राष्ट्रीय प्रौधोगिकी संस्थान गोवा

NATIONAL INSTITUTE OF TECHNOLOGY GOA

फर्मागुडी, फोंडा, गोवा-४०३ ४०१, इंडिया

Farmagudi, Ponda, Goa – 403 401, India

Academic Hand Book

CURRICULUM AND SYLLABI

B.Tech Programme

First year Syllabus

(Applicable to 2023 admission onwards)

http://www.nitgoa.ac.in

Table of Contents

1. Institute Vision and Mission

Vision

National Institute of Technology Goa shall emerge as one of the Nation's pre-eminent institutions. Through its excellence, it shall serve the Goan society, India and humanity at large with all the challenges and opportunities.

Mission

- ✓ NIT Goa strives for quality faculty, good students and excellent infrastructure.
- ✓ Strives for excellence, through dissemination, generation and application of knowledge by laying stress on interdisciplinary approach in all the branches of Science, Engineering, Technology, Humanities and Management with emphasis on human values and ethics.

2. Curriculum

The total credits for completing B.Tech. in ***any*** of the engineering discipline is ***168***. The structure of B.Tech. programmes shall have the following course classifications as listed in Table.1.

Table 1: Course classifications of the B.Tech. programmes

Sl. No.	Classifications	Course Type	Credits For CGPA	Courses
1	Basic Sciences	**BS**	21	MA→11, PH→5, CY→5
2	Basic Engineering Sciences and Technical Arts	**ES**	21	EM→3, BMC→3, BES→6, CPPS→4, ED→3, WP→2
3	Humanities and Social Sciences	**HU & HS**	7	PC →4, ECO→ 3
4	Indian Knowledge Systems	**IKS**	5	HH →2 and an Open Elective Course →3
5	Others: Liberal Arts, Innovation & Entrepreneurship	**OT**	2	LA→1, IE→1
6	Mandatory Learning Courses (Non-Credit)	**MLC**	0	PE, ES, PEHV
7	Department Core	**DC**	79-85	Core Theory and Lab courses, Comprehensive Viva-Voce→1, Summer Internship→1, Project Work→5
8	Department Elective (including MOOCs or any other as approved by the Institute)	**DE**	21-27	7-9 Electives
9	Open Elective (including MOOCs or any other as approved by the Institute)	**OE**	0-6	Upto 2 Open Electives
Total Credits			**168**	
10	Minor Program	**MR**	**18**	

Course abbreviations used in Table 1 are as below:

MA	:	Mathematics	CPPS	:	Computer Programming and Problem Solving	LA	:	Liberal Arts
PH	:	Physics	ED	:	Engineering Drawing	IE	:	Innovation & Entrepreneurship
CY	:	Chemistry	WP	:	Workshop Practices	PE	:	Physical Education
EM	:	Engineering Mechanics	PC	:	Professional Communication	ES	:	Environmental Studies
BMC	:	Basics of Mechanical and Civil Engineering	ECO	:	Economics	PEHV	:	Professional Ethics and Human Values
BES	:	Basic Electrical Engg. / Basic Electronics Engg.	HH	:	Health and Happiness	MOOCs	:	Massive Open Online Courses

3. Contact Hours and Credits

Every Course comprises of specific Lecture-Tutorial-Practical (L-T-P) Schedule. Generally, a courses' credits are fixed based on the following norms. However, there can be a few special courses with a slight variation in credit allotment.

Lectures/Tutorials : 1 hour per week is assigned 1 credit
Lab/Practicals : 3 hours per week assigned with 2 credits will run as a Full-Semester Course
: 2 hours per week assigned with 1 credit will run as a Full-Semester Course
: 3 hours per week assigned with 1 credit will be run as a Half-Semester Course

Example:

a theory course with a L-T-P schedule of 3-1-0 will be assigned 4 credits;
a lab/practical course with a L-T-P schedule of 0-0-3 will be a Full-Semester Course when 2 credits are assigned; with 0-0-2 will be a Full-Semester Course when 1 credit is assigned and 0-0-3 will be a Half-Semester Course when 1 credit is assigned.

