipline / Subject provided they secure additional 8 credits in skill-based vocational courses (skill-based courses, internship, mini projects etc) offered during summer vacation after the second year.

• Students exiting the 3-year UG program will be awarded B. Voc. in the relevant Discipline /Subject upon securing minimum 120 credits with additional 8 credits in skill-based vocational courses (skill-based courses, internship, mini projects etc.) offered during summer vacation after the sixth semester.

• Exit options shall be provided with Certification, Diploma and B. Vocational degrees to the students at the end of the second, fourth and sixth semester, respectively, in the four-year degree programme. Students will receive a Bachelor's degree with the single minor on successfully completing all eight semesters of the UG Programmes either at a stretch or with opted exits and re-entries. In addition to this, student will receive a Bachelor's degree with Double Minor/Honours/ Research subject to earning additional 18 credits.

Distribution of Credits:

Type of Course	Course Code	No. of Credits as per Maharashtra Govt.	No. of credits as per LTCE
Basic Science Course	BSC	14-18	**18**
Engineering Science Course	ESC	12-16	**16**
Programme Core Course	PCC	44-56	**51**
Programme Elective Course	PEC	20	**15**
Multidisciplinary Minor	MDM	14	**12**
Open Elective (OE) Other than a particular program	OE	8	**06**
Vocational and Skill Enhancement Course	VSEC	8	**08**
Ability Enhancement Course (AEC -01, AEC-02)	AEC	4	**05**
Entrepreneurship/Economics/ Management Courses	EEMC	4	**06**
Indian Knowledge System (IKS)	IKS	2	**02**
Value Education Course (VEC)	VEC	4	**04**
Research Methodology	ELC	4	
Comm. Engg. Project (CEP)/Field Project (FP)		2	**02**
Project		4	**10**
Internship/ OJT		12	**08**
Co-curricular Courses (CC)	CC	4	**02**
Total Credits (Major)		**160-176**	**165**
Total Credits (Major + Honors)		**178-194**	**165+18=183**

Abbreviations:

AEC	Ability Enhancement Course
AEL	Ability Enhancement Laboratory
BSC	Basic Science Course
BSL	Basic Science Laboratory
CEP	Common Engineering Project
CC	Co-curricular courses
CIE	Continuous Internal Evaluation
ELC	Experiential Learning Course
ESC	Engineering Science Course
ESE	End Semester Exam
ESL	Engineering Science Laboratory
IKS	Indian Knowledge System
L	Lecture
MDM	Multidisciplinary Minor
MSE	Mid Semester Exam
OE	Open Elective
P	Practical
PCC	Programme Core Course
PCL	Programme Core Laboratory
PEC	Programme Elective Course
T	Tutorial
VEC	Value Education Course
VSEC	Vocational and Skill Enhancement Course

First Year Engineering: Semester I (w.e.f. AY 2024-25)

Course Code	Course Name	Teaching Scheme			Credit Assigned			Total Credits	Examination scheme					Total
									Internal Assessment		End Semester Exam		Oral &/ Practical	
		L	P	T	L	P	T		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)	Marks	Duration (Hrs)		
BSC101	Applied Mathematics -I	2	-	1	2	-	1	3	20	20 +25$	60	2	-	125
BSC102	Applied Physics I	2	-	-	2	-	-	2	20	15	40	1.5	-	75
BSC103	Applied Chemistry I	2	-	-	2	-	-	2	20	15	40	1.5	-	75
ESC101	Engineering Mechanics	2	-	-	2	-	-	2	20	20	60	2	-	100
ESC102	Basic Electrical & Electronics Engineering	3	-	-	3	-	-	3	20	20	60	2	-	100
BSL101	Applied Physics I Lab	-	1	-	-	0.5	-	0.5	-	25	-	-	-	25
BSL102	Applied Chemistry I Lab	-	1	-	-	0.5	-	0.5	-	25	-	-	-	25
ESL101	Engineering Mechanics Lab	-	2	-	-	1	-	1	-	25	-	-	25	50
ESL102	Basic Electrical & Electronics Engineering Lab	-	2	-	-	1	-	1	-	25	-	-	25	50
AEC101	Professional and Communication Ethics	2	-	-	2	-	-	2	20	15	40	1.5	-	75
AEL101	Professional and Communication Ethics Lab	-	2		-	1	-	1	-	25	-	-	-	25
VSEC101	Engineering Workshop-I	-	2	-	-	1	-	1	-	25	-	-	-	25
VSEC102	C Programming	-	2*+2	-	-	2	-	2	-	25	-	-	25	50
CC101	Induction cum Universal Human Values	2#	-	-	2	-	-	2						
	Total	**15**	**14**	**01**	**15**	**07**	**01**	**23**	**120**	**305**	**300**	**10.5**	**75**	**800**

$ For continuous assessment of tutorials

* Two hours of practical class to be conducted for full class as demo/discussion.

Course evaluation is activity-based which may be an individual or group of four students.

Theory / Tutorial 1 credit for 1 hour and Practical 1 credit for 2 hours

First Year Engineering: Semester II (w.e.f. AY 2024-25)

Course Code	Course Name	Teaching Scheme			Credit Assigned			Total Credit	Examination scheme					Total
									Internal Assessment		End Semester Exam		Oral &/ Practical	
		L	P	T	L	P	T		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)	Marks	Duration (Hrs)		
BSC201	Applied Mathematics II	2	-	1	2	--	1	3	20	20 +25$	60	2	-	125
BSC202	Applied Physics II	2	-	-	2	--	-	2	20	15	40	1.5	-	75
BSC203	Applied Chemistry II	2	-	-	2	--	-	2	20	15	40	1.5	-	75
ESC201	Engineering Graphics	3	-	-	3	--	-	3	20	20	60	3	-	100
PCC2011	Data Structure	2	-	-	2	--	-	2	20	20	60	2	-	100
BSL201	Applied Physics II Lab	-	1	-	-	0.5	-	0.5	-	25	-	-	-	25
BSL202	Applied Chemistry II Lab	-	1	-	-	0.5	-	0.5	-	25	-	-	-	25
ESL201	Engineering Graphics Lab	-	2	-	-	1	-	1	-	25	-	-	25	50
PCL2011	Data Structure Lab	-	2	-	-	1	-	1	-	25	-	-	25	50
CC201	Social Science & Community Services	-	2@	-	-	1	-	1	-	25	-	-	-	25
IKS201	Indian knowledge System	-	2#+2	-	-	2	-	2	-	25	-	-	-	25
VSEC201	Engineering Workshop II	-	2	-	-	1	-	1	-	25	-	-	-	25
VSEC202	Python Programming	-	2*+2	-	-	2	-	2	-	25	-	-	25	50
Total		**11**	**18**	**01**	**11**	**09**	**01**	**21**	**100**	**315**	**260**	**10**	**75**	**750**

$ For continuous assessment of tutorials

@ Class wise common curricular and extracurricular activities to be conducted (Yoga, Sports, Music, social activities, community services, etc.)

Course evaluation is activity-based which may be individual or group of four students.

* Two hours of practical class to be conducted for full class as demo/discussion

Theory / Tutorial 1 credit for 1 hour and Practical 1 credit for 2 hours.

Program Core Course

PCC201X	Name of Program as per Cluster	Name of Program Core Course
PCC2011	Computer Engineering, CSE (AI & ML), CSE(DS), CSE (IoT & CSBT)	**Data Structure**
PCC2012	Electronics & Telecommunication-Engineering	**Elements of Telecommunication**
PCC2013	Electrical Engineering	**Elements of Electrical Systems**
PCC2014	Mechanical Engineering	**Elements of Mechanical Engineering**

Program Core Lab

PCL201X	Name of Program as per Cluster	Name of Program Core Course
PCL2011	Computer Engineering, CSE (AI & ML), CSE(DS), CSE (IoT & CSBT)	**Data Structure Lab**
PCL2012	Electronics & Telecommunication-Engineering	**Elements of Telecommunication Lab**
PCL2013	Electrical Engineering	**Elements of Electrical Systems Lab**
PCL2014	Mechanical Engineering	**Elements of Mechanical Engineering Lab**

First Year Engineering Curriculum: Semester I

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
BSC101	Applied Mathematics-I	02	-	01	02	-	01	03

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		End Semester Exam (ESE)			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
BSC101	Applied Mathematics-I	20	20 +25*	60	1	2	125

* Tutorial Assessment

Course Objectives: The course is aimed

1. To build a strong foundation in Mathematical concepts that are essential for solving Engineering problems.
2. To equip students with knowledge of basic Mathematical tools and techniques necessary for their further studies in Engineering.

Course Outcomes: Students will be able to

1. Apply the basic concepts of Complex Numbers and will be able to use them to analyze for engineering problems.
2. Apply hyperbolic functions and logarithms in subjects like electrical circuits and electromagnetic wave theory for cutting-edge tools and technology.
3. Apply the basic concepts of partial differentiation of function of several variables and will be able to use in subjects like Electromagnetic Theory, Heat and Mass Transfer, etc.
4. Apply the concept of Maxima, Minima, and Successive differentiation and will be able to use it for optimization and tuning the systems in emerging and computing areas.
5. Apply the concept of Matrices and be able to use it for solving the KVL and KCL in electrical networks in emerging and telecommunications areas.
6. Apply the concept of Numerical Methods for solving engineering problems.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Complex Numbers** **Pre-requisite:** Review of Complex Numbers-Algebra of Complex Numbers, Cartesian, polar and exponential form of complex number, Statement of D'Moivre's Theorem. 1.1. Expansion of $\sin^n\theta$, $\cos^n\theta$ in terms of sines and cosines of multiples of θ and Expansion of $\sin n\theta$, $\cos n\theta$ in powers of $\sin\theta$, $\cos\theta$. 1.2. Powers and Roots of a complex number. **# Self-learning topic:** Basic of Complex Number.	**2** **2**	**CO1**

02	**Hyperbolic Functions & Logarithms of Complex Numbers** 2.1. Circular functions of complex number and Hyperbolic functions. Inverse Circular and Inverse Hyperbolic Functions. Separation of real and imaginary parts of all types of Functions. (Simple Examples) 2.2. Logarithm of Complex Number (Simple Examples) **# Self-learning topic:** Applications of complex numbers in Electrical circuits.	**3** **1**	**CO2**
03	**Partial Differentiation** 3.1. Partial Differentiation: Function of two and three variables, Partial derivatives of first and higher order. Differentiation of composite function. 3.2. Euler's Theorem on Homogeneous functions with two independent variables (with proof). Deductions from Euler's Theorem. (without proof). **# Self-learning topics:** Total differentials, implicit functions, Euler's Theorem on Homogeneous functions with three independent variables.	**3** **2**	**CO3**
04	**Applications of Partial Differentiation and Successive Differentiation.** 4.1. Maxima and Minima of a function of two independent variables, 4.2. Successive differentiation: nth derivative of standard functions. Leibnitz's Theorem (without proof) and simple examples. **# Self-learning topics:** Jacobian's of two and three independent variables (simple problems) Lagrange's Multiplier method.	**1** **3**	**CO4**
05	**Matrices** **Pre-requisite:** Inverse of a matrix, addition, multiplication, and transpose of a matrix, symmetric, skew-symmetric Matrix (Only Definition). 5.1. Types of Matrices (Hermitian, Skew Hermitian, Unitary, Orthogonal Matrices and properties of Matrices (without proof)). The rank of a Matrix using Echelon form, reduction to normal form, and PAQ form (Only 3X3 Matrix) 5.2. System of homogeneous and non-homogeneous equations, their consistency, and solutions. **# Self-learning topics:** Application of inverse of a matrix to coding theory. Reduction to normal form and PAQ form (m x n Matrix)	**3** **2**	**CO5**
06	**Numerical Solutions of Transcendental Equations and System of Linear Equations and Expansion of Function.** 6.1. Solution of Transcendental Equations: Solution by Newton Raphson method and Regula – Falsi method. 6.2. Solution of a system of linear algebraic equations, by (1) Gauss Jacobi Iteration Method, (2) Gauss Seidel Iteration Method. **# Self-learning topics:** Indeterminate forms, L- Hospital Rule, Gauss Elimination Method, Gauss Jordan Method.	**2** **2**	**CO6**

References:

1. Higher Engineering Mathematics, Dr.B.S. Grewal, Khanna Publication
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited, 9thEd.
3. Engineering Mathematics by Srimanta Pal and Subodh, C.Bhunia, Oxford University Press
4. Matrices, Shanti Narayan, S. Chand publication.
5. Applied Numerical Methods with Matlab for Engineers and Scientists by Steven Chapra, McGraw Hill
6. Elementary Linear Algebra with Application by Howard Anton and Christ Rorres. 6th edition, John Wiley & Sons, INC.
7. A textbook of Engineering Mathematics by N.P. Bali & Manish Goyal. Laxmi Publication.
8. A textbook of Applied Mathematics Vol-I & Vol-II by P. N. Wartikar & J.N. Wartikar.

General Instructions:

1. Batch-wise tutorials are to be conducted. The number of students per batch should be as per the LTCE norms

2. A minimum of 6 Tutorials has to be conducted and students need to give presentation on self-learning topics from the syllabus.

Internal Assessment (65 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (45 Marks)

I. Continuous Internal Evaluation of Theory (20 Marks)

1. Assignments: 5 Marks
2. Class test/Quiz/Student Activity: 10 Marks
3. Regularity and attendance: 5 Marks

II. Continuous Internal Evaluation of Tutorial (25 Marks)

1. Tutorials: 10 Marks
2. Presentation: 10 Marks
3. Regularity and active participation: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
BSC102	Applied Physics I	02	-	-	02	-	-	02

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		End Semester Exam (ESE)			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
BSC102	Applied Physics I	20	15	40	1	1.5	75

Rationale:

Most of the engineering branches are being off-spring of basic sciences where physics is playing a pivotal role in concept and understanding of foundation of core engineering branches. This syllabus is developed by keeping in mind, needs of all branches that we offer in University of Mumbai. In the distribution of modules, core physics and its applied form are given priority. Further, it is ensured that these modules will cover prerequisites needed for engineering courses to be introduced in higher semesters as core subjects or as interdisciplinary subjects in respective branches.

Course Objectives:

1. To provide students with a basic understanding of laser operation.
2. To explain the basic working principle of Optical fiber and its use in communication technology.
3. To demonstrate principles of interference in thin film.
4. To describe Maxwell's equations and their significance.
5. To build a foundation of quantum mechanics needed for modern technology.
6. To give exposure to the concept of Fermi level in semiconductors.

Course Outcomes:

1. Learners will be able to ILLUSTRATE the use of laser in LiDAR and Barcode reading.
2. Learners will be able to APPLY the foundation of fiber optics in the development of modern communication technology
3. Learners will be able to determine the wavelength of light and refractive index of liquid using the interference phenomenon.
4. Learners will be able to ARTICULATE the significance of Maxwell's equations.
5. Learners will be able to RELATE the foundations of quantum mechanics with the development of modern technology.

6. Learner will be able to CLASSIFY semiconductors and EXPLAIN variation of Fermi level with temperature and doping concentration.

DETAILED SYLLABUS:

	Name of Module	**Detailed Content**	**Hours**	**CO Mapping**
	Prerequisite	Basic knowledge of optics and atomic structure, Wavefront and Huygens principle, reflection and refraction, Interference by division of wavefront, Refractive index of a material, Snell's law, Basics of vector algebra, partial differentiation concepts, Dual nature of radiation, Photoelectric effect, Matter waves, Davisson-Germer experiment. Intrinsic and extrinsic semiconductors, electrical resistivity and conductivity concepts	--	--
I	**Lasers**	Lasers: Spontaneous and stimulated emission, population inversion, pumping, active medium & active center, resonant cavity, coherence length and coherence time, Characteristics of lasers, He-Ne laser: construction and working. Fiber laser Construction and working Application: (i)Elementary knowledge of LiDAR (ii) Barcode reader (iii) Application of laser in metal work	**04**	**CO1**
II	**Fibre Optics**	Optical fibers: Critical angle, acceptance angle, acceptance cone, numerical aperture, total internal reflection and propagation of light, Types of optical fibers: Single mode & multimode, step index & graded index, attenuation, attenuation coefficient, factors affecting attenuation, Fibre Optic Communication System, Advantages of optical fiber communication, numerical	**04**	**CO2**
III	**Interference In Thin Films**	Interference in thin film of uniform thickness, conditions of maxima and minima for reflected system, Conditions for maxima and minima for wedge shaped film (qualitative), engineering applications – (i) Newton's rings for determination of unknown monochromatic wavelength and refractive Index of transparent liquid (ii) Anti Reflecting Coating	**04**	**CO3**
IV	**Electrodynamics**	Vector Calculus: Gradient, Divergence, Curl. Gauss's law, Amperes' circuital Law, Faraday's law, Divergence theorem, Stokes theorem Maxwell's equations in point	**04**	**CO4**

		form, Integral form and their significance (Cartesian coordinate only)		
V	**Quantum Physics**	de Broglie hypothesis of matter waves, de Broglie wavelength for electron, Properties of matter waves, Wave function and probability density, mathematical conditions for wave function, problems on de Broglie wavelength, Need and significance of Schrödinger's equations, Schrödinger's time independent and time dependent equations, Energy of a particle enclosed in a rigid box and related numerical problems, Quantum mechanical tunneling, Principles of quantum computing: concept of Qubit.	**06**	**CO5**
VI	**Basics Of Semiconductor Physics**	Direct and Indirect Band Gap Semiconductors, Electrical Conductivity of Semiconductors, Drift Velocity, Mobility and Conductivity in Conductors Fermi- Dirac distribution function, Position of Fermi Level in Intrinsic and Extrinsic Semiconductors.	**04**	**CO6**

Text Books:

1. A Text book of Engineering Physics -Dr. M. N. Avadhanulu, Dr. P. G. Kshirsagar, S. Chand, Revised Edition 2014
2. Modern Engineering Physics - A. S. Vasudeva, S. Chand, Revised Edition 2013
3. Engineering Physics D. K Bhattacharya, Poonam Tandon, Oxford Higher Education, 1st Edition 2015
4. Engineering Physics -R. K. Gaur, S. L. Gupta, Dhanpat Rai Publications, 2012
5. Engineering Physics -V. Rajendran, McGraw Hill Educations, 2017
6. A Textbook of Nanoscience and Nanotechnology, T. Pradeep Tata McGraw Hill Education Pvt. Ltd., 2012.

References:

1. Concepts of Modern Physics – Arther Beiser, Shobhit Mahajan, S. Choudhury, McGraw Hill, 7thEdition 2017
2. Fundamentals of optics - Francis A. Jenkins, Harvey E. White, McGraw Hill Publication, India, 4th Edition
3. Fundamentals of Physics, Halliday and Resnick, Wiley publication
4. Introduction to Electrodynamics, D. J. Griffiths, Pearson Publication

Online References:

Sr. No.	Website Name
1.	https://archive.nptel.ac.in/courses/115/102/115102124/
2.	https://archive.nptel.ac.in/courses/115/102/115102025/
3.	https://archive.nptel.ac.in/courses/115/105/115105132/

Internal Assessment (35 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (15 Marks)

1. Assignments: 5 Marks
2. Quiz/Open book test/Presentation: 7 Marks
3. Regularity and attendance: 3 Marks

End Semester Examination (40 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
BSL101	Applied Physics I Lab	-	01	-	-	0.5	-	0.5

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		Oral & Practical			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
BSL101	Applied Physics I Lab	-	25	-	-	-	25

Course Objectives:

1. To develop scientific understanding of the physics concepts.
2. To develop the ability to explain the processes and applications related to science subjects.
3. To apply skills and knowledge in real life situations.
4. To improve the knowledge about the theory concepts of Physics learned in the class.
5. To improve ability to analyze experimental result and write laboratory report.
6. To develop understanding about inferring and predicting.