4. Programme Outcomes (POs)

PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

5. Course numbering scheme

Course numbers are 5 character alpha numeric string following the below rules:

<table>
<tr><th colspan="2">Code of the Department offering the course (departments list is given in next section)</th><th>Year</th><th>Semester</th><th>Course Type</th></tr>
<tr><td rowspan="2">X</td><td rowspan="2">Y</td><td>1 [1st Yr]
2 [2nd Yr]
3 [3rd Yr]
4 [4th Yr]</td><td>0 [Odd]
5 [Even]</td><td>0, 1, 2, … Running Index</td></tr>
<tr><td>5 [Elective]</td><td colspan="2">00, 01, 02,….. Running Index</td></tr>
</table>

*Elective courses start with 500 series

6. List of Codes for Departments

Department Code	Name of the Department
CS	Computer Science and Engineering
CE	Civil Engineering
CY	Chemistry
EC	Electronics and Communication Engineering
EE	Electrical and Electronics Engineering
HS	Social Sciences
HU	Humanities
MA	Mathematics
ME	Mechanical Engineering
PE	Physical Education
PH	Physics

7. List of courses to be registered in first year of B. Tech. programme

Sl. No.	Course Code	Course Name	Type	L-T-P	Credits
1.	MA100	Matrices and Advanced Calculus	BS	3-1-0	4
2.	MA150	Differential Equations and Vector Calculus	BS	3-1-0	4
3.	PH100	Engineering Physics	BS	3-0-0	3
4.	PH101	Engineering Physics Lab	BS	0-0-3	2
5.	CY150	Engineering Chemistry	BS	3-0-0	3
6.	CY151	Engineering Chemistry Lab	BS	0-0-3	2
7.	HU150	Professional Communication	HU	2-0-3	4
8.	CS100	Computer Programming and Problem Solving	ES	3-0-0	3
9.	CS101	Computer Programing Lab	ES	0-0-2	1
10.	EE100	Basics of Electrical Engineering	ES	2-0-0	2
11.	EE101	Basics of Electrical Engineering Lab	ES	0-0-3	1*
12.	EC150	Basics of Electronics Engineering	ES	2-0-0	2
13.	EC151	Basics of Electronics Engineering Lab	ES	0-0-3	1*
14.	ME100	Engineering Mechanics	ES	3-0-0	3
15.	ME150	Basics of Mechanical and Civil Engineering	ES	3-0-0	3
16.	ME101	Engineering Drawing	ES	1-0-3	3
17.	ME151	Workshop Practices	ES	0-0-3	2
18.	HU100	Liberal Arts	OT	0-0-2	1
19.	HU151	Health & Happiness	IKS	2-0-0	2
20.	PE150	Physical Education	MLC	1-0-2	0#
***: Half-Semester Course, #: Non credit Course**			**Total Credits**		**46**

8. Semester-wise courses of First year B. Tech. Programme

I Semester

Sl. No.	Course Code	Course Name	Type	L-T-P	Credits
1.	MA100	Matrices and Advanced Calculus	BS	3-1-0	4
2.	PH100	Engineering Physics	BS	3-0-0	3
3.	CS100	Computer Programming and Problem Solving	ES	3-0-0	3
4.	EE100	Basics of Electrical Engineering	ES	2-0-0	2
5.	ME100	Engineering Mechanics	ES	3-0-0	3
6.	HU100	Liberal Arts	OT	0-0-2	1
7.	PH101	Engineering Physics Lab	BS	0-0-3	2
8.	CS101	Computer Programming Lab	ES	0-0-2	1
9.	EE101	Basics of Electrical Engineering Lab	ES	0-0-3	1*
10.	ME101	Engineering Drawing	ES	1-0-3	3
	Total Credits				**23**

II Semester

Sl. No.	Course Code	Course Name	Type	L-T-P	Credits
1.	MA150	Differential Equations and Vector Calculus	BS	3-1-0	4
2.	CY150	Engineering Chemistry	BS	3-0-0	3
3.	HU150	Professional Communication	HU	2-0-3	4
4.	EC150	Basics of Electronics Engineering	ES	2-0-0	2
5.	ME150	Basics of Mechanical and Civil Engineering	ES	3-0-0	3
6.	HU151	Health & Happiness	IKS	2-0-0	2
7.	CY151	Engineering Chemistry Lab	BS	0-0-3	2
8.	EC151	Basics of Electronics Engineering Lab	ES	0-0-3	1*
9.	ME151	Workshop Practices	ES	0-0-3	2
10.	PE150	Physical Education	MLC	1-0-2	0#
	Total Credits				**23**

***: Half-Semester Course, #: Non credit Course**

9. Detailed Syllabi of First year courses

Course Code	Course Name	L	T	P	Credits
MA100	Matrices and Advanced Calculus	3	1	0	4

Course Objective

The aim of this course is to provide engineers and scientists with a strong foundation in essential mathematical principles. By focusing on key topics such as differential calculus, integral calculus, sequences & series, Fourier series, and linear algebra, students will develop a deep understanding of applied mathematics.

Course Outcomes

At the completion of this course, the student shall acquire knowledge and ability

CO1. Develop a solid grasp of the basic principles of matrix theory and effectively apply them to solve engineering problems.

CO2. Understanding of the significance of differential calculus and its wide- ranging applications.

CO3. Comprehend the fundamental concepts of integral calculus and its practical applications,

CO4. Apply appropriate techniques to test the convergence of sequences and series, as well as analyze Fourier series,

Relationship of Course Outcomes to Program Outcomes

H = High correlation; M = Medium correlation; L = Low correlation

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	M	L			L	L	M		H
CO2	H	H	H	M				L	L	M		H
CO3	H	H	H		L			L	L	M		H
CO4	H	H	H	H	L			L	L	M		H

Syllabus

Module 1: Matrices and Applications- *Matrices:* Matrix operations -addition, scalar multiplication, multiplication, transpose, adjoint and their properties; System of linear equations and Gaussian elimination, Determinants and their properties; Cramer's rule;
*Vector Space***:** Subspaces, Linear dependence/independence, Basis, Dimension, Standard Basis of R^n, Linear transformations, Matrix of a linear transformation, change of basis and similarity, rank-nullity theorem; Inner product spaces, Gram-Schmidt process, and Orthonormal bases, Eigenvalues and Eigenvectors, Characteristic polynomials, Diagonalization.

Module 2: Differential Calculus- *Functions of single variable***:** Functions and transcendental

Functions; Limits, Continuity and Differentiability; Mean value theorems, Taylor's and Maclaurin's theorems; Parametric equations and Polar coordinates. *Functions of several variables***:** Partial differentiation; Total differentiation, Euler's theorem and generalization; Change of variables, Jacobians; Maxima and inima, Lagrange's method of Multipliers.

Module 3: Integral Calculus- Fundamental theorem of calculus; Improper integrals; Beta and Gamma functions; Applicationsof Integrals.

Module 4: Fourier Series: *Infinite Series:* Convergence of sequences and series, Power series; *Fourier series:* Periodic functions, Euler's formulae, Dirichlet's condition, Even and odd functions, Half Range Series.

Reference Books/Material

1. G. B. Thomas and R. L. Finney, *Calculus and Analytic Geometry* (14thEdition), ISE Reprint, Addison-Wesley, Pearson, 2018.
2. E. Kreyszig, *Advanced Engineering Mathematics* (8th Edition), JohnWiley, 1999.
3. G. Strang, *Introduction to Linear Algebra,* Wellesley, 2021.
4. G. Strang, *Linear Algebra and Its Applications*, Cengage, 2005

R. K Jain and S.R.K. Iyengar, *Advanced Engineering Mathematics*,3rd edition,Narosa publications, 2007.

Course Code	Course Name	L	T	P	Credits
PH100	Engineering Physics	3	0	0	3

Course Objective

To refurbish the understanding of fundamental Physics and provide concepts & application perspectives of modern physics

Course Outcomes

At the completion of this course, the student shall acquire knowledge and ability.

- **CO1.** Understands the basic concepts of Quantum Physics.
- **CO2.** Apply the Quantum Mechanical Principles to solve the physical problems.
- **CO3.** Apply the concepts of interference, diffraction, and polarization in Engineering Measurements.
- **CO4.** Use of lasers and optical fibers in engineering and communication fields.
- **CO5.** Understand the utility of renewable Energy Sources for engineering applications.

Relationship of Course Outcomes to Program Outcomes
H = High correlation; M = Medium correlation; L = Low correlation

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	L	M		L	L	L	M		H
CO2	H	H	M	M	M		L	L	L	M		H
CO3	H	H	M	M	M	L	L	L	L	M		H
CO4	H	H	M	M	H	M	M	L	L	M		H
CO5	H	M	M	L	H	M	M	L	L	M		H

Syllabus

Module 1: Dual nature of particles and waves: Representation of a wave, Phase and Group velocities, Black body radiation, Electromagnetic radiation, Dual nature of light and the photoelectric effect, Properties of photons, Matter waves, de-Broglie principles, Davisson and Germer experiment (basic ideas) to show the existence of matter waves.