Course Outcomes: Learners will be able to:

1. Determine wavelength / divergence of laser beam.
2. Determine parameters like numerical aperture / power attenuation of an optical fiber.
3. Perform experiments based on interference in thin film and determine radius of curvature of lens / diameter of wire / thickness of paper.
4. Calculate basic parameters / constants using semiconductors.
5. Determine energy gap / resistivity of a semiconductor.
6. Learner to understand the concept for virtual lab as per syllabus.

Suggested List of Experiments (Minimum five experiments required)

Sr No	List of Experiments	Hrs	CO Mapping
01	Determination of wavelength using Diffraction grating. (Laser source)	**01**	**CO1**
02	Study of divergence of laser beam	**01**	**CO1**
03	Determination of Numerical Aperture of an optical fibre.	**01**	**CO2**
04	Measuring optical power attenuation in your plastic optical fiber	**01**	**CO2**

05	Determination of radius of curvature of a lens using Newton's ring set up.	**01**	**CO3**
06	Determination of diameter of wire/hair or thickness of paper using Wedge shape film method.	**01**	**CO3**
07	Determination of 'h' ..photo cell	**01**	**CO4**
08	Determination of 'h' using LED	**01**	**CO4**
09	Determination of energy band gap of semiconductor.	**01**	**CO5**
10	Determination of resistivity by four probe method.	**01**	**CO5**
11	Any other experiment based on syllabus may be included, which would help the learner to understand concept. Virtual lab may be developed and used for performing the experiments, after defining a suitable CO	**01**	**CO6**

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
BSC103	Applied Chemistry I	02	-	-	02	-	-	02

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		End Semester Exam (ESE)			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
BSC103	Applied Chemistry I	20	15	40	1	1.5	75

Rationale:

Chemical science has contributed in many ways to most of the Engineering branches where "Environmental Chemistry" is the modern approach to learn impact of Technology on habitat and can be common to all Core Groups, "Engineering Materials" can be prerequisites to many subjects of all core groups and Impact of corrosion on metals as engineering materials is the important area of concern. "Conventional and Non Conventional Energy Study" is the matter of general approach to all Core groups as Energy issue is the most recent concern even for designing computational engines (Include hardware & software energy efficient).

Course Objectives:

1. To study Coal as a conventional source of energy.
2. To study the effect of corrosion by different mechanisms on metals and methods of corrosion control.
3. To recognise importance of alloys and can apply the phase rule on it to study the effect of temperature and composition.
4. To introduce important properties of polymers as Engineering material.
5. To recognise the composition, properties and functions of various composite materials.
6. To study importance of Green Chemistry by comparative study of conventional and Green routes of syntheses, solvents and fuels.

Course Outcomes: Student will be able to -

1. Determine the quality of coal and quantify the oxygen required for combustion of coal.
2. Apply different methods to minimize corrosion in industries.
3. Interpret various phase transformations of alloy using thermodynamics.
4. Use the polymers for specific engineering applications on the basis of the properties.
5. Identify different types of composite materials for engineering applications.
6. Apply the principles of Green chemistry and study environmental impact for sustainable development

Prerequisite:

1. Knowledge about basic difference in Conventional and non-conventional energy sources.

2. Knowledge about concepts of Electrochemistry.
3. Knowledge of basic properties of metals and nonmetals.
4. Knowledge of 12 principles of Green Chemistry

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
I	**Fuels and Combustion**	A) Fuel: - Definition, Characteristics of good fuel. B) Calorific value (Definition, Types, Determination, Dulong's formula, Numerical) C) Coal: - Analysis of coal – Proximate analysis, Ultimate analysis, Numerical) D) Combustion of coal – Numerical	**04**	**CO1**
II	**Corrosion**	A) Introduction: - Definition, Types of Corrosion – i) Dry or Atmospheric Corrosion, ii) Wet or Electrochemical corrosion (In Acidic medium, In Neutral medium) B) Factors affecting rate of corrosion:- i) Position of metal in electro-chemical and galvanic series, ii) Purity of Metal, iii) Nature of Corrosion product, iv) Temperature, v) pH of medium, vi) Humidity, vii) Relative Cathodic and Anodic area C) Methods to control corrosion: - i) Proper Designing, ii) Cathodic protection, iii) Use of Corrosion Inhibitors, iv) Metallic Coating	**05**	**CO2**
III	**Alloys**	A) Purpose of making alloys. B) i) Gibbs Phase rule – Statement, Terms involved with examples. ii) Reduced phase rule, Two-component system (Pb-Ag) & Numerical. iii) Merits and Limitations of Phase rule.	**04**	**CO3**
IV	**Introduction to Polymers**	A) Macro-molecular science, basic concept of polymers, Chemical bonding in polymers, Classification of Polymers. B) Properties of Polymers:- i) Molecular weight - Number average molecular weight, Weight average molecular weight, Numerical, ii) Crystallinity - Crystalline and amorphous polymers – Glass transition temperature, iii) Hardness, tensile strength, creep, fatigue, impact resistance, insulation resistance, surface resistivity, refractive index, colour (Definitions and Significance)	**05**	**CO4**
V	**Introduction to Composites**	A) Definition, Characteristics of Composites, B) Constituents of Composites – Matrix Phase and Dispersed Phase (Definition and Functions) C) Classification of Composites	**03**	**CO5**
VI	**Green Chemistry for**	A) Comparative study of synthesis of following industrially important molecules by conventional and green route:- i) Indigo dye, ii) Adipic acid, iii)	**05**	**CO6**

	sustainable development	Carbaryl B) Green Solvents: - characteristics and applications of Supercritical solvents and ionic liquids C) Green Fuels:- Synthesis and Advantages of i) Biodiesel, ii) Ethanol		

Recommended Books:

1. Engineering Chemistry, Jain and Jain, Dhanpat Rai Publication
2. A textbook of Engineering Chemistry, S. S. Dara, S. Chand and Company
3. Polymer science: Vasant Gowarikar, Wiley Estern Ltd, new Delhi
4. Green Chemistry: V. K. Ahluwalia

Online References:

Sr. No.	Website Name
1.	https://archive.nptel.ac.in/courses/103/106/105106205/
2.	https://courses.nptel.ac.in/noc20_ch41/preview

Recommended Books:
1. Engineering Chemistry, Jain and Jain, Dhanpat Rai Publication
2. A textbook of Engineering Chemistry, S. S. Dara, S. Chand and Company
3. Polymer science: Vasant Gowarikar, Wiley Estern Ltd, new Delhi
4. Green Chemistry: V. K. Ahluwalia

Internal Assessment (35 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (15 Marks)

1. Assignments: 5 Marks
2. Quiz/Open book test/Presentation: 7 Marks
3. Regularity and attendance: 3 Marks

End Semester Examination (40 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
BSL102	Applied Chemistry I Lab	-	01	-	-	0.5	-	0.5

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		Oral & Practical			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
BSL102	Applied Chemistry I Lab	-	25	-	-	-	25

Course Objectives:

1. To apply knowledge acquired during the theory class in carrying out the experiments for qualitative and quantitative determination.
2. To analyze experimental results and write laboratory reports.

Course Outcomes:

After completion of experiment, the learners will be able to:

1. Understand the significance of proximate analysis of coal and determine quality of coal sample.
2. Learn various quantitative analytical techniques to determine % of elements from alloy samples.
3. Synthesize biodiesel at laboratory level and calculate % atom economy from Green chemistry point of view.
4. Learn the effect of various factors on the rate of corrosion.
5. Synthesize bioplastic at laboratory level using from Green chemistry.
6. Quantitative determination of N2 / Flue gas.

Prerequisite:

1. Knowledge of basic safety practices in the Chemistry Laboratory
2. Knowledge of Proximate analysis of coal
3. Knowledge of volumetric analysis

Suggested List of Experiments (Minimum five experiments required)

Sr No	List of Experiments	Hrs	CO Mapping
01	Determination of moisture content of coal	**01**	**CO1**
02	Determination of ash content of coal	**01**	**CO1**
03	Determination of Zn in Brass	**02**	**CO2**
04	Synthesis of Biodiesel from vegetable oil	**02**	**CO3**
05	Determination of Cu in Brass	**02**	**CO2**
06	Flue gas analysis by Orsat Apparatus	**02**	**CO6**
07	Synthesis of biodegradable plastics	**01**	**CO5**

08	Determination of nitrogen by Kjeldahl's method	**02**	**CO6**
09	To compare rate of corrosion of various metals in acidic medium	**02**	**CO4**

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
ESC101	Engineering Mechanics	02	-	-	02	-	-	02

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		End Semester Exam (ESE)			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
ESC101	Engineering Mechanics	20	20	60	1	2	100

Rationale:

Engineering mechanics is a branch of science that deals with the behavior of solid bodies when subjected to external forces or loads and the effects of these forces on the bodies. It is a fundamental discipline within engineering and provides the basis for understanding and analyzing various types of structures and mechanisms.

Course Objectives:

1. To acquaint with basic principles of centroid and its application
2. To familiarize with the concepts of force, moment, Resultant and Equilibrium of system of coplanar force.
3. To acquaint with the basic concept of friction and its application in real-life problems.
4. To understand the parameters required to quantify the Kinematics of Particle and Rigid body.
5. To understand the parameters required to quantify the Kinetics of Particle.
6. To acquaint with the basics of Robot kinematics

Course Outcomes:

1. Determine the equivalent force-couple system for a given system of forces. (L3)
2. Demonstrate the understanding of Centroid and its significance and locate the same. (L3)
3. Illustrate the concept of force, moment and apply the same along with the concept of equilibrium in rigid bodies with the help of FBD. (L3)
4. Calculate position, velocity and acceleration etc. of particle/rigid body using principles of kinematics (L3)
5. Analyze particles in motion using force and acceleration, work-energy and impulse-momentum principles (L4)
6. Establish the relation between robot joints and parameters (L2).

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping

0	**Prerequisite**	Resolution of a force, Use of trigonometry functions, Parallelogram law of forces, Law of triangle, Polygon law of forces, Lami's theorem, Concepts of Vector Algebra. Uniformly accelerated motion along a straight line, motion under gravity, projectile motion, Time of flight, Horizontal range, Maximum height of a projectile. Law of conservation of Energy, Law of conservation of Momentum, and Collision of Elastic Bodies, Work-Energy Principle. (Note: There will be no questions from the prerequisite in the theory examination)	**01**	
I	**System of Forces**	Classification of force systems, Principle of transmissibility, composition and resolution of forces, Resultant of coplanar force system (Concurrent forces, parallel forces and general system of forces), Moment of force about a point, Couples, Varignon's Theorem. Resultant of Non-Coplanar (Space Force): Concurrent force system	**04**	**CO1**
II	**Centroid**	Centroids of plane laminas: Plane lamina consisting of primitive geometrical shapes.	**03**	**CO2**
III	**Equilibrium of Force system and Friction**	**3.1 Equilibrium**: Conditions of equilibrium for concurrent forces, parallel forces and general forces, Couples, Equilibrium of rigid bodies, free body diagrams. **3.2 Equilibrium of Beams:** Types of beams, types of supports and reactions: Determination of reactions at supports for various types of loads on beams (Excluding problems on internal hinges). **3.3 Friction:** Laws of friction, Cone of friction, angle of repose, angle of friction, equilibrium of bodies on a horizontal and inclined plane.	**06**	**CO3**
IV	**Kinematics of particle and rigid bodies**	**4.1** Motion of particle with variable acceleration, Motion curves (a-t, v-t, s-t curves), Motion along plane curved path, velocity and acceleration in terms of tangential and normal component of acceleration. **4.2** Introduction to general plane motion, concept of Instantaneous Center of Rotation (ICR) method for velocity, location of ICR for 2 linkage mechanism, velocity analysis of rigid body using ICR.	**05**	**CO4**

V	**Kinetics of particle**	**5.1** Force and Acceleration: Introduction to basic concepts, D'Alembert's Principle, concept of Inertia force, Equations of dynamic equilibrium. **5.2** Principle of linear impulse and momentum, Impact and collision: Law of conservation of momentum, Coefficient of Restitution, Direct Central Impact and Oblique Central Impact, Loss of Kinetic Energy in collision of inelastic bodies.	**05**	**CO5**
VI	**Introduction to Robot Kinematics**	Fundamental of Robot Mechanics, Degree of Freedom, D-H Parameters, robot kinematics (Forward), Homogeneous transformation (limited to 2 DOF Serial robot)	**02**	**CO6**

Text Books:

1. Engineering Mechanics by A K Tayal, Umesh Publication.
2. Engineering Mechanics by Kumar, Tata McGraw Hill
3. Engineering Mechanics by Beer &Johnston, Tata McGraw Hill

References:

1. Engineering Mechanics by R. C. Hibbeler.
2. Engineering Mechanics by F. L. Singer, Harper& Raw Publication
3. Engineering Mechanics by Macklin & Nelson, Tata McGraw Hill
4. Engineering Mechanics by Shaum Series
5. Engineering Mechanics (Statics) by Meriam and Kraige, Wiley Bools
6. Engineering Mechanics (Dynamics) by Meriam and Kraige, Wiley Bools
7. Introduction to Industrial Robotics by Ramchandran Nagrajan, Pearson publication

Online References:

Sr. No.	Website Name
3.	https://archive.nptel.ac.in/courses/112/106/112106286/
4.	https://onlinecourses.nptel.ac.in/noc21_me70/preview
3.	https://archive.nptel.ac.in/courses/112/106/112106180/

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage upto Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
ESL101	Engineering Mechanics Lab	-	02	-	-	01	-	01

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		Oral & Practical			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
ESL101	Engineering Mechanics Lab	-	25	25	-	-	50

Course Objectives:

1. To familiarize with the concepts of force, moment, Resultant and Equilibrium of the system of coplanar force.
2. To acquaint with basic principles of centroid and its application.
3. To acquaint with the basic concept of friction and its application in real-life problems.
4. To understand the parameters required to quantify the Kinematics of Particles.
5. To understand the parameters required to quantify the Kinetics of particles.

Course Outcomes:

Learners will be able to

1. Apply equation of equilibrium of coplanar force system and verify the same.
2. Illustrate the concept of the law of moments.
3. Determine the centroid of plane lamina.
4. Determine the coefficient of friction between the different surfaces in contact.
5. Differentiate the different types of motion of kinematics of particles.
6. Demonstrate the types of collision/ impact and determine corresponding coefficient of restitution.

Suggested List of Experiments:

Minimum six experiments from the following list of which a minimum one should be from dynamics.

Sr No	List of Experiments	Hrs	CO mapping
01	Verification of Polygon law of coplanar forces	**02**	**CO1**
02	Verification of the equations of equilibrium for non-concurrent non-parallel (General) force systems.	**02**	**CO1**
03	Determination of support reactions of a Simply Supported Beam.	**02**	**CO1**
04	Verification of the Principle of Moments (Bell crank lever)	**02**	**CO2**
03	Determination of the centroid of plane lamina	**02**	**CO3**
05	Determination of coefficient of friction using inclined plane	**02**	**CO4**
07	Kinematics of particles. (Uniform motion, Projectile motion, and Motion under gravity)	**02**	**CO5**
08	Kinetics of particles. (collision of bodies)	**02**	**CO6**

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. Mid Semester Oral & Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Oral & Practical Exam (25 Marks)

An Oral & Practical exam will be held based on entire syllabus.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
ESC102	Basic Electrical and Electronics Engineering	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		End Semester Exam (ESE)			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
ESC102	Basic Electrical and Electronics Engineering	20	20	60	1	2	100

Course Objectives:

1. To provide knowledge on fundamentals of DC circuits
2. To provide knowledge of single phase and three phase AC circuits.
3. To inculcate fundamental knowledge of 1-Φ transformer.
4. To provide basic knowledge on fundamentals of DC and AC machines.
5. To provide knowledge of special purpose Diodes.
6. To provide knowledge of Transistor.

Course Outcomes:

1. Apply various network theorems to determine the circuit response / behavior.
2. Evaluate and analyze 1-Φ and 3-Φ AC circuits.
3. Understand the construction, operation and applications of 1-Φ transformers.
4. Illustrate the working principle of 3-Φ, 1-Φ Induction motors and DC Motors.
5. Study the construction, operation and applications of some special purpose Diodes.
6. Study construction, operation and applications of some Transistors.

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Resistance, inductance, capacitance, series and parallel connections of resistance, concepts of voltage, current, power and energy and its units. Magnetic circuits, MMF, Magnetic field strength, reluctance.		
I	01	DC Circuits: (Only independent sources) Kirchhoff's Laws, Ideal and Practical Voltage and Current Sources, Source Transformation, Mesh and Nodal Analysis (no super node and super mesh) Star-Delta / Delta-Star Transformations, Superposition Theorem, Thevenin's Theorem, Norton's Theorem and Maximum Power Transfer Theorem.	**10**	**CO1**
II	02	AC Circuits: Generation of alternating voltage, basic	**12**	**CO2**

		definitions, average and RMS values, phasor and phase difference, sums on phasors, Single-phase ac series and parallel circuits consisting of R, L, C, RL, RC, RLC combinations, definitions - real, reactive and apparent power, admittance (Y), Series and parallel resonance (only theory). Generation of Three-Phase Voltages, voltage & current relationships in Star and Delta Connections.		
III	03	Single Phase Transformer: (Numerical are not expected) Working principle of single-phase transformer, types of single- phase transformer, transformation ratio, actual (practical) and ideal transformer, Transformer losses, efficiency, applications of transformer.	**04**	**CO3**
IV	04	Electrical Machines: (Numerical are not expected) principle of operation, constructional details, classification and applications of DC Motor, three-phase induction motor, Single-Phase induction motors and BLDC motor	**05**	**CO4**
V	05	Special Purpose Diodes: (Numerical are not expected) Characteristics and operation of Zener Diode and application as a voltage regulator. Basic and structure of LED. Application of LED in indicative and lighting displays.	**04**	**CO5**
VI	06	Introduction to Transistors: (Numerical are not expected) structure and operation of BJT. BJT configurations (only common emitter). FET structure and operation. Application of BJT and FET in amplification, switching and oscillators.	**04**	**CO6**

Text Books:

1**.** V. N. Mittal and Arvind Mittal "Basic Electrical Engineering" Tata McGraw Hill, (Revised Edition)
2. Vincent Del Toro "Electrical Engineering Fundamentals", PHI Second edition, 2011
3. Edward Hughes "Hughes Electrical and Electronic Technology", Pearson Education (Tenth edition)
4. D P Kothari and I J Nagrath "Theory and Problems of Basic Electrical Engineering", PHI 13th edition 2011.
5. M. Naidu,S. Kamakshaiah "Introduction to Electrical Engineering" McGraw-Hill Education, 2004.
6. B.R Patil "Basic Electrical Engineering" Oxford Higher Education,
7. Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky

References:

1. B.L. Theraja "Electrical Engineering " Vol-I and II.
2. S.N. Singh, "Basic Electrical Engineering" PHI , 2011Book.

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
ESL102	Basic Electrical and Electronics Engineering Lab	-	02	-	-	01	-	01

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		Oral & Practical			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
ESL102	Basic Electrical and Electronics Engineering Lab	-	25	25	-	-	50

Course Objectives:

1. To impart the basic concept of network analysis and its application.
2. To provide the basic concept of AC circuit analysis and its application.
3. To illustrate the operation of the transformer.
4. To illustrate the operation of machines.
5. To explain the Zener diode voltage regulation characteristic.
6. To explain the BJT and FET as switches and amplifiers.