Module 2: Quantum Mechanics: Limitations of classical mechanics, The wave equation, State functions, Normalization of wave functions, Schrödinger equation, Time-dependent form, operators and expectation values, Time independent Schrödinger equation, Eigen values and Eigen functions, Applications of Schrödinger equation- Particle in an infinite and Finite potential well, tunnelling, Harmonic oscillator, Uncertainty principle, Energy and time form of the uncertainty principle, explanation of zero point energy.

Module 3: Concept of interference, Newton's Rings. Fabry-Perot Interferometer and its application as a wavelength filter, Fraunhofer Class of diffraction at single, double and multiple slits diffraction at the circular aperture, Resolving Power, diffraction grating and its applications. Polarization Devices: Principles, working and applications of wave plates, Half-shade Polari meter, Photo elasticity and plane Polari scope. Lasers and Optical Fibers: Basics principles and Characteristics of laser light. Lasing action, construction and working of Three Level and Four Level Lasing Systems. PN Junction as a light source and Detector-Construction and working of LED and Laser Diode. Principle of Light Guidance in an optical fiber communication. Advantages of optical fibers over conventional systems

Module 4: Modern and Renewable Energy sources: Nuclear fission and fusion; Different Types of Nuclear Reactors-Thermal/Fast Neutron-Description and working of Gas Cooled, Boiling Water (BWR), Pressurised Water (PWR), Pressurised Heavy Water (PHWR) and Fast Neutron (FBR) Nuclear Reactors. Solar Cells: Solar spectrum, photovoltaic effect, structure and working principle of solar cell, I- V characteristics, power conversion efficiency, materials for PV,

emerging PV technologies for alternative energy devices. Introduction to other Renewable Energy sources-Wind-Tidal-Geothermal systems

Reference Books/Material

1. David Halliday, Robert Resnick, & Walker Jearl, (2014). *Fundamentals of Physics.* Wiley Publications.
2. Arthur Beiser, Shobhit Mahajan, & S Rai Choudhury, (2017). *Concepts of Modern Physics.* Tata McGraw - Hill Education.
3. S. O. Kasap, (2012). *Optoelectronics and Photonics-Principles and Practices.* Pearson Publications.
4. Raymond A. Serway, & John W. Jewett, (2008). *Physics for Scientists and Engineers with modern physics.* Thomson Brooks/Cole publisher.
5. Ajoy Ghatak, (2021). *Optics.* McGraw Hills Education.
6. P. K Palaniswamy, (2017). *Applied Physics.* SCITECH publications
7. David Halliday, Robert Resnick, & Walker Jearl, (2014). *Principles of Physics.* Willey.
8. Hugh D. Young, Roger A. Freedman, & A Lewis Ford, (2015). *University Physics with Modern Physics.* Pearson Publisher.
9. Vaidyanathan G., (2013). *Nuclear Reactor Engineering (principles and Concepts.* S. Chand Publication
10. Thomas Schulenberg, (2022). *The fourth generation of nuclear reactors: Fundamentals, Types, and Benefits*. Springer Publication

Course Code	Course Name	L	T	P	Credits
CS100	Computer Programming and Problem Solving	3	0	0	3

Course Objective

The objective of the course is to make the students learn problem-solving by writing algorithms and implementing them using C Programming language. The course helps the students to write programs to solve computational problems.

Course Outcomes

At the completion of this course, the student will be able to:

- **CO1.** Develop basic understanding of computers and the concept of algorithms.
- **CO2.** Design algorithms for solving simple computational problems, including searching and sorting.
- **CO3.** Examine the suitability of C programming features to solve specific problems.

Relationship of Course Outcomes to Program Outcomes
H = High correlation; M = Medium correlation; L = Low correlation

POs → COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	L							
CO2	H	H	H	H	M							
CO3	H	H	H	H	M							

Syllabus

Module 1: Introduction to Computers, Elements of Computing Systems, Overview of Systems Software.

Getting Started: Problem-solving techniques – Basic algorithms**,** C standards. What is C, Getting Started with C, The C Character Set, Constants, Variables, and Keywords, Types of C Constants, Rules for Constructing Integer, Real and Character Constants. Types of C Variables, Rules for Constructing Variable Names, C Keywords. The First C Program: Compilation and Execution, Receiving Input. Algorithms and flowcharts. C Instructions: Type Declaration Instruction, Arithmetic Instruction, Integer and Float Conversions, Type Conversion in Assignments, Hierarchy of Operations, Associativity of Operators, and Control Instructions in C.

The Decision Control Structure: The if Statement, The if-else Statement, Nested if-elses, Forms of if. Use of Logical Operators: The else if Clause, The ! Operator, the Conditional Operators.

The Loop Control Structure: Loops: while Loop, for Loop, break statement, continue statement, do-while Loop.

The Case Control Structure: Decisions using the switch, switch versus if-else Ladder, The goto Keyword.

Module 2: Functions & Pointers: Basics of Functions, Value Passing, Scope rules of Functions, calling convention, Advanced Features of Functions. Introduction to Pointers, Pointer Notation, Recursion, Recursion and Stack, Pointers to Functions, Functions returning pointers, Functions with variable number of arguments.

Data Types Re-visited: Integers- long, short, signed, unsigned. Chars-signed, unsigned. Floats & Doubles. Storage Classes in C.

The C Preprocessor: Features of C Preprocessors, Macro Expansion, File Inclusion, Conditional Compilation, #if and #elif Directives, The Build Process.

Module 3: Arrays: Basics of Arrays, Pointers & Arrays, Two-Dimensional Arrays, Array of Pointers, Three-Dimensional Arrays.
Strings: Basics of Strings, Pointers & Strings, Standard Library String Functions, Dynamic Allocation of Memory, Two-Dimensional Array of Characters, Array of Pointers & Strings.

Structures & Unions: Basics, Declaration, and Usage.

Console Input and Output: Formatting output for functions in the printf () family, Formatting input for functions in the scanf () family, Escape sequences.

Module 4: Module File Processing: Opening and closing files, reading and writing sequential files, Using argc and argv.

Operations on Bits: Bitwise Operators, Hexadecimal Numbering System, Relation between Binary and Hex. Mixed Features: Enumerated Data type, Typedef, Typecasting, Bit Fields, The volatile Qualifier.

Books/ Reference Books:

1. Brian W. Kernighan & Dennis M. Ritchie, "The C Programming Language," Second edition, Prentice Hall Inc.
2. Herbert Schildt, "C: The Complete Reference," 4th edition, McGraw Hill Education, 2017.
3. R.G. Dromey, How to solve it by Computers? Prentice Hall, 2007.
4. J.R.Hanly and E.B. Koffmann, Problem Solving and Program design in C, 6th Edition, Pearson Education, 2009.
5. E.Balagurusamy, "Programming in ANSI C", McGraw Hill Education India Private Limited; Seventh edition, July 2017.
6. Byron Gottfried, Programming with C, 4th Edition, Tata McGraw Hill Education, 2018.
7. Yashavant Kanetkar, Let Us C, 15th Edition, BPB Publications, 2016.

Course Code	Course Name	L	T	P	Credits
EE100	Basics of Electrical Engineering	2	0	0	2

Course Objective

The objectives of studying this course are: to understand how electrical power system works, to analyze electrical and magnetic circuits, and also to understand the principle of operation of transformers and electromechanical energy conversion.

Course Outcomes

At the completion of this course, the student shall acquire knowledge and ability

CO1. to understand how electrical power is generated, transmitted and distributed.
CO2. to analyze and solve DC circuits and AC circuits.
CO3. to understand the concept of voltage, current, power and energy and their interrelations
CO4. to analyze and solve magnetic circuits
CO5. to understand the principle of operation of transformers and electromechanical energy conversion

Relationship of Course Outcomes to Program Outcomes
H = High correlation; M = Medium correlation; L = Low correlation

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M					M	L					
CO2	M	H			L							
CO3	H	H										
CO4	M											
CO5	H	M										

Syllabus

Module1: Introduction to power engineering: generation, transmission and distribution, sources of energy, renewable energy sources,

Module2: Electric circuit elements and sources, network analysis and theorems, transient analysis,

Module3: AC analysis of single phase systems, series and parallel circuits, resonance, real and reactive power, power factor, improvement in pf, AC analysis of symmetrical 3-phase systems, power and energy measurement in single phase and three phase systems, energy consumption of domestic loads, electricity tariff

Module4: Magnetic circuits and mutual inductance, introduction to transformers, introduction to electromechanical energy conversion.