Course Outcomes:

1. Interpret and analyze the behavior of DC circuits using network theorems.
2. Perform and infer experiments on single-phase and three-phase AC circuits
3. Illustrate the performance of a single-phase transformer
4. Illustrate the performance of A.C. machine and DC Motor
5. Perform an experiment on voltage regulation characteristics of Special diode
6. Perform an experiment on the V-I characteristics of Transistor.

Suggested List of Experiments (Minimum eight experiments need to be performed).

Sr No	List of Experiments	Hrs	CO Mapping
01	Basic safety precautions. Introduction and use of measuring instruments - voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors	**01**	**CO1**
02	To measure output voltage across load resistor/current through load resisto and verify the result using Mesh and Nodal analysis	**01**	**CO1**
03	Verification of Superposition Theorem.	**02**	**CO1**
04	Verification Thevenin's and Norton's theorem	**02**	**CO1**
05	Verification Maximum Power Transfer Theorem.	**02**	**CO1**
06	To find the resistance and inductance of a coil connected in series with a pur resistance using the voltmeter method	**02**	**CO2**
07	To measure the relationship between phase and line, currents and voltages i three-phase system (star & delta)	**02**	**CO2**
08	To demonstrate cut-out sections of the single-phase transformer.	**02**	**CO3**
09	To demonstrate cut-out sections of the DC machine	**02**	**CO4**
10	To plot Zener diode voltage regulation characteristics	**02**	**CO5**
11	To demonstrate the application of LED in indicative and lighting display	**02**	**CO5**
12	To demonstrate the application of BJT as a switch	**02**	**CO5**
13	To demonstrate BJT/FET as an amplifier	**02**	**CO6**

Online Resources:

Sr. No.	Website Name
1.	All About Circuits (https://www.allaboutcircuits.com)
2.	Circuit Lab (https://www.circuitlab.com)
3.	**Tinkercad (https://www.tinkercad.com)**

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. Mid Semester Oral & Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Oral & Practical Exam (25 Marks)

An Oral & Practical exam will be held based on entire syllabus.

Course	Course Name	Teaching Scheme	Credits Assigned

		L	P	T	L	P	T	Total
AEC101	**Professional Communication and Ethics**	02	-	-	02		-	02

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		End Semester Exam (ESE)			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
AEC101	**Professional Communication and Ethics**	20	15	40	1	1.5	75

Rationale

This course has been designed to hone the communicative abilities of First Year Engineering students by providing them skill-based training on LSRW (Listening-Speaking-Reading-Writing) to prepare them for a career in the industry and for competitive exams pertaining to higher studies.

Course Objectives - The learners should be able to:

1. Effectively evaluate the dynamics of communication and navigate professional arenas
2. Competently acquire active listening skills by comprehending various types of Speech Acts
3. Critically analyse communication barriers, audience and purpose to speak proficiently
4. Minutely comprehend extensive texts, technical and non-technical, to execute relevant tasks
5. Efficiently organize and create purposeful technical writing for professional transaction
6. Successfully manage teams, by applying ethical standards to deliver synergistic solutions

Course Outcomes - The learners will be able to:

1. Evaluate the dynamics of communication and effectively navigate professional arenas
2. Acquire active listening skills by comprehending various types of Speech Acts
3. Analyse different communication barriers, audience and purpose, and speak proficiently
4. Comprehend extensive texts, technical and non-technical, to execute relevant tasks
5. Organize and create purposeful technical writing for professional transactions
6. Manage teams successfully, by applying ethical standards to deliver synergistic solutions

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
01	**Module 1- Fundamentals of Communication**	**1.1. Basic Concepts of Communication** • Definition, Objectives, Postulates **1.2. Process of Communication**	**08**	**CO1**

		• Stimulus, Sender, Encoding, Message, Medium, Channel, Receiver, Decoding, Feedback **1.3. Methods of Communication** • Verbal (*Written & Spoken*). • Non-verbal cues perceived through the five senses (*Visual, Auditory, Tactile, Olfactory, Gustatory*) • Non-verbal cues transmitted cues through (*The body, Voice, Space, Time, Silence*) **1.4. Barriers to Communication** • Mechanical, Physical, Semantic & Linguistic, Psychological, Socio-cultural **1.5. Organisational Communication** • Formal (*Upward, Downward, Horizontal*). • Informal (*Grapevine*)		
02	**Module 2 - Developing Basic Listening Skills**	**2.1. Concepts of Active Listening** • Listening for Details • Listening for Gist • Listening for Inference **(*For details please refer to Lab. Syllabus*)** **2.2. Enhancing Listening Proficiency Using Language Labs or on Open Source Platforms**	**02**	**CO2**
03	**Module 3 - Developing Basic Speaking Skills**	**3.1. Conversational Activities - Monologues** • Introducing yourself, Introducing others, One-minute impromptu speeches, Scaffolded story telling **3.2. Conversational Activities - Dialogues** • Role plays on everyday interactions, Interviews (Find out if…), Information Gap Activities, Picture descriptions and feedback, Situational conversations. **3.3. Conversational Activities - Pronunciation, Stress & Rhythm, Intonation** • Neutralisation of accent, Word stress, Rhythm & Pauses, Tonal variations/inflections ***(For details please refer to Lab. Syllabus)***	**02**	**CO3**

04	**Module 4 - Developing Basic Reading Skills**	**4.1. Verbal Aptitude** • Root Words, Meanings, Word Forms, Synonyms, Antonyms, Collocations, Prefixes, Suffixes at a similar difficulty level of entrance tests like **CAT/GRE/GMAT & proficiency tests like TOEFL/IELTS** **4.2. Grammar** • Identifying Common Errors (*Subject-verb agreement, Articles. Prepositions, Misplaced modifiers and Punctuations*) Redundancies, Idioms, Cliches at a similar difficulty level of entrance tests like **CAT/GRE/GMAT & proficiency tests like TOEFL/IELTS** **4.3. Techniques to Improve Reading Fluency and Comprehension** • Intensive Reading • Extensive Reading • Skimming • Scanning • SQ5R Method *(Survey, Question, Reading, Recording, Recall, Review and Revise)* **4.4. Reading & Summarisation Skills** • Summarising text to Graphic Organisers (GO) and visa-versa. Venn diagrams, Radial Diagrams (*Mindmaps*), Tree Diagrams, Cyclic Diagrams, Flow Charts, Timelines, Matrix (*Tables*), Pyramids • Summarising text in point form • Summarising text in one-sentence central idea	**02**	**CO4**
05	**Module 5 - Developing Basic Writing Skills**	**5.1. Coherence & Cohesion in Writing** • Basic Units of Writing (W*ords, Sentences, Paragraphs*) • Coherence (*Structure of written pieces, CSI Order of Organisation*) • Cohesive Devices (*Referencing, Repetition, Substitution, Ellipsis, Transition Signals*). • Structure of a Paragraph (*Topic Sentence, Supporting Ideas, Concluding Sentence*). **5.2. Seven Cs of Business Writing** • Completeness, Conciseness, Consideration, Concreteness, Clarity, Courtesy, Correctness. **5.3. Format & Types of Formal Letters** • Parts of a Formal Letter in **Complete Block Style** • Request/Permission Letter • Claim and Adjustment Letter • Sales Letter • E-mails	**09**	**CO5**

		5.4. Writing User Instructions • Styles of Instruction Presentation (*Impersonal, Indirect, Direct, Imperative*) • Describing general function/purpose of an object/process, • Drawing labelled diagrams • Describing labelled parts • Writing User Instructions • Writing Special Notices (*Note, Caution, Warning, Danger*) **5.5. Content Creation for Social Media and e-Commerce Platforms** • Blogs • Poetry • Keynote speeches • Podcast titles • Landing pages • Social media posts • YouTube video description • Screenwriting/Script Writing ***(Ensure minimum 3 of these categories are covered in the form of competitions)***		
06	**Module 6 - Ethical and Managerial Skills for Engineers**	**6.1. Team building** • Five stages of Team, (Forming, Storming, Norming, Performing and Adjourning) **6.2. Goal setting** • SMART goals – short term and long-term goals **6.3. Ethical Considerations for Professional Integrity** • Fairness and Honesty • Difference between Values and Ethics • Ethical principles • Ethical use of AI Tools • Plagiarism and copyright infringement • Ethical-dilemma case studies	**03**	**CO6**

References:

1. Communication Skills by Sanjay Kumar & Pushp Lata
2. Business Communication with Writing Improvement Exercises. Hemphill, McCormick and Hemphill
3. Business Communication: Building Critical Skills by Locker, Kitty O. Kaczmarek, Stephen Kyo
4. Effective Business Communication by Herta Murphy
5. Technical Communication: Principles and Practice by Raman and Sharma
6. Effective Technical Communication: A Guide for Scientists and Engineers by Rizvi
7. Oxford Guide to Effective Writing & Speaking by John Seely
8. English Grammar by Raymond Murphy

9. Word Power Made Easy by Norman Lewis

Online References:

1.	https://bbclearningenglish.org
2.	https://www.bbc.co.uk/learningenglish

Internal Assessment (35 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus. The exam should preferably consist of application-based exercises.

B. Continuous Internal Evaluation (15 Marks)

1. Assignments/MCQ/Quiz: 10 Marks
2. Regularity and Attendance: 5 Marks

End Semester Examination (40 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage. The exam should preferably consist of application-based exercises.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
AEL101	Professional Communication and Ethics Lab	-	02	-	-	01	-	01

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		Oral & Practical			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
AEL101	Professional Communication and Ethics Lab	-	25	-	-	-	25

Course Objectives: The learners should be able to:

1. Effectively evaluate the dynamics of communication and navigate professional arenas
2. Competently acquire active listening skills by comprehending various types of Speech Acts
3. Critically analyse communication barriers, audience and purpose to speak proficiently
4. Minutely comprehend extensive texts, technical and non-technical, to execute relevant tasks
5. Efficiently organize and create purposeful technical writing for professional transactions
6. Successfully manage teams, by applying ethical standards to deliver synergistic solutions

Course Outcomes: The learners will be able to:

1. Apply the understanding of communication dynamics and navigate professional arenas
2. Appreciate other's point of view and apply effective listening strategies
3. Analyse different communication barriers, audience and purpose to speak proficiently
4. Comprehend extensive technical and non-technical texts to execute specific tasks
5. Plan and create purposeful technical writing for professional transactions
6. Employ ethical standards and managerial skills in various professional situation

DETAILED SYLLABUS:

Sr. No.	Module No.	Practical/ Tutorial	Detailed Content	Hours	CO Mapping
1	Fundamentals of Communication	1	1.1. Situational Application of Fundamentals of Communication 1.2. Case Studies on Fundamentals of Communication	02	CO1

2	**Developing Basic Listening Skills**	2	**2.1. Listening for Details** • Listen to a song and fill in the blanks, Listen to a telephonic conversation and fill in the blanks, Listen to a story/lecture/podcast and fill in the blanks, Listen to a monologue and complete the sentences **2.2. Listening for Gist** • Listen to an audio recording and identify the gist/main idea/theme in the form of MCQs or True/False statements **2.3. Listening for Inference** • Listen to short passages and draw inferences in the form of MCQs or True/False statements **2.4. Listening Comprehension Exercises in the Language Lab or on Open Source Platforms** • Listening to a telephonic conversation, Listen to a Podcast **Examples of the Activities That Can Be Done under the Above 4 Heads:** Listen to a Formal Speech • Martin Luther King Jr., • Swami Vivekananda • Dr. A. P. J. Abdul Kalam • John F. Kennedy • Mr. Ratan Tata • Steve Jobs **Note-taking & Designing Quizzes** • Listen to a lecture, take notes and prepare a quiz for others **Dictations** • Take old-fashioned dictation with special focus on punctuations and spellings	**04**	**CO2**

			Draw a Story • Listen to a descriptive passage read out by the teacher on a scenery/item and draw a picture based on what you hear **Labelling a Map, Plan, Diagram, Table & Flow Charts** • Listen to your teacher and write labels on a plan (*e.g. of a building*), map (*e.g. of part of a town*) diagram (*e.g. of a piece of equipment*), table (*e.g. place/time/price*), flow chart (*e.g. a process which has clear stages*).		
3	**Developing Basic Speaking Skills**	3	**3.1. Conversational Activities - Monologues** • Introducing yourself, Introducing others, One-minute impromptu speeches, Scaffolded story telling **3.2. Conversational Activities - Dialogues** • Role plays on everyday interactions, Interviews (Find out if…), Information Gap Activities, Picture descriptions and feedback, Situational conversations. **3.3. Conversational Activities - Pronunciation, Stress and Rhythm, Intonation** • Neutralisation of accent, Word stress, Rhythm & Pauses, Tonal variations/inflections **Suggested Examples of Functional Communication Activities That Can Be Done under the Above 3 Heads:** • Asking for and giving information • Taking initiative • Seeking and giving favour/offers • Requesting and responding to requests • Apologizing and forgiving • Seeking and giving permission	**04**	**CO3**

			• Congratulating people on their success • Expressing opinions, likes and dislikes, agreements and disagreements • Expressing condolences • Asking questions and responding politely • Giving instructions • Agreeing and disagreeing • Asking for and giving advice and suggestions • Expressing sympathy • Using mobile phone • Live commentary on videos on mute • Debates		
4	**Developing Basic Reading Skills**	4	**4.1. Verbal Aptitude** **Reading Fluency & Comprehension Monitoring** • Reading short/long passages to answer MCQs based on factual, general and inferential comprehension skills • Reading short/long passages to answer MCQs based on factual, general and inferential comprehension skills ***(Passages should be of a technical nature and minimum length of passages should be 350-400 words)*** **4.2. Vocabulary Building Activities** **Examples of Word Games:** • Crosswords • Bingo • Word Ladders • Hangman • Word Association	**04**	**CO4**
			4.3. Reading & Summarisation Skills		

			• Summarising text to Graphic Organisers and visa-versa
			  ○ Venn diagrams
			  ○ Radial Diagrams (*Mindmaps*)
			  ○ Tree Diagrams
			  ○ Cyclic Diagrams
			  ○ Flow Charts
			  ○ Timelines
			  ○ Matrix (*Tables*)
			  ○ Pyramids
			• Summarising text in bullet points
			• Summarising text in one-sentence central idea		

5	**Developing Basic Writing Skills**	5	**5.1. Mechanics of Writing - Paragraph Writing** • Building paragraphs developing coherence (*Structure of written pieces, CSI Order of Organisation*) • Coherence (*Structure of written pieces, CSI Order of Organisation*) • Cohesive Devices (*Referencing, Repetition, Substitution, Ellipsis, Transition Signals*). • Structure of a Paragraph (*Topic Sentence, Supporting Ideas, Concluding Sentence*). **5.2. Write Letters and eMails** • Request/Permission Letter • Claim & Adjustment Letter • Sales Letter *(Complete Block format applying the seven Cs)* • eMails USE ONLY COMPLETE BLOCK FORMAT **5.3. Writing User Instructions** **Examples:**	**04**	**CO5**

			• Installing a software • Ordering food on delivery apps (Zomato, Swiggy) • Using payment system (Google Pay, PhonePe, Paytm) • Using AI Tools (ChatGPT, Gemini, ZeroGPT and GPTZero) • Electronic Devices/ Gadget *(Gaming Console, Smartwatch)* • Home Appliances *(Mixer-Grinder, Microwave Oven, Air Fryer)* • Tools *(Chisel, Screw-driver)* **5.4. Content Creation for Social Media and e-Commerce Platforms** **Examples:** • Blogs • Poetry • Keynote speeches • Podcast Titles • Landing Pages • Social media posts • YouTube Video Description • Screenwriting/Script Writing ***(Ensure minimum 3 of these categories are covered in the form of competitions)***		
6	**Ethical and Managerial Skills for Engineers**	6	**6.1. Ethics** • Case Studies on Ethical dilemma **6.2. Team building** **Examples:** • Newspaper Bridges/ Towers/ Dress Building • Best out of waste • Obstacle Race	**02**	**CO6**

Nos.	List of Suggested Assignments/Activities	Details	Hrs.
01	Case studies and Role Play on Situations based on Module 1	Non-verbal communication role plays, Conversational Channels, barriers and solutions. Must include Methods and Barriers from Module 1	1
02	Consolidated Listening Skills Activity Sheet with Students' Answers	Different types of listening activities must be taken from Module 2. (Minimum 2)	1
03	Performance-based Oral Activities	Should be based on Continuous Evaluation of activities from the entire lab syllabus. Follow the Common European Framework of Reference (CEFR) Rubrics for assessment. At the end of the semester, the average of all assignments will be mapped with CO3 as a single assignment of 10 marks.	1
04	**A.** Summarisation with Graphic Organizer **B.** Objective Test on Verbal Aptitude & Grammar	**A.** Mind Maps, Venn diagrams, Tree diagrams, Flow chart, Linear diagram etc. **B.** Must be based on Module 4 at the same difficulty level of entrance tests like CAT/GRE/GMAT & proficiency tests like TOEFL/IELTS	1
05	Assignment on Writing Skills	Must include 3 types of letters from Module 5	1
06	Application-based Assignment on Ethics	Case studies on ethical dilemma from Module 6	1

References:

1. Communication Skills by Sanjay Kumar & Pushp Lata
2. Business Communication with Writing Improvement Exercises. Hemphill, McCormick and Hemphill
3. Business Communication: Building Critical Skills by Locker, Kitty O. Kaczmarek, Stephen Kyo
4. Effective Business Communication by Herta Murphy
5. Technical Communication: Principles and Practice by Raman and Sharma
6. Effective Technical Communication: A Guide for Scientists and Engineers by Rizvi
7. Oxford Guide to Effective Writing & Speaking by John Seely
8. English Grammar by Raymond Murphy
9. Word Power Made Easy by Norman Lewis

Online References:

Sr. No.	Website Name
1.	https://bbclearningenglish.org
2.	https://www.bbc.co.uk/learningenglish

Continuous Internal Evaluation (25 Marks)

1. Lab Activity: 10 Marks
2. Oral Presentation during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Sr. No.	Head	Marks	Instructions
1.	**Lab Activities**	10	Activities mentioned in the Lab syllabus. Total 6 from all 6 Modules
2.	**Oral Presentation during Lab session (Conversational/ Dialogue/ Monologue/Speech)**	10	Follow Common European Framework of Reference (CEFR) Rubrics for assessment.
3.	**Regularity and Attendance**	05	Practical attendance

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
VSEC101	Engineering Workshop-I	-	02	-	-	01	-	01

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		Oral & Practical			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
VSEC101	Engineering Workshop-I	-	25	-	-	-	25

Course Objectives

1. To impart training to help the students develop engineering skill sets.
2. To inculcate respect for physical work and hard labour.
3. To get exposure to the interdisciplinary engineering domain.

Course Outcomes: Learners will be able to…

1. Develop the necessary skill required to handle/use different fitting tools.
2. Develop skill required for hardware maintenance.
3. Able to install an operating system and system drives.
4. Able to identify the network components and perform basic networking and crimping.
5. Able to prepare the edges of jobs and do simple arc welding.

Sr. No.	Detailed Content	Hrs.	CO Mapping
Trade-1	**1.1 Course Introduction** The core information and abilities required for working safely. This hands-on course introduces the fundamental principles, equipment, and techniques utilised in a variety of workshop scenarios, such as fitting, hardware and networking, and welding. **1.2 Fitting:** • Use and setting of fitting tools for chipping, cutting, filing, marking,center punching, drilling, tapping. • Term work to include one job involving following operations: filingto size, one simple male- female joint, drilling and tapping	08	CO1

Trade-2	**Hardware and Networking:** • Dismantling of a Personal Computer (PC), Identification of Components of a PC such as power supply, motherboard, processor,hard disk, memory (RAM, ROM), CMOS battery, CD drive, monitor, keyboard, mouse, printer, scanner, pen drives, disk drives etc. Assembling of PC, Installation of Operating System (Any one) and Device drivers, Boot-up sequence. Installation of application software (at least one) Basic troubleshooting and maintenance Identification of network components: LAN card, wireless card, switch, hub, router, different types of network cables (straight cables, crossover cables, rollover cables) Basic networking and crimping. NOTE: Hands on experience to be given in a group of not more than four students	**06**	**CO2, CO3, CO4**
Trade-3	**Welding:** • Edge preparation for welding jobs. Arc welding for different job like, Lap welding of two plates, butt welding of plates with simple cover, arc welding to join plates at right angles.	**06**	**CO5**
Trade-4	**Machine Shop:** • At least one turning job is to be demonstrated and simple job to be made for continuous evaluation in a group of 4 students.	**06**	**CO6**

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. In-Semester Oral & Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
VSEC102	C Programming	-	2*+2	-	-	02	-	02

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		Oral & Practical			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
VSEC102	C Programming	-	25	25	-	-	50

Course Objectives: This subject aims to provide students with an understanding of the role computation can play in solving problems. The Course will be taught using C-Programming Language.

1. Understand and use basic terminology in computer programming.
2. Use various data types in C programs effectively.
3. Design and implement programs involving decision structures, loops, and functions.
4. Design Implement Arrays, String, and Structure
5. Describe and utilize memory dynamics through the use of pointers.
6. Use different data structures and create/update basic data files in C.

Course Outcomes: Learners will be able to

1. Illustrate the basic terminology used in computer programming.
2. Use different data types in a computer program.
3. Design programs involving decision structures, loops and functions.
4. Implement Arrays, String, and Structure
5. Describe the dynamics of memory by the use of pointers.
6. Use different data structures and create/update basic data files.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO mapping
1	**Fundamentals of C-Programming**	1.1 Character Set, Identifiers and keywords, Data types, Constants, Variables. 1.2 **Operators**-Arithmetic, Relational and logical, Assignment, Unary, Conditional, Bitwise, Comma, other operators. Expression, statements, Library Functions, Preprocessor. 1.3 **Data Input and Output** – getchar( ), putchar( ),	**06**	**CO1, CO2**

		scanf(), printf( ), gets( ), puts( ), Structure of C program .		
2	**Control Structures**	**2.1 Branching** - If statement, If-else Statement, Multiway decision. **2.2 Looping** – while, do-while, for **2.3 Nested control structure**- Switch statement, Continue statement Break statement, Goto statement.	**05**	**CO3**
3	**Functions and Parameter**	**3.1** Function -Introduction of Function, Function Main, defining a Function, accessing a Function, Function Prototype, Passing Arguments to a Function, Recursion. **3.2** Storage Classes –Auto , Extern , Static, Register	**05**	**CO3**
4	**Arrays , String Structure**	**4.1 Array**-Concepts, Declaration, Definition, Accessing array element, One-dimensional and Multidimensional array. **4.2 String**- Basic of String, Array of String, Functions in String.h **4.3 Structure**- Declaration, Initialization, structure within structure, Operation on structures, Array of Structure.	**05**	**CO4**
5	**Pointer**	**5.1 Pointer:** Introduction, Definition and uses of Pointers, Address Operator, Pointer Variables, Dereferencing Pointer, Void Pointer, Pointer Arithmetic, Pointers to Pointers, Pointers and Array.	**03**	**CO5**
6	**Files**	**6.1 File**s: File operation- Opening, Closing, Creating, Reading, Processing File.	**02**	**CO6**

Text Books

1. “Basics of Computer Science”, by BehrouzForouzan , Cengage Learning .
2. “Programming Techniques through C”, by M. G. Venkateshmurthy, Pearson Publication.
3. “Programming in ANSI C”, by E. Balaguruswamy, Tata McGraw-Hill Education.
4. “Programming in C”, by Pradeep Day and Manas Gosh, Oxford University Press.
5. “Let Us C”, by Yashwant Kanetkar, BPB Publication.

Reference Books

1. "The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie, Publisher: Prentice Hall
   Publication Date: February 22, 1988 ,ISBN-13: 978-0131103627 ,
2. "C Programming: A Modern Approach" by K. N. King, Publisher: W. W. Norton & Company
   Publication Date: April 26, 2008 (2nd Edition), ISBN-13: 978-0393979503
3. "C Primer Plus" by Stephen Prata, Publisher: Addison-Wesley Professional Publication Date: December 27, 2013 (6th Edition) ISBN-13: 978-0321928429

4. "Programming in C" by Stephen G. Kochan Publisher: Addison-Wesley Professional Publication Date: August 18, 2014 (4th Edition) ISBN-13: 978-0321776419

Online Resources:

Sr. No.	Website Name
1.	Learn C - This website offers a free, interactive tutorial to learn C programming, covering both basic and advanced topics.
2.	Codecademy - Codecademy provides a comprehensive, interactive course for learning C, complete with real-world projects and skill paths.
3.	Coursera - Coursera, in collaboration with Duke University, offers a specialization in C programming, including hands-on projects and a certificate upon completion.
4.	edX - This course, offered by edX, covers C programming with a focus on Linux, including professional certification.

Sr No	Suggested List of Experiments	Hrs
01	a) Program to demonstrate Operators Data Input and Output – getchar( ), putchar( ), scanf( ), printf( ), gets( ), puts( ) b) Program to demonstrate Operators-Arithmetic, Relational and logical, Assignment, Unary, Conditional, Bitwise, Comma, other operators.	**02**
02	a) Program to demonstrate Branching - If statement, If-else Statement, Multiway decision. b) Program to demonstrate Looping – while, do-while	**02**
03	a) Program to demonstrate Nested control structure- Switch statement, Continue statement, Break statement, Goto statement	**02**
04	a) Program to demonstrate Function, Passing Arguments to a Function (call by value and call by reference	**02**
05	a) Implement an iterative function for factorial/ Fibonacci etc. b) Implement a recursive function for factorial/ Fibonacci etc.	**02**
06	a) Program to demonstrate Storage Classes –Auto, Extern, Static, Register	**02**
07	c) Program to demonstrate Array 1D, d) Program to demonstrate Array 2D	**02**
08	e) Program to demonstrate String f) Program to demonstrate String arrays of string	**02**
09	Program to demonstrate Structure Write a program to store and display information of a student/employee etc. using structures. a) Define a structure.	**02**

	b) Read and store details. c) Display the stored information.	
10	Program to demonstrate pointers a) Define a node structure. b) Implement functions to insert, delete, and display nodes.	**02**
11	Program to demonstrate files Write a program to maintain a simple student/employee etc. database using file handling. a) Open a file to store student records. b) Implement functions to add, update, and display records. c) Ensure data persistence by saving changes to the file.	**02**
12	Implement one small application using Function, Files, Structure and Pointers concepts you have learnt in C (eg.: Simple Library Management System 1.Functions: Add, display, and search books. 2. Files: Store and retrieve book data. 3. Structures: Represent a book. 4. Pointers: Manage the list of books dynamically	**02**

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. Assignment: 5 Marks
3. Mid Semester Oral & Practical Exam during lab session: 5 Marks
4. Regularity and Attendance: 5 Marks

Oral & Practical Exam (25 Marks)

An Oral & Practical exam will be held based on entire syllabus.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
CC101	Induction cum Universal Human Values	02#	-	-	-	-	-	02

Course Code	Course Name	Examination Scheme					
		Marks Distribution					Total Marks
		Internal Assessment		End Semester Exam (ESE)	Exam Duration (Hrs)		
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
CC101	Induction cum Universal Human Values	-	-	-	-	-	-

Rationale:

"The purpose of the education system is to develop good human beings capable of rational thought and action, possessing compassion and empathy…, with sound ethical moorings and values. It aims at producing engaged, productive, and contributing citizens for building an equitable, inclusive, and plural society as envisaged by our Constitution. Education must develop not only cognitive capacities. but also social, ethical, and emotional capacities and dispositions…. Education is fundamental for achieving full human potential, developing an equitable and just society, and promoting national development… A holistic and multidisciplinary education would aim to develop all capacities of human beings – intellectual, aesthetic, social, physical, emotional, and moral in an integrated manner" [NEP 2020, p 4].

UHV courses are intended to help students to develop a holistic, humane world vision. A self-reflective, explorational methodology is adopted. All content discussed is universal, rational, and verifiable, and leads to harmony.

Holistic education inculcates the following three aspects in the student:

1. **Holistic, Humane Vision of Life** – harmonious individual to cosmos
2. **Human Values**– human feelings, participation based on holistic vision
3. **Skills**– required to live with these values in mutual relationship at all levels of human existence

Course Objectives:

The objectives of the course are:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.
5. Prepare learner for achieving full human potential who can be contribute for developing an equitable and just society, and promoting national development

6. developing clarity of these fundamental universal human values to help the learner in understanding and living by the various specific expressions. E.g., National values enshrined in the Constitution, aspirations articulated in NEP 2020, UN MDGs and SDGs...

Course Outcomes: After completion of the course learner will be able to:

1. Identify basic human aspirations and programme for its fulfilment.
2. Express existing reality of Human being
3. Explain the values in human-human relationship and program for its fulfilment to ensure mutual happiness.
4. Describe harmony in surroundings family and society.
5. Explain harmony nature, existence as coexistence and become more responsible in life, in handling problems with sustainable solutions.
6. Apply what they have learnt to their own self in day-to-day life and utilize the professional competence for augmenting universal human order, develop holistic technologies, management models and production systems.

Prerequisite: There is no prerequisite for this course.

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	No prerequisite		
I	**Introduction - Need, Basic Guidelines, Content and Process for Value Education**	Purpose and motivation for the course, Self-Exploration, Continuous Happiness and Prosperity- the basic Human Aspirations, Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfil the above human aspirations.	**05**	**CO1**
II	**Understanding Harmony in the Human Being**	Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. the Body as an instrument of 'I', characteristics and activities of 'I' and harmony in 'I', harmony of I with the Body: Self-regulation and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Self-regulation and Health.	**04**	**CO2**
III	**Understanding Harmony in the Family**	Understanding values in human-human relationship and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, the other salient values in relationship	**07**	**CO3**

IV	**Understanding 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.	**03**	**CO4**
V	**Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**	Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature, cyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all pervasive space, Holistic perception of harmony at all levels of existence.	**04**	**CO5**
VI	**Implications of the Holistic Understanding of Harmony on Professional Ethics**	Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic. Universal Order, Competence in professional ethics: Ability to utilize the professional competence for augmenting universal human order and identify the scope and characteristics of people friendly and eco-friendly production systems. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order. Sum up.	**03**	**CO6**

(In every module one lecture can be used for students sharing and discussion)

Text Books:

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 3rd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. The Teacher's Manual Teachers‟ Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
3. A Foundation Course in Holistic Human Health – Its Philosophy and Practice, Sharmila Asthana, Akhilesh Shukla, T Sundara Raj Perumall, 1st Edition, October 2023, Published by UHV Publications, , Kanpur, UP.7

References:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya
2. Prakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. The Story of Stuff (Book).
5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
6. Small is Beautiful - E. F Schumacher.
7. Slow is Beautiful - Cecile Andrews
8. Economy of Permanence - J C Kumarappa

9. Bharat Mein Angreji Raj – Pandit Sunderlal
10. Rediscovering India - by Dharampal
11. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
12. India Wins Freedom - Maulana Abdul Kalam Azad
13. Vivekananda - Romain Rolland (English)
14. Gandhi - Romain Rolland (English)

Online References:

Sr. No.	Website Name
5.	https://uhv.org.in

Note:

1. This is an **audit course.**
2. This course is to be taught by faculty from every teaching department
3. Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.
4. In the discussions, the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration
5. One or two periods from each module may be used for tutorials. These are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life.
6. Depending on the nature of topics, worksheets, home assignment and/or activity can be included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

First Year Engineering Curriculum: Semester II

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
BSC201	Applied Mathematics-II	02	-	01	02	-	01	03

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		End Semester Exam (ESE)			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
BSC201	Applied Mathematics-II	20	20+25$	60	1	2	125

$ Tutorial Assessment

Course Objectives

1. To build a strong foundation in Mathematical concepts that are essential for solving Engineering problems.
2. To equip students with knowledge of basic Mathematical tools and techniques necessary for their further studies in Engineering.

Course Outcomes: Students will be able to…

1. Apply the concepts of First Order and first degree Differential equation to the problems in the field of engineering.
2. Apply the concepts of Higher Order Linear Differential equation to the engineering problems.
3. Apply concepts of Beta and Gamma function to solve improper integrals.
4. Apply concepts of Double integral of different coordinate systems to the engineering problems.
5. Apply concepts of triple integral of different coordinate systems to the engineering problems and its application.
6. Solve differential equations and integrations numerically to experimental aspect of applied mathematics.

DETAILED SYLLABUS:

Module	Detailed Contents	Hrs.	CO Mapping
01	**Differential Equations of First Order and First Degree** **1.1** Exact differential Equations, Equations reducible to exact form by using integrating factors. **1.2** Linear differential equations (Review), equation reducible to linear form, Bernoulli's equation. **# Self learning topics:** Simple application of differential equation of first order and first degree to electrical and Mechanical Engineering problem	7	CO1

02	**Linear Differential Equations with Constant Coefficients of Higher Order** **2.1** Linear Differential Equation with constant coefficient-complementary function, particular integrals of differential equation of the type f(D)y = X where X is e^{ax}, sin(ax + b),cos (ax +b), x^m, $e^{ax}V$ 2.2 Method of variation of parameters. **# Self learning topics:** Cauchy's homogeneous linear differential equation and Legendre's differential equation, Applications of Higher order differential equation.	**7**	**CO2**
03	**Beta and Gamma Function, Differentiation under Integral sign** **3.1** Beta and Gamma functions and its properties. **3.2** Differentiation under integral sign with constant limits of integration. **# Self learning topics:** Rectification of curves. (Cartesian, Polar and Parametric)	**6**	**CO3**
04	**Multiple Integration- I** **Pre-requisite: Tracing of curves** **4.1** Double integration-definition, Evaluation of Double Integrals. (Cartesian & Polar) **4.2** Change the order of integration. (No Evaluation) **4.3** Evaluation of double integrals by changing to polar coordinates	**7**	**CO4**
05	**Multiple Integration- II** **5.1** Triple integration definition and evaluation (Cartesian, cylindrical and spherical polar coordinates). **5.2** Application of double integrals to compute Area, Mass. **# Self learning topics:** Application of triple integrals to compute Volume.	**6**	**CO5**
06	**Numerical solution of ordinary differential equations of first order and first degree, and, Numerical Integration** **6.1** Numerical solution of ordinary differential equation using (a) Euler's method (b) Modified Euler method, (c) Runge-Kutta fourth order method **6.2** Numerical integration-by (a) Trapezoidal (b) Simpson's 1/3rd (c) Simpson's 3/8th rule (all without proof)	**6**	**CO6**

References:

1. Higher Engineering Mathematics, Dr.B.S.Grewal, Khanna Publication
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley EasternLimited, 9thEd.
3. Engineering Mathematics by Srimanta Pal and SubodhBhunia, Oxford University Press

4. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven Chapra, McGraw Hill
5. Elementary Linear Algebra with Application by Howard Anton and Christ Rorres. 6th edition. John Wiley & Sons,INC.

Internal Assessment (65 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (45 Marks)

III. Continuous Internal Evaluation of Theory (20 Marks)

1. Assignments: 5 Marks
2. Class test/Quiz/Student Activity: 10 Marks
3. Regularity and attendance: 5 Marks

IV. Continuous Internal Evaluation of Tutorial (25 Marks)

1. Tutorials: 10 Marks
2. Presentation: 10 Marks
3. Regularity and active participation: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
BSC202	Applied Physics II	02	-	-	02	-	-	02

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		End Semester Exam (ESE)			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
BSC202	Applied Physics II	20	15	40	1	1.5	75

Course Objectives:

1. To provide students with a basic understanding of Semiconductors in the field of Basic Engineering.
2. To establish the foundation of crystallography and its applications
3. To learn about superconductors and super capacitors and their importance for industry.
4. To understand the basics of sensors and their applications in the field of electronics.
5. To understand Properties of Engineering materials and their applications in modern technology.
6. To give exposure to the upcoming field of Nanotechnology in the field of solid state physics.

Course Outcomes:

1. Learners will be able to USE and DEMOSTRATE his/her ability earned here to apply it to calculate Hall voltage,and PLOT I-V characteristics of p-n junction diode.
2. Learners will be able to IMPLEMENT knowledge of crystallography and calculate parameters of crystal structure.
3. Learners will be able to ASSIMILATE concept of superconductivity -Supercapacitor and its role in emerging applications .
4. Learners will be able to EXAMINE the use of appropriate sensors for applications .
5. Learnerwill be able to RELATE significance of engineering materials in emerging technology
6. Learner will be able to APPLY the knowledge of Nano Technology to certain emerging areas of technology.