Text Books:

1. Fitzgerald, D. E. Higginbotham, A. Grabel, Basic Electrical Engineering, 5th Edition, McGraw-Hill, 2009.
2. William H. Hayt Jr. , Jack E. Kemmerly, Steven M. Durbin, Engineering Circuit Analysis, 6th Edition,TMH, 2002
3. Edward Hughes, Electrical and Electronics Technology, 10th Edition, Pearson, 2008

Reference Books:

1. V. Del Toro, “Electrical Engineering Fundamentals,” PHI Learning, 2015
2. Giorgio Rizzoni, Fundamentals of Electrical Engineering Paperback – Import, 16 March 2008
3. Parker Smith, Problems on Electrical Engineering, 9th edition, CBS, 2018

Course Code	Course Name	L	T	P	Credits
ME100	Engineering Mechanics	3	0	0	3

Course Objective

The main objective of studying this course is to understand and apply the fundamental concepts of engineering mechanics including statics and dynamics.

Course Outcomes

At the completion of this course, the student shall acquire knowledge and ability

- **CO1.** to describe force and force systems, moments, and equilibrium conditions in static systems
- **CO2.** to understand relationships between forces and motions using free body diagrams and kinematics of particles using rectangular, normal-tangential, and polar coordinates
- **CO3.** to apply the concepts of statics and dynamics to solve engineering problems
- **CO4.** to analyze various problems of statics and dynamics involving force equilibrium, trusses, distributed forces, kinematics, and kinetics of particles

Relationship of Course Outcomes to Program Outcomes

H = High correlation; M = Medium correlation; L = Low correlation

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H											
CO2	H	M										
CO3		H	L	M								
CO4		H	L	M	M							

Syllabus

Module1: Fundamentals of Mechanics: Basic Concepts, Vector and Scalar Quantities, Newton's Laws, Elements of Vector Algebra, Force Systems: Fundamentals, Rectangular Components, Moment and Couple, Resultants.

Equilibrium: Concept of Equilibrium, Free Body Diagrams, Equilibrium Conditions, Plane Trusses, Method of Joints and Sections.

Module2: Distributed Forces: Center of Mass and Centroids of Areas, Moment of Inertia of Mass and Areas, Composite Areas.

Friction: Characteristics of dry friction, Problems involving dry friction, Wedges.

Virtual Work: Definition of Work, Principle of Virtual Work, Principle of Virtual Work for a System of Connected Rigid Bodies, Conservative Forces.

Module3: Kinematics of Particles: Introduction, Rectilinear Motion, Plane Curvilinear Motion, Rectangular, Normal-Tangential, and Polar Coordinates.

Module4: Kinetics of Particles: Introduction, Force, Mass, and Acceleration: Newton's Second Law, Rectilinear and Plane Curvilinear Motion, Work and Energy, Impulse and Momentum.

Module5: Plane Kinematics of Rigid Bodies: Rotation, Absolute Motion, Relative Velocity, Instantaneous Center of Zero Velocity, Relative Acceleration, Motion Relative to Rotating Axes.

Reference Books/Material

1. Hibbler, R. C. *Engineering Mechanics - Statics and Dynamics*, 14th Ed, Pearson Education, 2017.
2. Beer, F. P. & Johnston Jr, E. R. et al. *Vector Mechanics for Engineers - Statics and Dynamics*, 12th Ed, McGraw Hill, 2019.
3. Meriam, J. L, Kraige, L. G., Bolton, J. N. *Engineering Mechanics – Statics*, 8th Ed, Wiley, 2016.
4. Meriam, J. L, Kraige, L. G., Bolton, J. N. *Engineering Mechanics – Dynamics*, 9th Ed, Wiley, 2018.
5. Shames, I. H., Rao, G. K. M. *Engineering Mechanics - Statics and Dynamics*, 4th Ed, Pearson Ed., 2005.

Timoshenko, S. P., Young, D. H., Rao, J. V., Patil, S. *Engineering Mechanics*, 5th Ed, McGraw Hill, 2017.