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
	Prerequisite	Energy bands in conductors, semiconductors and insulators, Semiconductor diode, I-V characteristics in forward and reverse bias. Electric current, drift velocity, mobility and, Ohm's law, electrical resistance, V-I characteristics. Temperature dependence of resistance. Scattering of electrons, tunneling effect, Electrostatic focusing, magneto static focusing. Transducer concept, piezoelectric effect, IR waves. Para magnetic materials, diamagnetic materials, ferromagnetic materials. Crystal Physics (Unit cell, Space lattice, Crystal structure, Simple Cubic, Body Centered Cubic, Face Centered Cubic, Diamond Structure, Production of X-rays	-	-
1	**Basics of Semiconductors**	Types of semiconductors Fermi Dirac distribution. Fermi level; Fermi energy level in intrinsic & extrinsic semiconductors; Effect of impurity concentration and temperature on Fermi level. Hall Effect. P-N junction (Energy Band diagram). LED, Zener diode, photo conductors, Photo voltaic cell.	**6**	**CO1**
2	**Study of Crystal Structure**	Crystal planes and Miller indices; Inter planar spacing: Relation between inter planar spacing and Miller indices for cubic unit cell. Diffraction of X-ray and Bragg's law; Bragg's spectrometer: Principle, Construction and working; Determination of crystal structure using Bragg's spectrometer.	**4**	**CO2**

3	**Superconductivity& Super capacitor**	Superconductivity: Critical temperature, critical magnetic field, Meissner's effect, Type I and Type II and; BCS Theory (concept of Cooper pair); Applications of superconductors- SQUID, MAGLEV Introduction to Super capacitors: Principle, construction, materials and applications, comparison with capacitor and batteries: Energy density, Power density	**4**	**CO3**
4	**Physics of sensors**	Ultrasonic sensors: Concept of inverse piezoelectricity, Ultrasonic transducer as distance meter, Applications Light sensors: Photo diode & LDR (Principle, working & Applications) Hall sensor: (Principle of Hall effect, working & Applications) IR sensor: (Principle, working & Applications)	**4**	**CO4**
5	**Engineering materials and applications**	Liquid crystals: Nematic, Smectic and cholesteric phases, Liquid crystal display. Multiferroics: Type I & Type II multiferroics and applications, introduction to spintronics.	**4**	**CO5**
6	**Nano Technology**	Introduction to Nano technology, Properties (optical, Electrical, Structural, Mechanical) Importance of surface to Volume ratio, Application: Synthesis methods, Constructions & working of SEM &AFM	**4**	**CO6**

Text Books:

1. Engineering Physics by D.K. Bhattacharya, Poonam Tandon-Oxford University Press
2. Solid State Electronic Devices–B.G. Streetman–Pearson
3. A Textbook of Nanoscience and Nanotechnology, T.Pradeep Tata McGraw Hill Education Pvt. Ltd., 2012
4.A text book of Engineering Physics- Avadhanulu & Kshirsagar, S. Chand
5.Modern Engineering Physics – Vasudeva, S.Chand
6.Concepts of Modern Physics- Arther Beiser, Tata McGraw Hill
7.A Text Book of Engineering Physics, S. O. Pillai, New Age International Publishers.
8.Introduction to Solid State Physics- C. Kittle, John Wiley& Sons publisher
9.Ultracapacitors: The future of energy storage- R.P Deshpande, McGraw Hill

10 Advanced functional materials – Ashutosh Tiwari, Lokman Uzun, Scrivener Publishing LLC.

References:

1. Semiconductor Physics and Devices–Basic Principles–Donald Neamen–McGraw Hill
2. Physics of Semiconductor Devices- S.M.Sze, KwokK. Ng -John Wiley & Sons
3. Electronic Devices and Circuit Theory- R.Boylestad, LNashelsky -Pearson

Internal Assessment (35 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (15 Marks)

1. Assignments: 5 Marks
2. Quiz/Open book test/Presentation: 7 Marks
3. Regularity and attendance: 3 Marks

End Semester Examination (40 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
BSL201	Applied Physics II Lab	-	01	-	-	0.5	-	0.5

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		Oral & Practical			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
BSL201	Applied Physics II Lab	-	25	-	-	-	25

Course Objectives:

1. To develop scientific understanding of the physics concepts.
2. To develop the ability to explain the processes and applications related to science subjects.
3. To apply skills and knowledge in real life situations.
4. To improve the knowledge about the theory concepts of Physics learned in the class.
5. To improve ability to analyze experimental result and write laboratory report.
6. To develop understanding about inferring and predicting.

Course Outcomes:

Learners will be able to:

1. Understand the concepts of Hall effect.
2. Experimentally obtain I-V characteristics of various junction diodes.
3. Understand function of Solid-state sensors.
4. Analytically obtain The Miller Indices of crystal structure.
5. Use virtual lab effectively to perform experiments.

Suggested List of Experiments. (Minimum five experiments required)

Sr No	List of Experiments	Hrs	CO
01	Measurement of Hall Voltage	**01**	**CO1**
02	I-V Characteristics of p-n junction diode	**01**	**CO2**
03	Measuring distance using ultrasonic distance meter	**01**	**CO3**
04	I-V Characteristics of LED	**01**	**CO2**
05	I-V Characteristics of Zener diode	**01**	**CO2**
06	Study of crystal planes	**01**	**CO4**
07	Carrier concentration using Hall Effect	**01**	**CO1**
08	Characteristics of LDR sensor	**01**	**CO3**
09	Simulation experiments based on liquid crystals using open-source	**01**	**CO5**

	simulation		
10	Simulation experiments based on nanotechnology using open-source simulation	**02**	**CO5**
11	Any other experiment based on syllabus may be included, which would help the learner to understand concept, after defining a suitable LO	**02**	**CO5**

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. In-Semester Oral & Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
BSC203	Applied Chemistry II	02	-	-	02	-	-	02

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		End Semester Exam (ESE)			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
BSC203	Applied Chemistry II	20	15	40	1	1.5	75

Course Objectives:

1. To analyse the quality of water and use the modern methods of water treatment.
2. To develop understanding of basic principles of spectroscopic techniques.
3. To study properties, uses and application of Nanomaterials.
4. To provide an insight into properties of lubricants used in engineering field or in industries.
5. To demonstrate sustainable practices to make the environment clean.
6. To understand the impact of hazardous waste on public health and environment and its treatment.

Course Outcomes:

Student will be able to –

1. Apply knowledge of various analytical techniques to determine the hardness and other impurities in water.
2. Demonstrate knowledge of spectroscopic techniques in identification of compound.
3. Identify suitable engineering material for solving real world problems
4. Analyse quality and properties of lubricants for solving/providing solution to various engineering problems.
5. Apply knowledge of non-conventional energy sources for sustainable development.
6. To identify methods for hazardous waste treatment to protect public health and environment.

Pre-requisites:

1. Basic concepts of Environmental Chemistry in various scientific Engineering activities
2. Knowledge about Adsorption, Surface roughness, Surface attraction on metal surfaces.
3. Knowledge about demerits of Conventional Energy Sources and basic difference between conventional and non-conventional energy source.
4. Knowledge of Electromagnetic Spectrum.

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
I	**Water Chemistry**	A) Impurities in water, Hardness of water, types and numerical problems. B) Determination of hardness of water by EDTA method and numerical problems. C) Softening of water by Ion Exchange process and numerical problems. D) BOD, COD- definition, significance and numerical problems. E) Water purification-membrane technology- Electrodialysis and Reverse Osmosis.	**05**	**CO1**
II	**Spectroscopic Techniques and Applications**	A) Introduction: Principle of Spectroscopy, definition, origin of spectrum B) Classification of spectroscopy-atomic and molecular, selection rules. C) Emission spectroscopy-Principle, Instrumentation and applications (Flame Photometry) D) Introduction to fluorescence and phosphorescence, Jablonski diagram.	**05**	**CO2**
III	**Nanomaterials**	A) Introduction to Nanomaterials B) Preparation of carbon nanomaterial (Laser and CVD method), Properties and uses of CNTs C) Fullerenes-Properties and uses. D) Application of Nanomaterials.	**03**	**CO3**
IV	**Lubricants**	A) Introduction, definition, functions of a lubricant B) Classification of Lubricants- Liquid or Lubricating oils, semi-solid or greases and solid C) Properties of Lubricating oils i) Flash Point or Fire Point ii) Viscosity Index iii) Acid Value	**04**	**CO4**
V	**Non-Conventional Energy Sources**	A) Need of non-conventional energy sources B) Sources of Energy Primary Energy resources Secondary Energy resources C) Solar Energy -Introduction, space heating and Water heating by Solar Energy Production of Electrical Energy using Photovoltaic cell and Solar trough collectors.	**05**	**CO5**

VI	**Hazardous Waste Treatment Technologies**	A) Definition and composition of hazardous waste. B) Hazardous waste management control methods. i) Physical method- Sedimentation, adsorption, aeration, ion exchange, electrodialysis and reverse osmosis ii) Chemical method-neutralization, precipitation, reduction and oxidation. iii) Biological method	**04**	**CO6**

Recommended Books:

1. Engineering Chemistry, Jain and Jain, Dhanpat Rai Publication
2. A textbook of Engineering Chemistry, S. S. Dara, S. Chand and Company
3. "Energy Resources: Conventional & Non-Conventional" by R. K. Rajput
4. Engineering Chemistry, O. G. Palana, Tata McGraw Hill Publication
5. Environmental Chemistry, A. K. De, Tenth edition, New Age International,

Online References:

Sr. No.	Website Name
1.	https://www.researchgate.net/
2.	https://www.sciencedirect.com/topics/chemistry/nanomaterial

Internal Assessment (35 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (15 Marks)

1. Assignments: 5 Marks
2. Quiz/Open book test/Presentation: 7 Marks
3. Regularity and attendance: 3 Marks

End Semester Examination (40 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
BSL202	Applied Chemistry II Lab	-	01	-	-	0.5	-	0.5

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		Oral & Practical			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
BSL202	Applied Chemistry II Lab	-	25	-	-	-	25

Course Objectives:

1. To apply knowledge acquired during the theory class in carrying out the experiments for qualitative and quantitative determination.
2. To analyse experimental results and write laboratory reports.

Course Outcomes:

After completion of experiment, the learner will be able to:

1. To analyse the quality of water sample using suitable methods.
2. Determine the concentration of given inorganic sample and to validate Beer-Lambert law using colorimeter.
3. Synthesize Nanoparticles
4. To determine the various properties of a Lubricant
5. Produce report on energy saving appliances
6. Understand the technique of removal of metal ions using ion exchange resins.

Prerequisite:

1. Knowledge of basic safety practices in Chemistry Laboratory
2. Knowledge of volumetric analysis

Suggested List of Experiments (Minimum five experiments required)

Sr No	List of Experiments	Hrs	CO Mapping
01	Determination of Total, Temporary and Permanent Hardness of water by EDTA method	**02**	**CO1**
02	Determination of Chloride Content of water.	**01**	**CO1**
03	Determination of pH various samples.	**01**	**CO2**
04	Colorimetric determination of concentration of given inorganic sample.	**02**	**CO3**
05	Validate Beer-Lambart Law using colorimeter.	**01**	**CO2**

06	Removal of metal-ions using ion exchange resins.	**01**	**CO6**
07	Preparation of Nanoparticles.	**02**	**CO5**
08	To determination of flash point of a given lubricating oil.	**01**	**CO5**
09	To determine the acid value of a given lubricating oil.	**01**	**CO6**
10	Making report on energy saving appliances.	**01**	**CO4**

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
ESC201	Engineering Graphics	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		End Semester Exam (ESE)			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
ESC201	Engineering Graphics	20	20	60	1	3	100

Rationale:

Engineering Graphics is an essential subject across all engineering disciplines, as it develops crucial visualization skills, enabling students to comprehend and design complex structures and systems in three dimensions. It facilitates precise technical communication, allowing engineers to convey design ideas, concepts and specifications effectively, which is vital for collaboration in multidisciplinary teams. It is a language engineers, designers, and architects use to convey their ideas to manufacturers, constructors, and stakeholders. This subject enhances problem-solving abilities of students to create and interpret detailed technical drawings, helping to identify and resolve design issues early. Furthermore, it emphasizes accuracy and precision, which are critical in producing exact drawings for fabrication and assembly across all branches of engineering.

Course Objectives:

1. To impart and inculcate proper understanding of the theory of projection.
2. To impart the knowledge to read and interpret a drawing
3. To improve the visualization skill.
4. To enable students to represent three-dimensional objects on a two-dimensional surface in a way that accurately conveys their shape, size, and orientation.
5. To acquaint students with representing internal features of a three-dimensional object by way of section that accurately conveys their internal orientation.

Course Outcomes: Learners will be able to …

1. Apply basic concepts of geometrical constructions to create engineering curves.
2. Apply the basic principles of projections in Projection of Lines and Planes
3. Apply the basic principles of projections in Projection of Solids.
4. Apply the basic principles of sectional views in Section of solids.
5. Apply the basic principles of projections in converting pictorial views into orthographic Views.
6. Apply the basic principles of projections in converting orthographic Views into isometric drawing.

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping

0	Prerequisite	1.To draw basic geometric shapes like pentagon, hexagon and square (in different orientation). 2. Divide a line into equal number of parts. 3. Divide a circle into equal number of parts. **Comment** (Prerequisite syllabus should not be considered for paper setting)	**01**	
I	**Introduction to Engineering Drawing**	1.1 Introduction to Engineering Graphics and its significance in Engineering domain, Types of Lines, Dimensioning Systems as per IS conventions. 1.2 Engineering Curves: Basic construction of Cycloid, Involutes and Helix (cylinder only).	**03**	**CO1**
II	**Projections of Points, Lines and Planes**	**2.1 Projections of Points** Projections of points in any quadrants as well as resting on planes. **2.2 Projections of Lines** Projections of lines inclined to both the reference planes (Excluding Traces of lines), Simple application based problems on projection of lines. **2.3 Projections of Planes** Projections of planes (Triangular, Square, Rectangular, Pentagonal, Hexagonal and Circular) inclined to both the Reference Planes (Exclude composite planes).	**06**	**CO2**
III	**Projections of Solids**	Projections of solids with the axis inclined to one and both reference planes (prism, pyramid, cylinder and cone only), Triangular to hexagonal prism and pyramids to be considered, Exclude Spheres, Composite, hollow solids and frustum of solids), Use change of position or Auxiliary plane method.	**06**	**CO3**
IV	**Sections of Solids and Development of Surfaces**	**4.1 Sections of Solids** Sections of Prism, Pyramid, Cylinder, & Cone cut by plane perpendicular to at least one reference plane (Exclude Curved Section Plane), Use change of position or Auxiliary plane method. **4.2 *Development of Surfaces** Development of lateral surface (only) of prism and pyramid only.	**08**	**CO4**
V	**Orthographic Projections**	**5.1 Orthographic Projections** Fundamentals of orthographic projections like concept of quadrants, observer position, horizontal, vertical and profile plane, symbol etc., Different orthographic views, First and Third angle method of projection, Views of a simple machine part as per the first angle projection method recommended by I.S. **5.2 Sectional Orthographic Projections**	**09**	**CO5**

		Fundamentals of sectional projections like concept of section plane, its representation, section lines and its features, need of sectional views, rib and web in section, Types of section and its representation, Different views of a simple machine part as per the first angle projection.		
VI	**Isometric Views**	Basic concept of isometric projection like why it is called isometric, what does it represents, its need, isometric and non-isometric lines, isometric axes and isometric scale, Difference between isometric projection and isometric views, Conversion of orthographic views to isometric views (Excluding sphere).	**07**	**CO6**
* only to be considered for lab course (i.e.; Questions will not be asked for examination).				

Textbooks:

1. N.D. Bhatt, "Engineering Drawing (Plane and solid geometry)", Charotar Publishing House Pvt. Ltd.

2. N.D. Bhatt & V.M. Panchal, "Machine Drawing", Charotar Publishing House Pvt. Ltd.

References:

1. Narayana, K.L. & P Kannaiah (2008), Textbook on Engineering Drawing, Scitech Publisher.

2. Prof. Sham Tickoo (Purdue University) & Gaurav Verma, "(CAD Soft Technologies).

3. Auto CAD 2012 (For engineers and Designers)", Dreamtech Press New Delhi.

4. Dhananjay A Jolhe, "Engineering Drawing" Tata McGraw Hill.

Online References:

Sr. No.	Website Name
1.	https://archive.nptel.ac.in/courses/112/105/112105294/
2.	https://nptel.ac.in/courses/112103019
3.	https://archive.nptel.ac.in/courses/112/102/112102304/

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Sketch Book Assignment#: 5 Marks
2. Drawing Sheet Assignment: 10 Marks
3. Regularity and attendance: 5 Marks

Sketch book is the class work book and assessed during lecture hours.

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
ESL201	Engineering Graphics Lab	-	02	-	-	1	-	1

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		Oral & Practical			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
ESL201	Engineering Graphics Lab	-	25	25	-	-	50

Course Objectives:

1. To impart and inculcate proper understanding of the theory of projection.
2. To impart the knowledge to read and interpret a drawing
3. To improve the visualization skill.
4. To enable students to represent three-dimensional objects on a two-dimensional surface in a way that accurately conveys their shape, size, and orientation.
5. To acquaint students with representing internal features of a three-dimensional object by way of section that accurately conveys their internal orientation.
6. To impart basic AutoCAD skills.

Course Outcomes: Learners will be able to …

1. Apply basic concepts of geometrical constructions to create engineering curves.
2. Apply the basic principles of projections in projection of basic geometric objects.
3. Apply the basic principles of projections in projection of regular solid objects.
4. Apply the basic principles of projections in converting pictorial views into orthographic Views.
5. Apply the basic principles of projections in converting orthographic views into isometric drawing.
6. Apply basic AutoCAD skills in construction of views and objects.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
I	**Basic Engineering Curves**	Construction of basic engineering curves like cycloid, involutes and helix (cylinder only).	**02**	**CO1**
II	**Projections of Lines and Planes**	**2.1 Projections of Lines** Simple problems to apply the concept of projections of lines inclined to both the reference planes. **2.2 Projections of Planes**	**04**	**CO2**

		Problems on projections of planes inclined to both the reference planes.		
III	**Operations on Solids**	**3.1 Projections of Solids** Problems on projections of solids with the axis inclined to one and both reference planes, Use change of position or auxiliary plane method. **3.2 Sections of Solids** Problems on sections of solids cut by plane perpendicular to at least one reference plane, Use change of position or auxiliary plane method. **3.3 *Development of Surfaces** Development of lateral surface (only) of prism, pyramid and cylinder.	**04**	**CO3**
IV	**Orthographic Projections**	**4.1 Orthographic Projections** Construction of orthographic views from pictorial view of an object, Use of proper dimensioning technique for dimensioning the drawn views. **4.2 Sectional Orthographic Projections** Construction of orthographic views (with section) from pictorial view of an object, Location of section plane in concerned views.	**04**	**CO4**
V	**Isometric Views**	Conversion of orthographic views to isometric views.	**02**	**CO5**
VI	**Drafting Technique**	**6.1 Overview of Computer Graphics Covering:** Basic information about the drafting software (CAD), Demonstrating knowledge of the theory of CAD software such as: Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects. **6.2 Customization & CAD Drawing:** Consisting of set up of the drawing page and the printer including scale settings,setting up of units and drawing limits, ISO and ANSI standards for coordinate dimensioning. **6.3 Annotations, layering & other Functions Covering:** Applying dimensions to objects, applying annotations to drawings, setting up and use of layers, layers to create drawings, Create, edit and use customized layers, changing line lengths through modifying existing lines (extend/lengthen).	**08**	**CO6**

* Questions will not be asked for examination

Textbooks:

1. N.D. Bhatt, "Engineering Drawing (Plane and solid geometry)", Charotar Publishing House Pvt. Ltd.
2. N.D. Bhatt & V.M. Panchal, "Machine Drawing", Charotar Publishing House Pvt. Ltd.

References:

1. Narayana, K.L. & P Kannaiah (2008), Textbook on Engineering Drawing, Scitech Publisher.
2. Prof. Sham Tickoo (Purdue University) & Gaurav Verma, "(CAD Soft Technologies).
3. Auto CAD 2012 (For engineers and Designers)", Dreamtech Press NewDelhi.
4. Dhananjay A Jolhe, "Engineering Drawing" Tata McGraw Hill.

Online Resources:

Sr. No.	Website Name
1.	https://archive.nptel.ac.in/courses/112/105/112105294/
2.	https://nptel.ac.in/courses/112103019
3.	https://archive.nptel.ac.in/courses/112/102/112102304/

Suggested List of Experiments:

Sr No	List of Experiments	Hrs	CO Mapping
01	Two problems on Engineering Curves *to be drawn on drawing sheet.*	02	CO1
02	Minimum four problems on Projection of Lines *to be drawn on drawing sheet.*	02	CO2
03	Minimum four problems on Projection of Planes *to be drawn on drawing sheet.*	02	CO2
04	Minimum of two problems on Projection of Solids *to be drawn on drawing sheet.* Out of two problems one should be on the prism category (includes cylinder) and other should be on the pyramid category (includes cone).	02	CO3
05	Minimum of two problems on Sections of Solids *to be drawn on drawing sheet.* Out of two problems one should be on the prism category (includes cylinder) and other should be on the pyramid category (includes cone).	02	CO3
06	Minimum two problems on Development of Surfaces *to be drawn on drawing sheet.* Out of two problems one should be on the prism category (includes cylinder) and other should be on the pyramid category (includes cone).	02	CO3
07	Two problems on Orthographic Projections (without section) *using drafting software.*	02	CO4, CO6
08	Two problems on Orthographic Projections (with section) *using drafting software.*	02	CO4, CO6
09	Minimum of two problems on Isometric Projections *to be drawn on drawing sheet.* Out of the two problems, one should include a circular portion and one problem should have a sloping surface. Also, one problem should be solved by natural scale and another problem should be solved by isometric scale.	02	CO5
10	Minimum two problems on Isometric Projections *using drafting software.*	02	CO5, CO6

Continuous Internal Evaluation (25 Marks)

1. Lab Performance (CAD Printout): 10 Marks
2. Mid Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Practical Exam (25 Marks)

End semester Practical exam will be held using CAD software only. This exam will be based on the following syllabus.

1. Isometric projections (One problem, compulsory)

2. Orthographic Projection (without section)

3. Orthographic Projection (with section)

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
PCC2011	Data Structure	02	-	-	02	-	-	02

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		End Semester Exam (ESE)			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
PCC2011	Data Structure	20	20	60	1	2	100

Course Objectives: The course aims to

1. Learn the purpose and significance of data structures, as well as their fundamentals.
2. Learn linear and nonlinear data structures, as well as how they are implemented.
3. Analyze the data structures, such as stacks, queues
4. Learn the terminologies, types and various operations in Linked list
5. Explore the fundamentals of Tree and learn about its operations and applications.
6. Explore the real time applications of various data structures

Course Outcomes: After successful completion of the course students will be able to

1. Classify and Apply the concepts of Linear and Non-Linear data structures in real life problem solving and apply the operations like insertion, deletion, and traversal operations on them.
2. Explore data structures such as Stacks, learn about their operations, and use them to solve problems in a variety of domains.
3. Examine Queue data structures and use them to address real-world problems.
4. Apply the concept of Linked list to evaluate the problems in a diverse applications
5. Analyze and apply the concepts of Trees and their applications in real life problem solving.
6. Demonstrate the ability to analyze, construct, implement, and use data structures to solve real-world problems and evaluate their effectiveness.

Prerequisite: Concepts in C Programming

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	**Prerequisite**	Concepts of Functions, Recursion, Arrays, Pointers, Structures and C programming constructs.		
I	**Introduction**	Introduction to Data Structures, Concept of ADT, Types of Data Structures- Linear, Nonlinear, Static, Dynamic and operations on Data Structures.	**2**	**CO 1** **CO 2**

II	**Stack**	Introduction to Stack, Stack as ADT, ADT Operations on Stack, Array Implementation of Stack, Multiple Stacks, Evaluation of Arithmetic Expressions.	**4**	**CO 1** **CO3**
III	**Queue**	Introduction to Queue, ADT operations on Queue, Array Implementation of Queue, Types of Queues: Circular Queue, Priority Queue, Double Ended Queue and Multiple Queues	**5**	**CO 1** **CO 3**
IV	**Linked List**	Concept of Linked Lists, Linked List v/s Array, Types of Linked List- Singly linked lists, doubly linked lists and circular linked lists. Insertion, deletion, update and copying operations with Singly linked lists, doubly linked lists. Implementation of Stack and Queue using linked list. Reversing a singly linked list.	**6**	**CO 1** **CO 4**
V	**Tree**	Introduction to Trees, Tree Terminologies, Binary Tree, Binary Tree Representation, Types of Binary Tree, Binary Tree Traversals, Binary Search Tree, Insert, Delete, Search Operations on Binary Search Tree.	**5**	**CO 1** **CO 5**
VI	**Applications of Data Structures**	**Stacks:** Conversion of Arithmetic Expressions using Infix, Prefix and Postfix Notations, Reversing a String/List, Parentheses Checker. **Trees**: Representing expressions using of Expression tree and Huffman Encoding.	**4**	**CO 1** **CO 6**

Text Books:

1. Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, “Data Structures Using C”, Pearson Publication.
2. Reema Thareja, “ Data Structures using C”, Oxford Press.
3. E. Balagurusamy, “Data Structure Using C”, Tata McGraw-Hill Education India.
4. Richard F. Gilberg and Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C”, 2ndEdition, CENGAGE Learning.

References:

1. Sahni Horowitz, Fundamentals of data structures in C, computer science press, 2008.
2. Jean Paul Tremblay, P. G. Sorenson, “Introduction to Data Structure and Its Applications”, McGraw-Hill Higher Education
3. Narasimha Karumanchi, Data Structures And Algorithms, 5th Edition,CareerMonk, 2016.
4. Robert Kruse, C. L. Tondo, Bruce Leung, “Data Structures and Program Design in C”, Pearson Publication.

Online References:

Sr. No.	Website Name
1.	https://nptel.ac.in/courses/106/102/106102064/
2.	Data Structure using C Programming - Course (swayam2.ac.in)

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
PCL2011	Data Structure Lab	-	02	-	-	1	-	1

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		Oral & Practical			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
PCL2011	Data Structure Lab	-	25	25	-	-	50

Course Objectives: The course aims to

1. Learn about the purpose and importance of data structures, as well as their principles.
2. Understand linear and nonlinear data structures, as well as their implementation.
3. Analyze data structures, such as stacks and queues.
4. Study the terminologies, types, and various operations in linked lists.
5. Discover the principles of Tree, including its operations and uses.
6. Investigate the real-time uses of different data structures.

Course Outcomes: After successful completion of the course students will be able to

1. Classify and apply linear and non-linear data structure concepts to real-world problem solving, as well as performing operations such as insertion, deletion, and traversal.
2. Explore data structures like Stacks, learn about their operations, and apply them to solve issues in a variety of domains.
3. Examine queue data structures and apply them to use in diverse real-world applications.
4. Apply the concept of linked lists to evaluate problems in a variety of applications.
5. Analyze and apply the concepts of Trees and their applications in real life problem solving.
6. Demonstrate the ability to analyze, construct, implement, and use data structures to solve real-world problems and evaluate their effectiveness.

Prerequisite: Fundamentals of C programming and its concepts like Functions, Recursion, Arrays, Structures and Pointers.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Constructs of C like Functions, Recursion, Arrays, Structures and Pointers.		
I	Introduction	Overview of Data Structure, Elementary Data Structure Organization, Classification of Data Structures,	**04**	**CO 1**

		Operations on Data Structures and Abstract Data Type, recursion.		
II	Stack	Introduction to Stacks, Array representation of Stacks, Operations on a Sack.	**04**	**CO 2**
III	Queue	Introduction to Queues, Array representation of Queues, Types of Queues, Operations on Queue, Applications of Queues.	**04**	**CO 3**
IV	Linked list	Basics of Linked list, ADT Operations Singly Linked Lists, Circular Linked Lists, Doubly Linked Lists, Linked representation of Stacks, and Linked representation of Queues.	**04**	**CO 4**
V	Tree	Basic Terminology, Types of Trees, Binary Tree traversal, Operations on Binary Search Trees.	**04**	**CO 5**
VI	Applications of Data Structures	**Stack:** Reversing a list/String, Implementing Parentheses Checker, Evaluation of Arithmetic Expressions, **Tree:** Evaluating the expressions using expression tree and implementation of Huffman Encoding.	**06**	**CO 6**

Text Books:

1. Reema Thareja, "Data Structures using C", Oxford Press.
2. Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, "Data Structures Using C", Pearson Publication.
3. Ellis Horowitz, Sartaj Sahni, Fundamentals of Data Structures, Galgotia Publications; 2010.
4. E. Balagurusamy, "Data Structure Using C", Tata McGraw-Hill Education India.

References:

1. Narasimha Karumanchi, Data Structures And Algorithms, 5th Edition, CareerMonk, 2016.
2. Jean Paul Tremblay, P. G. Sorenson, "Introduction to Data Structure and Its Applications", McGraw-Hill Higher Education.
3. Robert Kruse, C. L. Tondo, Bruce Leung, "Data Structures and Program Design in C", Pearson Edition.

Online Resources:

Sr. No.	Website Name
1.	https://nptel.ac.in/courses/106/102/106102064/
2.	Data Structure using C Programming - Course (swayam2.ac.in)

Suggested List of Experiments:

'*' marked experiments are compulsory while rest can be taken from the given list.

Note:

1. All the practicals must be performed in C programming language
2. Students are required to complete at least 10 experiments.

Sr No	List of Experiments	Hrs
1. *	Implementation of Insertion and deletion in a specific position in an Array using Function.	2
2.	Implementation of recursive program.	2
3. *	Array Implementation of Stack.	2
4. *	Array Implementation of Linear Queue.	2
5.	Array Implementation of Circular Queue.	2
6. *	Implement Singly Linked List.	2
7.	Implement Doubly Linked List.	2
8. *	Implementation of Double Ended Queue using Linked List.	2
9.	Implementation of Stack using Linked list	2
10. *	Implementation of Binary Search Tree and its traversal methods.	2
11.	Program to count Number of leaf nodes, find the biggest and smallest and height of the tree.	2
12.	Implementation of Reversing a List using Stack.	2
13.	Convert an Infix expression to Postfix expression using stack ADT.	2
14. *	Program to Evaluate Postfix Expression using Stack ADT.	2

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. Mid Semester Oral & Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Oral & Practical Exam (25 Marks)

An Oral & Practical exam will be held based on entire syllabus.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
PCC2012	Elements of Telecommunication	02	-	-	02	-	-	02

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		End Semester Exam (ESE)			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
PCC2012	Elements of Telecommunication	20	20	60	1	2	100

Course Objectives:

1. To provide students with a foundational understanding of wireless communication systems.
2. To understand the basic principles of fiber optic communication.
3. To learn computer network fundamentals
4. To understand the basics of analog
5. To digital communication system
6. To provide students with a foundational understanding of satellite

Course Outcomes : -Students will be able to :-

CO1: Understand basics of analog communication system
CO2: Explain basics of digital communication system
CO3: Learn the fundamental key concepts of computer networks
CO4: Know the various elements of mobile communication systems.
CO5: Understand the fundamentals of Fiber Optical Communication System.
CO6: Describe t**he** fundamentals **of the satellite communication system.**

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	Prerequisite			
1	Analog Communication	Introduction to Communication Systems, Analog & Digital Signal, Need for Modulation and Demodulation.	**4**	**CO1**

		Amplitude and Frequency Modulation and Demodulation.		
2	Digital Communication	Introduction to Digital Communication, Definition of sampling theorem, Pulse Code Modulation, Basics of ASK, FSK & PSK waveforms.	**4**	**CO2**
3	Computer Communication Network	Introduction to Computer Network, Network Topologies, TCP/IP and OSI Model, Data Communication and Transmission Media.	**4**	**CO3**
4	Mobile Communication	Introduction to wireless communication:Mobile Radio Telephony, Types of mobile wireless services/systems – Cellular, Standard, Introduction to 2G, 3G, 4G and 5G technologies.	**5**	**CO4**
5	Fiber Optical Communication	Introduction to Basics of Fiber Optic Communication, Historical Development, Reflection, Refraction, and Dispersion, structure of Optical Fibers, Advantages & Disadvantages, Applications of Fiber Optics Communication.	**5**	**CO5**
6	Satellite Communication	Introduction to Satellite Communication, types of satellites, Applications of satellite communication systems, Frequency bands used in satellite communication, such as C-band, Ku-band, and Ka-band. Components of satellite communication systems.	**4**	**CO6**

Text Books:

1. "Electronics Communications System" by George Kennedy.

2. “Optical Fiber Communications” by Gerd Keiser, 5th Edition

3. "Data Communications and Networking" by Behrouz A. Forouzan, Fifth Edition TMH, 2013.

4. T. Pratt, C. Bostian, and J. Allnutt, *Satellite Communications*, 2nd ed., Wiley, 2002.

References:

1. Simon Haykin, “Communication Systems”, 4th Edition, John Wiley & Sons, 2004.

2. Optical Fiber Communication: Principles and Practice, John M. Senior, 3rd edition.

3. M. Richharia and L. K. T. S. Mhurchu, *Satellite Communications Systems: Systems, Techniques and Technology*, 6th ed., Wiley, 2020.

Online References:

Sr. No.	Website Name
1.	Analog Communication By Prof. Goutam Das (IIT Kharagpur); https://swayam.gov.in/nd1_noc20_ee69/preview
2.	https://nptel.ac.in/courses/108/101/108101113/
3. 3	https://nptel.ac.in/courses/117/101/117101050/
4. 4	http://nptel.ac.in/courses/117104099/ - (Advanced 3G and 4G Wireless Mobile communications)
5. 5	https://www.iitg.ac.in/psm/qip2015/material/Subir_Bandyopadhyay_Lecture1.pdf
6. 6	https://archive.nptel.ac.in/courses/117/105/117105131/

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)
End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
PCL2012	Elements of Telecommunication Lab	-	02	-	-	1	-	1

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		Oral & Practical			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
PCL2012	Elements of Telecommunication Lab	-	25	25	-	-	50

Course Objectives: -

1. To demonstrate generation and detection of analog modulation techniques.
2. To demonstrate generation and detection of digital modulation techniques.
3. To illustrate the different computer network topology.
4. To illustrate the mobile various AT commands of GSM & to know about parameters of Wi-Fi.
5. To make use of modern tools for simulation of communication systems.
6. To provide practical experience in simulating satellite communication.

Course Outcomes: Students will be able to

CO1: Demonstrate the concepts of AM and FM
CO2: Compare digital modulation techniques PCM, ASK, FSK
CO3: Simulate a computer network using various network components
CO4: Use of AT Commands in mobile device
CO5: Setting up of optical fiber link
CO6: Simulate satellite communication scenarios.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
I	Analog Communication	Modulation and Demodulation Techniques like AM and FM	2	CO1
II	Digital Communication	Digital Modulation technique like PCM, ASK, FSK	4	CO2

III	Computer Communication Network	Network topologies and devices. Implementation of above topologies using open source softwares.	2	CO3
IV	Mobile Communication	AT commands for GSM. Demonstrate AT commands. To know and study various parameters of Wi-Fi / Access points	4	CO4
V	Fiber Optical Communication	Components of Fibre Optic Communication	2	CO5
VI	Satellite Communication	Components of Satellite Communication	2	CO6

Text Books:

1. "Electronics Communications System" by George Kennedy.

2. “Optical Fiber Communications” by Gerd Keiser, 5th Edition

3. "Data Communications and Networking" by Behrouz A. Forouzan, Fifth Edition TMH, 2013.

4. T. Pratt, C. Bostian, and J. Allnutt, *Satellite Communications*, 2nd ed., Wiley, 2002.

References:

1. Simon Haykin, “Communication Systems”, 4th Edition, John Wiley & Sons, 2004.
2. Optical Fiber Communication: Principles and Practice, John M. Senior, 3rd edition.
3. M. Richharia and L. K. T. S. Mhurchu, *Satellite Communications Systems: Systems, Techniques and Technology*, 6th ed., Wiley, 2020.

Online Resources:

Sr. No.	Website Name
1.	Analog Communication By Prof. Goutam Das (IIT Kharagpur); https://swayam.gov.in/nd1_noc20_ee69/preview
2.	https://nptel.ac.in/courses/108/101/108101113/
3.	https://nptel.ac.in/courses/117/101/117101050/
4.	http://nptel.ac.in/courses/117104099/ - (Advanced 3G and 4G Wireless Mobile communications)
5.	https://www.iitg.ac.in/psm/qip2015/material/Subir_Bandyopadhyay_Lecture1.pdf
6.	https://archive.nptel.ac.in/courses/117/105/117105131/

Suggested List of Experiments:

Sr No	List of Experiments	Hrs
01	Simulation /Hands on modulation techniques AM	2
02	Simulation /Hands on modulation techniques FM.	2
03	Simulation /Hands on digital techniques PCM.	2
04	Simulation /Hands on digital techniques ASK.	2
05	Simulation /Hands on digital techniques FSK.	2
06	Simulation/Setting up of star topology using packet tracer (Open Source Softwares).	2
07	Simulation/Setting up of ring topology using packet tracer (Open Source Softwares).	2
08	Simulation/Setting up of mesh/tree topology using packet tracer (Open Source Softwares).	2
09	Simulation/Setting up of bus topology using packet tracer (Open Source Softwares).	2
10	Test the AT commands on mobile devices using open softwares.	2
11	To study parameters of Wi-Fi (IEEE 802.11)	2
12	Simulation of Satellite Communication System.	2
13	Setting up/ Simulate Analog fiber optic communication System using open source software	2
14	Setting up/ Simulate Digital fiber optic communication System using open source software	2

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. Mid Semester Oral & Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Oral & Practical Exam (25 Marks)

An Oral & Practical exam will be held based on entire syllabus.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
PCC2013	Elements of Electrical Systems	02	-	-	02	-	-	02

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		End Semester Exam (ESE)			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
PCC2013	Elements of Electrical Systems	20	20	60	1	2	100

Course Objectives:

1. To list & describe the different methods of Power generation
2. To elaborate the various types of transmission lines
3. To discuss the various types of electrical loads
4. To understand and calculate the power consumption in electrical system
5. To explain the various types of electrical energy storage system
6. To discuss the various types of electrical meters

Course Outcomes:

1. Understand the different methods of Power generation
2. Evaluate the sending end and receiving end voltage of transmission line
3. Study the various types of electrical loads
4. Understand the ratings and calculate the electrical energy consumption
5. Study the various types of electrical storage
6. Illustrate the working of different types of meters in electrical system

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
I	Generation of Electrical Power	Overview of different methods of Power generation: thermal (fossil fuels, nuclear), renewable (solar, wind, hydro, geothermal), nuclear and emerging technologies (tidal, wave, biomass). Layout of hydroelectric power station, thermal power plant, solar generation, nuclear power plant with their advantages and disadvantages. Cost of generation, peak load and base load plant.	**06**	**CO1**

II	Transmission	Short, medium and long transmission lines, Types of conductors used, Single phase transmission line, 3 phase transmission line (single circuit and double circuit). Application of KVL, KCL to find sending end and receiving end voltage. Calculations of Power transmitted	**04**	**CO2**
III	Utilization of Electrical Energy	Electric Power Distribution: Generation, Transmission and distribution systems: grid structure, voltage levels. Types of loads: Residential: lighting load, refrigeration and air conditioning, washing machine. Agricultural load: pumps. Industrial load: Electrical Drives- AC-DC, furnace, Electric heating & welding, Machines (Motors and generators: AC vs. DC)	**07**	**CO3**
IV	Ratings & Calculation of Energy Consumption	Power rating of household appliances such as tube light, fan, air conditioners, PCs, laptops, printers, etc. Definition of "unit" used for consumption of electrical energy, understand the calculation of electricity bill for LT & HT consumers.	**03**	**CO4**
V	Energy Storage	Battery Technologies: Chemistry basics: lead-acid, lithium-ion, sodium-ion, solid-state batteries. Charging and discharging characteristics. Battery management systems (BMS). Battery storage: types (lead-acid, lithium-ion, flow batteries), applications.	**03**	**CO5**
VI	Measurement in Electrical Energy Systems	Importance of measurement in electrical energy systems. Basic principles of electrical measurements: instruments and techniques. Moving coil and Moving iron Ammeters & Voltmeters, Power measurement by wattmeter in single phase circuit	**03**	**CO6**

Text Books:

1. Mahesh Verma, Power Plant Engineering, Metrolitan Book Co Pvt Ltd
2. RK Rajput, A Text Book of Power System engineering, Laxmi Publication
3. D. P. Kothari, I. J. Nagrath, Power System Engineering, 3 Edition, Mc GrawHill
4. B.R. Gupta, Power System Analysis And Design, S.Chand
5. Mehta V.K., Principles of Power System, S Chand
6. AK Sawhney, Electrical & Electronic Measurements and Instrumentation, Dhanpat Rai & Sons
7. Dincer I., and Rosen M. A. (2011); Thermal Energy Storage: Systems and Applications,Wiley

References:

1. W. D. Stevenson, Elements of Power System, 4 Edition TMH
2. Trevor M. Letcher, Storing Energy with Special Reference to Renewable Energy Source, Elsevier, 2016.
3. RS Sirohi & Radhakrisnan, Electrical Measurement & Instrumentation, New Age International

Online References:

Sr. No.	Website Name
1	https://www.energy.gov/eere/renewable-energy

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)
End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
PCL2013	Elements of Electrical Systems Lab	-	02	-	-	1	-	1

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		Oral & Practical			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
PCL2013	Elements of Electrical Systems Lab	-	25	25	-	-	50

Course Objectives:

1. Evaluate the performance of transmission lines.
2. Understand the performance parameters of a generator.
3. Evaluate the characteristics of batteries.
4. Study the operation and performance of an electric motor.
5. Analyze the performance of renewable energy sources.
6. Familiarize with electrical measurement techniques.

Course Outcomes:

1. To study various aspects of performance of different renewable energy sources.
2. To analyze the operational behavior of batteries and energy storage.
3. To evaluate the efficiency and performance of DC machines (motor and generator) under varying speed and load conditions.
4. To demonstrate the effective use of various meters to perform voltage, current and power measurements of single and three phase circuits.
5. To study the nature of V-I characteristics for single phase and three phase loads.
6. To analyze the behavior of a transmission line under varying load conditions

Online Resources:

Sr. No.	Website Name
1.	https://www.vlab.co.in/broad-area-electrical-engineering
2.	https://www.vlab.co.in/broad-area-electronics-and-communications

Suggested List of Experiments:

Sr No	List of Experiments
01	Measure and plot the no load magnetization (open circuit) characteristic (V-I curve) of a DC generator.
02	Calculate efficiency and voltage regulation of DC generator using external characteristics.
03	Case study to get the current-voltage (I-V) characteristics of a solar PV panel under different light intensities (simulated using lamps).
04	Calculate the MPPT of a solar PV panel under different light intensities (simulation using lamps).
05	Measure speed-torque characteristics of a DC motor under different load conditions.
06	Calculate efficiency and analyze the starting and running performance of a DC motor under different load conditions.
07	Measure charge-discharge characteristics of different types of batteries (e.g., lead-acid, lithium-ion).
08	To analyze efficiency, capacity, and voltage profiles of different types of batteries (e.g., lead-acid, lithium-ion) (simulation based or hands on).
09	Perform voltage, current and power measurements in single phase circuit using analog meters and verify Ohm's law.
10	Perform voltage, current and power measurements in single phase circuit using digital meters and verify Ohm's law.
11	Perform voltage, current and power measurements in three phase circuit using analog meters and verify Ohm's law.
12	Perform voltage, current and power measurements in three phase circuit using digital meters and verify Ohm's law.
13	To perform load test using 1- phase and 3 phase sources and loads using MATLAB Simulink
14	To deduce the transmission line performance i.e. sending end voltage and receiving end voltage for long, medium and short transmission lines using MATLAB Simulink.
15	Generation of sinusoidal voltage waveform using MATLAB Simulink.
16	Simulation of transmission line model using MATLAB Simulink
17	To perform speed control of DC motor using MATLAB Simulink

18	To perform practical using breadboard to extract the charging and discharging characteristics of capacitor.
19	Case Study to compare efficiency and reliability of different renewable energy sources
20	Case Study to analyze the effectiveness of energy storage in balancing supply and demand in distribution networks.

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. Mid Semester Oral & Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Oral & Practical Exam (25 Marks)

An Oral & Practical exam will be held based on entire syllabus.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
PCC2014	Elements of Mechanical Engineering	02	-	-	02	-	-	02

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		End Semester Exam (ESE)			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
PCC2014	Elements of Mechanical Engineering	20	20	60	1	2	100

Course Objectives:

1. To familiarize with various Mechanical Engineering domains.
2. To provide insights on fundamental concepts in mechanical engineering.
3. To familiarize with latest technological developments in Mobility and Manufacturing domains.

Outcomes: Learner will be able to…

1. Understand the role of mechanical engineering in industry, society and concept of thermodynamics.
2. Illustrate working of gas power cycles and components used in I.C. Engines.
3. Compare and evaluate various types of coupling, clutches, brakes and belt and gear drives.
4. Comprehend various types of Refrigerants and concept of Air conditioning along with modern manufacturing processes
5. Identify and describe various advancements in Mobility domain.
6. Compare and classify various Engineering Materials and their properties.

Module	Details	Hrs.
1.	**Introduction to Mechanical Engineering Domain:** Role of Mechanical Engineering in Industry and Society, Application of Mechanical Engineering in various domains such as Automobile, Aerospace, Energy, Manufacturing etc **Fundamentals of Mechanical Engineering:** Concept of Prime Mover, Sources of Energy, Force and Mass, Pressure, Work, Power, Energy, Temperature, Heat. **Basic Concept of Thermodynamics:**	**04**

	Definition, Microscopic and Macroscopic approach, System, Boundary and Surrounding, Thermodynamic properties Zeroth Law of Thermodynamics First law of thermodynamics, Internal Energy, Concept of Enthalpy and Entropy	
2.	**Gas Power Cycles:** Definition of Cycle, Air standard efficiency, Carnot cycle, Otto cycle, Diesel cycle, Dual combustion cycle, Atkinson cycle, and Brayton cycle(Gas turbine cycle) **Internal Combustion Engines:** Heat Engine, Classification of IC Engine, Components of IC Engine, Terms associated with IC Engine, Indicator diagram, Two stroke cycle engine, Four stroke cycle engine, Comparison between S.I and C.I engine.	**06**
3.	**Couplings, Clutches and Brakes** Types of Coupling-Rigid and flexible Types of clutch-Friction and positive contact clutches Classification of brakes and mechanical brakes **Mechanical Power transmission:** Belt drives-Components of belt drive and types of velocity ratio, Types of belt drives (Flat belt, V-belt etc) and its applications, Concept of rope and chain drives. Gear Drives-Types of gears and velocity ratio, Simple and Compound gear trains	**05**
4.	**Refrigeration and Air conditioning:** Application of refrigeration, Principle of refrigeration, Refrigeration system and Refrigerants. Air conditioning: Temperature, Humidity of air, Purity of air, Air circulation, Noise level **Introduction to Modern manufacturing tools and techniques** Components of CNC, Advantages of CNC, CNC machining centers and turning centers, Concept of Smart Manufacturing and Industrial IOT.	**05**
5.	**Insights into future of mobility:** Hybrid Electric Vehicle-Components, Series and parallel hybrids Electric Vehicle- PHEV,EREV,BEV and drives based on Battery and Motor locations Autonomous vehicles- SAE Taxonomy of Autonomous vehicles	**04**
6.	**Engineering Materials:** Classification of materials- Biomaterials, Advanced materials, Smarts Materials, Nanotechnology and Nanomaterials.	**06**

	Mechanical Properties of Metals, Ferrous Metals and Alloys, Non ferrous metals and alloys, Polymers and plastics, Ceramic materials and Composite materials	

#- Laboratory component of two hours

TEXT/REFERENCE BOOKS:-

1. Elements of Mechanical Engineering,V.K.Manglik
2. Elements of Mechanical Engineering, R.K.Rajput
3. Basic and Applied Thermodynamics, P.K.Nag, Tata McGraw Hill 2nd Ed., 2002
4. Internal Combustion Engine, V Ganesan, TMH
5. Electric Vehicle Technology Explained, James Larminie, John Lowry, Wiley

List of Experiments: (Minimum 6 experiments to be submitted as a part of Teamwork)

1. Study Visit to any Industry in either Automobile/Aerospace/Energy/Manufacturing engineering unit.
2. Dismantling and Assembly of S.I or C.I Engine.
3. Demonstration of any machine consisting gear train.
4. Demonstration of working of Coupling, clutch and brakes.
5. Demonstrate Components and Working principles of Domestic Refrigerator.
6. Study/visit any commercial centralized Air-Conditioning unit, understand various components and operations, and prepare a comprehensive report.
7. Study/Visit an Industry using CNC/ modern techniques and submit a report.
8. Demonstrate working of CNC machine with an appropriate application.
9. Prepare a case study/Report on any working HEV/EV/FCEV.
10. Prepare a case study on various materials used/selected for any industrial application (Gears /A.C. Unit/Solar panel/Automobile/Rocket/Airplane etc.) and its importance.

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
PCL2014	Elements of Mechanical Engineering Lab	-	02	-	-	1	-	1

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		Oral & Practical			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
PCL2014	Elements of Mechanical Engineering Lab	-	25	25	-	-	50

Course Objectives:

1. To study the basic concepts of Mechanical Engineering
2. To study operation of various mechanical components
3. To understand how a mechanical industry operates.
4. To introduce the concept of various boilers and steam generators
5. To understand the concept of mechanical power transmission
6. To corelate theory with practical working in industry

Course Outcomes:

1. Recall the fundamental role of mechanical engineering and lists its application areas.
2. Explain various ways in which energy is generated.
3. Compare different types of steam generators and boilers.
4. Understand basic working principles of different prime movers
5. Describe various tools used for Engine service.
6. Identify and describe various types of robots and its end effectors.

Prerequisite: Knowledge of physics and mathematics up to 12 science level.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Knowledge of physics and mathematics up to 12 science level.		
I	Introduction to Mechanical Engineering	Visit to any Workshop/Industry in either automobile/Aerospace/Energy/Manufacturing engineering unit and prepare a report.	**02**	**CO1**

II	Energy Resources	Prepare a comparative report on various Energy sources (Solid, Liquid, Gaseous fuels, Biofuels, Solar, Wind, Hydro, Nuclear etc).	**02**	**CO2**
III	Steam Generation and Boilers	Prepare a report on Steam generation process and different types of boilers used in Mechanical Industry	**02**	**CO3**
IV	Prime Movers	Prepare a report on different types of Turbines (Steam, Gas, Water)	**02**	**CO4**
V	Engines	Visit to any local workshop and prepare a report on its functioning.	**02**	**CO5**
VI	Robotics	Visit to any Workshop/ Industry in Robotics and understand various variety of robots and its operation	**02**	**CO6**

Text Books:

1. K.P.Roy, S.K.Hajra Choudhury, Nirjhar Roy, "Elements of Mechanical Engineering", Media Promoters & Publishers Pvt Ltd,Mumbai,7th Edition,2012
2. K.R.Gopalkrishna, "A text Book of Elements of Mechanical Engineering"-Subhash Publishers, Bangalore.
3. Pravin Kumar, "Basic Mechanical Engineering", 2013 Edition, Pearson.

References:

1. Mikell P.Groover, "Automation, Production Systems & CIM", 3rd Edition, PHI
2. S.TrymbakaMurthy, "A Text Book of Elements of Mechanical Engineering", 4th Edition 2006, Universities Press (India) Pvt Ltd, Hyderabad.

Online Resources:

Sr. No.	**Website Name**
1	https://www.youtube.com/watch?v=h0nRjn12jag&list=PLcM_rr2NOZ5fKCSbvx1fNIe95LeFt1HZh

Suggested List of Experiments:

Sr No	List of Experiments	Hrs
01	Dismantling and Assembly of Petrol/Diesel Engine	02
02	Determine the actual valve timing for a 4-stroke diesel engine and hence draw the diagram	02
03	Determine the actual PORT timing for a 2-stroke Petrol engine and hence draw the diagram.	02
04	Engine Performance test on 2/4 stroke Petrol engine	02
05	Engine Performance test on 2/4 stroke Diesel engine	02
06	Performance test on Francis Turbine	02
07	Performance test on Pelton wheel Turbine	02
08	https://mr-iitkgp.vlabs.ac.in/exp/forward-kinematics/ Should be conducted by V-labs	02
09	https://mr-iitkgp.vlabs.ac.in/exp/inverse-kinematics/ Should be conducted by V-labs	02
10	https://fab-coep.vlabs.ac.in/exp/computer-controlled-cutting/ Should be conducted by V-labs	02
11	Navigation of drone	02
12	Study experiment on types of boilers	02

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. Mid Semester Oral & Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Oral & Practical Exam (25 Marks)

An Oral & Practical exam will be held based on entire syllabus.

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
CC201	Social Science and Community Services	-	2$	-	-	1	-	1

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		Oral & Practical			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
CC201	Social Science and Community Services	-	25	-	-	-	25

$ Class wise common curricular and extracurricular activities to be conducted (Yoga, Sports, Music, social activities, community services, etc.)

Rationale: This course has been designed to support activities of Individual Interest, skill utilization and a desire to contribute towards social welfare. The course aims to create good citizens by engaging in activities ranging from social services, volunteering at the time of National Emergencies, and National level campaigns in the field of science and technology.

Course Objectives: The learner should be able to:

1. Communicate effectively by adapting social etiquette from professional and social communities.
2. Connect ideas to social experiences and develop emotional intelligence.
3. To foster creativity and critical thinking in developing solutions to social issues.

Course Outcomes:

1. Communicate effectively by selecting proper social etiquette toward peers, faculty, staff, employers and members of social community.
2. Manage personal affairs by demonstrating empathy toward others, caring for one's self and seeking assistance as needed.
3. Engage in socially relevant issues and create necessary solutions as per need.

List of Suggested Activities

1. Case studies on Personal and Professional etiquette
2. Discussions on matters of National importance
3. Role plays on Socially relevant issues
4. Community services like clean up drive, blood donation camps and awareness drive on social issues.
5. Empathetic participation during national emergencies like floods, earthquakes, water crisis, global warming, etc.

Online References:

Sr. No.	Website Name
1.	https://www.maharashtracdhg.gov.in/cde/index.php
2.	https://dgfscdhg.gov.in/training-0
3.	https://dgcd.assam.gov.in/sites/default/files/swf_utility_folder/departments/cdhg_webcomindia_org_oid_5/menu/information_and_services/eligibility_criteria_to_apply_for_civil_defence_0_5.pdf

Continuous Internal Evaluation (25 Marks)

1. Group Discussion/Presentation on socially relevant topics: 10 Marks
2. Group report on activities: 10 Marks
3. Regularity and attendance: 5 Marks

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
IKS201	Indian Knowledge System		02*+2	-	-	02*+2	-	02

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		End Semester Exam (ESE)			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
IKS201	Indian Knowledge System	-	25	-	-	-	25

Rationale:

The Indian Knowledge System (IKS) is vital for preserving India's rich cultural heritage, fostering holistic and sustainable practices, and integrating ancient wisdom with modern science to address contemporary challenges and enrich global knowledge.

Course Objectives: The learner should be able to:

1. Evaluate the historical and modern educational systems in our country
2. Explore and understand the evolution of Indian scientific thought
3. Know the richness of Indian Arts and Culture
4. Understand the principles of good governance
5. Understand the contributions of Indian Scientists
6. Analyse sustainable practices in ancient India

Course Outcomes: The learner will be able to:

1. Learn about our history of Indian ancient knowledge and education systems, and recognize its significance in the current scenario.
2. Analyse interdisciplinary connections between Indian knowledge systems and modern scientific & technological advancements.
3. Develop critical ability to appreciate and evaluate different interpretations of Indian knowledge systems in art, literature, media, and culture.
4. Analyse how Indian philosophical and spiritual ideas have influenced good governance and global thought.
5. Understand and appreciate the contributions of Indian scientists.
6. Understand the relevance of Indian knowledge systems in shaping sustainable practices.

Prerequisite:

1. Students should have the foundational knowledge and skills necessary for a comprehensive understanding of IKS

2. Students should be familiar with the Indian Culture, Language, and History of Science and Technology in India.

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
I	**Introduction to the Indian Knowledge System (I.K.S.)**	• Basic knowledge and scope of IKS • Bhartiya education system – ancient to modern era • Educational Institutions • Advantages and Disadvantages of the Gurukul System • Distinguish the Gurukul system And the Modern between Education System	4	**CO1**
II	**Development of Scientific Thoughts in Ancient India**	Development in Science, Technology, Astronomy, Mathematics, and Life Sciences – Life Science, Physiology, Ayurveda, etc.	**4**	**CO2**
III	**Development of Arts & Culture in India**	• Introduction to Ancient Architecture (Arts, Forts, Paintings, Sculpture, Temple architecture, etc) • Development in performing arts & culture: Music, Folk Arts, Dance traditions • Indian Narratives: (Mahabharata, Ramayana, Kathasaritsagar, Jataka Tales, etc.)	**6**	**CO3**
IV	**Good Governance in Ancient India**	• Introduction to Indian religions: (Animism, Vedic, Jainism, Buddhism, Modern Hinduism, etc.) • Indian Philosophies • Gana Sanghas • Principles of Good Governance in Ancient India.	**5**	**CO4**
V	**Contribution of Indian Scientists**	• Baudhayan, Aryabhatta, Brahmgupta, Bhaskaracharya, Varahamihira, Nagarjuna, Susruta, Kanada & Charak, C.V. Raman, Har Gobind Khorana.	4	**CO5**
VI	**Sustainable Practices in Ancient India**	• Agriculture, waste management, water conservation, forest conservation, architecture, urban planning, biodiversity preservation, etc • Yoga, pranayama, and meditation for health and well-being	3	**CO3**

Text Books:

1. A.K Bag, History of technology in India (Set 3 vol), Indian Nation Science Academy, 1997.
2. An Introduction to Indian Knowledge Systems: Concepts and Applications, B Mahadevan, V R Bhat, and Nagendra Pavana R N; 2022 (Prentice Hall of India).
3. Ancient Indian Knowledge: Implications To Education System, Boski Singh; 2019
4. India's Glorious Scientific Tradition by Suresh Soni; 2010 (Ocean Books Pvt. Ltd.)
5. Indian Art: Forms, Concerns, and Development in Historical Perspective (History of Science, Philosophy and Culture in Indian Civilization), General Editor: D.P. Chattopadhyaya, Ed. By. B.N. Goswamy; 1999 Munshiram Manoharlal Publishers Pvt. Ltd.
6. Indian Knowledge Systems: Vol I and II, Kapil Kapoor and A K Singh; 2005 (D.K. Print World Ltd).
7. Pandey, K.K. Kriya Sarira Comprehensive Human Physiology, Chaukhambha Sanskrit series, Varanasi, 2018
8. Shukla Vidyadhar & Tripathi Ravidatt, Aayurved ka Itihas evam Parichay, Chaukhambha Sanskrit Sansthaan, New Delhi, 2017
9. Textbook on The Knowledge System of Bharata by Bhag Chand Chauhan; 2023 (Garuda Prakashan)
10. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati; 2006
11. Traditional Knowledge System in India, Amit Jha.
12. A.K. Warder, Indian Kavya Literature. 8 volumes. (1972-2011) and Indian Buddhism.

Online References:

Sr. No.	Website Name
1.	https://swayam.gov.in/explorer?searchText=iks
2.	https://iksindia.org/book-list.php
3.	https://iksindia.org/index.php

Assessment:

Suggested Pedagogy and assessment criteria for Teachers:

1. Project-based activities.
2. Presentation, Group Discussions, and Case studies.
3. Visit historical places.
4. Flip class mode/ Roleplay
5. Quiz MCQ
6. Assignment as per the modules: 06
7. Internal Assessment through flipped class and PowerPoint presentation along with documentation

Sr No	Details of Activities*	Hrs
01	Project-based activities	02
02	Presentation	02

03	Case studies	02
04	Visit historical places and write a report	02
05	Flip class mode	02
06	Quiz with MCQ	02
07	Comparative Study of IKS & other philosophical & scientific systems around the world	02
08	Group Discussions	02
09	Roleplay	02
10	Self-study activities	02

***The faculty can choose any of these activities for continuous assessment**

Suggested Pedagogy and assessment criteria for Teachers:

1. Total Assignments as per the modules: 06
2. Continuous Internal Evaluation through flipped class, Group Discussions and Oral/PowerPoint Presentation.

Sample Case Studies:

- Mathematics of Madhava, Nilakantha Somayaji
- Astronomical models of Aryabhata
- Wootz steel, Aranumula Mirrors, and lost wax process for bronze castings
- Foundational aspects of Ayurveda
- Foundational aspects of Ashtanga yoga
- Foundational aspects of Sangeeta and Natya-shastra

Continuous Internal Evaluation (25 Marks)

1. MCQ/Quiz: 10 Marks
2. Presentation/Group Discussion/ Activity: 10 Marks
3. Regularity and Attendance: 5 Marks

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
VSEC201	Engineering Workshop-II	-	2	-	-	1	-	1

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		Oral & Practical			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
VSEC201	Engineering Workshop-II	-	25	-	-	-	25

Course Objectives

1. To impart training to help the students develop engineering skill sets.
2. To inculcate respect for physical work and hard labor.
3. To get exposure to interdisciplinary engineering domain.

Course Outcomes: Learner will be able to…

1. Develop the necessary skill required to handle/use different carpentry tools.
2. Identify and understand the safe practices to adopt in electrical environment.
3. Demonstrate the wiring practices for the connection of simple electrical load/ equipment.
4. Design, fabricate and assemble PCB.
5. Develop the necessary skill required to use different sheet metal and brazing tools.

DETAILED SYLLABUS:

	Detailed Content	Hrs.
Trade-1	**Carpentry** 1. Use and setting of hand tools like hacksaws, jack planes, chisels and gauges for construction of various joints, wood tuning and modern wood turning methods. 2. Term work to include one carpentry job involving a joint and report on demonstration of a job involving wood turning	**10**
Trade-2	**Basic Electrical work shop:** **1.** Single phase and three phase wiring. Familiarization. of protection switchgears and their ratings (fuse, MCB, ELCB). Wiring standards, Electrical safety in the work place safe work practices. Protective equipment, measures and tools.	08

	2. Layout drawing, layout transfer to PCB, etching and drilling and soldering technique	
Trade 3	**Sheet metal working and Brazing:** 1. Use of sheet metal, working hand tools, cutting, bending, spot welding	08

Text Books:

1. Workshop Technology, Volume-I, P.N.Rao, McGrrawHill Publication
2. Elements of Workshop Technology, Vol-I, S.K. Hajra Choudhury, A K Hajra Choudhury,Nirjar Roy, Media Promoters &Publishers Pvt Ltd

References:

1. Workshop Technology, Part-II, W A J Chapman, VIVA Books Pvt Ltd
2. A Course in Workshop Technology, B.S. Raghuvanshi, Dhanpat Rai and Co Ltd.

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. In-Semester Oral & Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Course	Course Name	Teaching Scheme			Credits Assigned			
		L	P	T	L	P	T	Total
VSEC202	Python Programming	-	2*+2	-	-	2	-	2

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		Oral & Practical			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
VSEC202	Python Programming	-	25	25	-	-	50

Course Objectives:

1. To familiarize learners with Python's basic syntax, variables, data types, operators, and input/output functions.
2. To reinforce the understanding and application of conditional statements, loops, and functions in Python programming.
3. To instill learners on file handling, exception management, and Python packaging.
4. To Introduce object-oriented programming principles and their application in Python.
5. To explore advanced topics such as regular expressions, pattern matching, and GUI development.
6. To introduce and demonstrate the use of popular Python libraries for data handling.

Course Outcomes: Learner will be able to

1. Demonstrate the proficiency in basic python programming or Create and perform various operations on data structures like list, tuple dictionaries and strings.
2. Apply Control Flow and Functions for efficient coding to solve problems.
3. Demonstrate proficiency in handling file operations, managing exceptions, and developing Python packages and executable files for modular programming.
4. Illustrate the concept of Object-Oriented Programming used in python.
5. Design Graphical User Interface (GUI) applications, utilizing appropriate Python libraries to create user-friendly interfaces.
6. Investigate and apply popular python libraries to conduct efficient data handling tasks.

Prerequisite: VSEC 102 C Programming

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs	CO Mapping
0	**Prerequisite**	Introduction to Programming**:** Understanding basic concepts like algorithms, flowcharts, and pseudocode. Problem-Solving Skills**:** Ability to approach problems methodically and apply logical thinking to develop solutions.	1	--
1	**Introduction to Python**	1. Basic Syntax and Data Types - Variables and data types, Operators, Input and output, 2. Data Structures- list, tuple, set and dictionary 3. Understanding the Syntax Transition: From C to Python	**4**	**CO1**
2	**Control Flow and Functions**	2.1 Conditional Statements: if, else, elif 2.2 Loops: for and while loop 2.3 Functions- Defining functions, Parameters and return values, Scope and lifetime of variables	**4**	**CO2**
3	**File Handling, Packaging, and Debugging**	3.1 File Handling- Reading and writing files, Exception handling 3.2 Creating Python Packages, Modules and executable files 3.3 Dealing with Syntax Errors, Runtime Errors and Scientific Debugging	**4**	**CO3**
4	**Object-Oriented Programming (OOP) in Python**	4.1 Introduction to OOP: Classes and objects, Encapsulation, inheritance, and polymorphism 4.2 Creating Classes and Objects: Class attributes and methods Constructor and destructor. 4.3 Type of Inheritance: Single, multiple and multilevel inheritance	**4**	**CO4**
5	**Advanced Python Concepts**	5.1 Regular Expressions, Pattern matching, Regex functions in Python 5.2 GUI Development using any Python GUI framework	**5**	**CO5**
6	**Python Libraries**	6.1 Introduction to Popular Libraries 6.2 NumPy for numerical computing, 6.3 Pandas for data manipulation 6.4 Matplotlib for data visualization	**4**	**CO6**

Text Books:

1. Core Python Programming, Dr. R. Nageswara Rao, Second Edition, Dreamtech Press.
2. Beginning Python: Using Python 2.6 and Python 3.1. James Payne, Wrox Publication.
3. Python Programming, Anurag Gupta and G. P. Biswas, First Edition,McGraw-Hill Education.

References:

1. Learn Python the Hard Way, Zed Shaw, Third Edition, Addison-Wesley.
2. Python Projects, Laura Cassell,Alan Gauld, First Edition, Wrox Publication.
3. Introduction to computing and problem-solving using python, Balagurusamy, First Edition, McGraw Hill Education.

Online Resources:

Sr. No.	Website Name
1.	Python Tutorial: http://docs.python.org/release/3.0.1/tutorial/
2.	Python for everybody specialization: https://www.coursera.org/specializations/python.

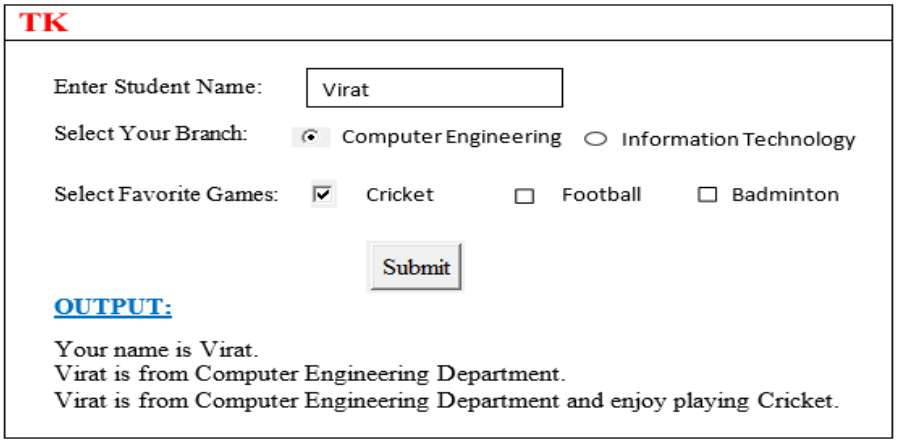
Suggested List of Experiments:

The following experiments serve as samples to illustrate the application of concepts covered in each unit. Instructors are encouraged to modify and adapt these experiments to meet the specific needs of the course and the learning objectives. It is essential to ensure that the fundamental concepts and skills outlined in each unit are adequately covered, even with modifications.

Week No	List of Experiments	Hrs
01	**Objective:** To enable learners to transition their understanding of basic programming constructs from C to Python by focusing on Python's syntax, variables, data types, operators, and input/output functions, and comparing these elements with their equivalents in C 1. **Personalized Greeting Generator* -** Write a python code to generate Personalized Greeting. 2. **Calculating Areas of Geometric Figures* -** Write a python program to calculate areas of any geometric figures like circle, rectangle and triangle. **3. Developing Conversion Utilities:** Develop any converter such as Rupees to dollar, temperature convertor, inch to feet etc. 4. **Calculating Gross Salary of an Employee*:** Write a Python program to calculate the gross salary of an employee. The program should prompt the user for the basic salary (BS) and then compute the dearness allowance (DA) as 70% of BS, the travel allowance (TA) as 30% of BS, and the house rent allowance (HRA) as 10% of BS. Finally, it should calculate the gross salary as the sum of BS, DA, TA, and HRA and display the result. 5. **Calculating Simple Interest:** Write a Python program to calculate the simple interest based on user input. The program should prompt the user to enter the principal amount, the rate of interest, and the time period in years. It should then compute the simple interest using the formula **Simple Interest=(Principal×Rate×Time) /100** and display the result. **6. Exploring Basic Arithmetic Operations in Python*:** Write a Python program to explore basic arithmetic operations. The program should prompt the user to enter two numbers and then perform addition, subtraction, multiplication, division, and modulus operations on those numbers. The results of each operation should be displayed to the user.	02
02	**Objective:** Mastering Python New Data Structures for Practical Applications **Task List Manager*:** Develop a Python program to manage a task list using lists and tuples, including adding, removing, updating, and sorting tasks. **Student Enrollment Manager *:** Create a Python code to demonstrate the use of sets and perform set operations (union, intersection, difference) to manage student enrollments in multiple courses / appearing for multiple entrance exams like CET, JEE, NEET etc. **Student Record Keeper *:** Write a Python program to create, update, and manipulate a dictionary of student records, including their grades and attendance.	02

03	**Objective:** To enable students to transition their understanding of control statements and loops from C to Python, emphasizing the adoption of Python syntax while reinforcing logical structures already learned. 1. **Triangle Pattern Generator Using Loops:** Write a Python program to print a triangle pattern (give any), emphasizing the transition from C to Python syntax. **2. Number Type Identifier*:** Develop a Python program that takes a numerical input and identifies whether it is even or odd, utilizing conditional statements and loops. **3. Character Type Identifier:** Create a Python program to check whether the given input is a digit, lowercase character, uppercase character, or a special character using an 'if-else-if' ladder. **4. Multiplication Table Generator:** Write a Python program to take a numerical input from the user and generate its multiplication table using loops. **5. Fibonacci Sequence Generator:** Develop a Python program to print the Fibonacci sequence using a while loop. **6. Factorial Generator*:** Design a Python program to compute the factorial of a given integer N. **7. Prime Number Analyzer*: U**sing function, write a Python program to analyze the input number is prime or not. **8. Simple Calculator Using Functions*:** Implement a simple Python calculator that takes user input and performs basic arithmetic operations (addition, subtraction, multiplication, division) using functions. **9. Interactive Guessing Game:** Develop a number guessing game where the program generates a random number, and the user has to guess it. Implement loops and conditional statements for user interaction.	02
04	**Objective:** To enable learners to proficiently handle file operations, manage exceptions, and create Python packages and executable files. *1.* **Extracting Words from Text File *****:** Develop a Python program that reads a text file and prints words of specified lengths (e.g., three, four, five, etc.) found within the file. 2. **Finding Closest Points in 3D Coordinates from CSV**: Write a python code to take a csv file as input with coordinates of points in three dimensions. Find out the two closest points. 3. **Sorting City Names from File:** Write a python code to take a file which contains city names on each line. Alphabetically sort the city names and write it in another file. **4. Building an Executable File*:** Create a executable file for any program developed in earlier practical.	02
05	**Objective:** To enable learners to proficiently handle errors and exceptions in Python programs, ensuring robust and fault-tolerant code. Learners will also develop debugging skills to identify, diagnose, and fix issues efficiently using scientific debugging methods. 1. **Basic Exception Handling***: Write a Python program that takes two numbers as input and performs division. Implement exception handling to manage division by zero and invalid input errors gracefully. 2. **Custom Exceptions**: Develop a Python program that simulates a banking system with a function to withdraw money. Raise custom exceptions for scenarios such as insufficient funds and invalid account numbers 3. **Logging for Debugging:** Enhance a Python program by adding logging statements to record the flow of execution and error messages. Use the logging module to configure different logging levels (INFO, DEBUG, ERROR).	02

	4. **Using a Debugger*:** Demonstrate the use of a Python debugger (e.g., pdb or an IDE with debugging capabilities) on a sample program with intentional errors. Guide students on setting breakpoints, stepping through code, and examining variable values. 5. **Scientific Debugging Techniques:** Provide a Python program with multiple logic and runtime errors. Instruct students to apply scientific debugging techniques, such as binary search debugging, to identify and resolve the issues methodically	
06	**Objective:** To apply object-oriented programming (OOP) principles in Python to model real-world scenarios and systems, fostering the development of modular, reusable, and efficient solutions. Fostering the ability to design and implement solutions for real-world problems. Choose any one real world scenario. Ask student to apply OOP principles such as encapsulation, inheritance, and polymorphism in practical scenarios. The sample real world scenarios are as follows. 1. **Event Management System:** Implement an event management system using OOP concepts to organize and manage various aspects of college festivals or events. Design classes for events, organizers, participants, and activities. Include methods for event registration, scheduling, participant management, and activity coordination. 2. O**nline Shopping System:** Develop classes for products, customers, and shopping carts. Include methods for adding items to the cart, calculating total costs, processing orders, and managing inventory. 3. **Vehicle Rental System:** Design a system using classes for vehicles, rental agencies, and rental transactions. Implement methods to handle vehicle availability, rental periods, pricing, and customer bookings.	02
07	**Objective:** To develop a graphical user interface (GUI) application for any use case. Choose any use case from below. 1. **GUI for Developing Conversion Utilities:** Develop a Python GUI application that performs various unit conversions such as currency (Rupees to Dollars), temperature (Celsius to Fahrenheit), and length (Inches to Feet). The application should include input fields for the values, dropdown menus or buttons to select the type of conversion, and labels to display the results. 2. **GUI for Calculating Areas of Geometric Figures:** Develop a Python GUI application that calculates the areas of different geometric figures such as circles, rectangles, and triangles. Allows users to input the necessary dimensions for various geometric figures and calculate their respective areas. The application should include input fields for the dimensions, buttons to perform the calculations, and labels to display the results. 3. **College Admission Registration Form:** The college admission registration form collects essential personal, educational, and contact information from prospective students. Create a GUI as shown in Figure-1 that allows the user to input his/her name, branch and favorite game. When the user clicks the Submit button, it should display the output as illustrated.	02

	 Figure-1: A basic GUI featuring text field and various buttons.	
08	**Objective:** To enable learners to effectively utilize regular expressions in Python for pattern matching, validation, and data extraction tasks, enhancing their ability to process textual data efficiently and accurately. 1. **Script to Validate Phone Number and Email ID *:** Write a Python script that prompts the user to enter their phone number and email ID. It then employs Regular Expressions to verify if these inputs adhere to standard phone number and email address formats 2. **Password Strength Checker:** Write a Python script that prompts the user to enter a password. Use regular expressions to validate the password based on these criteria: At least 8 characters long, Contains at least one uppercase letter, one lowercase letter, one digit, and one special character. 3. **URL Validator:** Develop a script that verifies if a given string is a valid URL. Use regular expressions to check for standard URL formats, including protocols (http, https), domain names, and optional path segments. Test with various URLs and ensure the validation covers common cases. 4. **Extracting Data from Text ***: Create a program that reads a text file containing various data (e.g., names, emails, phone numbers). Use regular expressions to extract specific types of data, such as email addresses, phone numbers, dates (e.g., MM/DD/YYYY format).	02
09	**Objective:** To equip learners with the skills to utilize the NumPy libraries for efficient numerical computing. 1. **Creating and Manipulating Arrays*:** Write a Python program to create a 1D, 2D, and 3D NumPy array. Perform basic operations like reshaping, slicing, and indexing. 2. **Array Mathematics*:** Develop a Python script to create two arrays of the same shape and perform element-wise addition, subtraction, multiplication, and division. Calculate the dot product and cross product of two vectors. 3. **Statistical Operations*:** Write a Python program to calculate mean, median, standard deviation, variance, and correlation coefficients of a given array.	02

10	**Objective:** To provide learners with the knowledge and skills necessary to effectively use the Pandas library for data manipulation and the Matplotlib library for data visualization. Learners will engage in tasks that involve analyzing real-world datasets, creating meaningful visualizations, and drawing insights from data. Following task should be performing on a real-world dataset: **Task1- Loading and Inspecting Data:** Load a CSV file containing information on global COVID-19 cases into a Data Frame. Display the first few rows, check the data types, and summarize basic statistics. **Task 2- Data Cleaning:** Identify and handle missing values in the dataset. Remove any duplicate rows and ensure data consistency. **Task 3-Data Aggregation:** Perform aggregation operations to summarize data. *Task 4-* ***Plotting graphs: Generate a line plot showing the trend / bar plot to compare data/ histogram to show distribution/ scatter plot to examine relationships between variables.*** Instructors can choose other datasets relevant to the course objectives. Sample datasets and task list are as follows. **1. Using the Iris Data** (https://www.kaggle.com/datasets/saurabh00007/iriscsv), perform the following tasks: i. Read the first 8 rows of the dataset. ii. Display the column names of the Iris dataset. iii. Fill any missing data with the mean value of the respective column. iv. Remove rows that contain any missing values. v. Group the data by the species of the flower. vi. Calculate and display the mean, minimum, and maximum values of the Sepal length column. **2. Using the Cars Data** (https://www.kaggle.com/datasets/nameeerafatima/toyotacsv) perform the following tasks: i. Create a scatter plot between the Age and Price of the cars to illustrate how the price decreases as the age of the car increases. ii. Generate a histogram to show the frequency distribution of kilometers driven by the cars. iii. Produce a bar plot to display the distribution of cars by fuel type. iv. Create a pie chart to represent the percentage distribution of cars based on fuel types. v. Draw a box plot to visualize the distribution of car prices across different fuel types.	02

Note: * Marks indicate the minimum required programs to be taken. Additional programs should be covered based on the student's learning pace.

The goal of these experiments is to provide a structured approach to learning Python programming concepts. Instructors are encouraged to use these samples as a foundation and customize them to create engaging and effective learning experiences for the students.

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. Mid Semester Oral & Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Oral & Practical Exam (25 Marks)

An Oral & Practical exam will be held based on entire syllabus.