Course Code	Course Name	L	T	P	Credits
HU100	Liberal Arts	0	0	2	1

Course Objective

The main objective is to introduce students to performing arts and to develop situational communication and inculcate sense of Time Management and Team work

Course Outcomes

At the completion of this course, the student shall acquire knowledge and ability

- **CO1.** Students will have a fair understanding of Performing Arts
- **CO2.** Students will be able to understand and apply Team Work & Time Management in Practical fields
- **CO3.** Students will develop Communication Skill.

Relationship of Course Outcomes to Program Outcomes
H = High correlation; M = Medium correlation; L = Low correlation

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3										H		

Syllabus

Module 1: Introduction to Natya Shashtra by Bharat Muni Natyashastra- Text- Origin of theatre-Scope and purpose-Description of the playhouse-Ten kinds of plays- Dharmi-Acting- Rasa & Bhav

Module 2: Select Playwrights of India and World-Their Seminal Works Kalidasa, William Shakespeare, Arthur Miller, Rabindranath Tagore, Girish Karnad, Habib Tanvir, Tendulkar

Module 3: Fundamentals of Acting Physical aspects of Acting & Exercises, Voice Modulation & Exercises, Speech & Diction & exercise, Process of Action & Character Portrayal or Characterization

Module 4: Introduction to stage craft: Set Design & Light Design Introduction to Set Design, Types of performance spaces, Creative Process of design, Introduction to Light design, Audio-Visual Techniques

Module 5: One Public Performance Any Contemporary Play maybe adopted: (Tughlaq by Girish Karnad)

Reference Books/Material

1. A Treastise on Ancient Indian Dramaturgy and Histrionics : Natyasastram Ascribed to Bharata Muni (2 Vol. set)
2. Felnagle, Richard. H., [1987], Beginning Acting, Prentice Hall, New Jersey
3. Funke, Lewis & Booth, John E., [1961], Actors Talk about Acting, Avon Book Division, New York
4. Hays, David, [1988], Light on The Subject, Seagull Books Calcutta
5. Dasgupta, G.N.,[1986], Guide to Stage Lighting, Annapurna Dasgupta, New Delhi
6. Campbell, Lily. B., [1970], Scenes and Machines on the English Stage during the Renaissance, New York Barnes and Noble Inc
7. Theatre Histories: An Introduction, Edited By Bruce McConachie, Tobin Nellhaus, Carol Fisher Sorgenfrei, Tamara Underiner

Course Code	Course Name	L	T	P	Credits
PH101	Engineering Physics Lab	0	0	3	2

List of Experiments: (8 Experiments will be conducted)

1. Hall Effect
2. Photoelectric Effect
3. Helmholtz Resonator
4. Newton's Rings Experiment
5. Determination of Wavelength of He-Ne Laser using a Metal Scale as a Grating
6. Determine the width of a single slit based on the Diffraction pattern
7. Determination of wavelength of Sodium Light using a transparent diffraction Grating
8. Determination of Optical absorption coefficient of materials using lasers
9. I-V Characteristics of Zener Diode
10. Determination of resonating frequency and bandwidth by LCR circuit.
11. Measurement of the half-life of the radioactive source using GM Counter
12. Determination of acceptance angle and numerical aperture of optical fiber

Course Code	Course Name	L	T	P	Credits
CS101	Computer Programming Lab	0	0	2	1

Course Objective

The objective of the course is to make the students implement the designed algorithms for computational problems using the C Programming language.

Course Outcomes:

At the completion of this course, the student will be able to:

CO1. Demonstrate an ability to work in a UNIX/LINUX environment.

CO2. Demonstrate an ability to develop algorithmic solutions for simple computational problems.

CO3. Implement algorithmic solutions using the C programming language features.

CO4. Develop an application using C Programming language features.

Relationship of Course Outcomes to Program Outcomes

H = High correlation; M = Medium correlation; L = Low correlation

POs → COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	M							
CO2	H	H	H	H	L							
CO3	H	H	H	H	M							
CO4	H	H	H	H	H							

Syllabus

1. Unix/Linux commands, editor, IDE.
2. Basic programs, program execution, debugging.
3. Programs on conditional control constructs.
4. Programs on loops (while, do-while, for).
5. Programs using user-defined functions and library functions.
6. Programs on arrays and matrices (single and multi-dimensional arrays).
7. Programs using pointers (int pointers, char pointers).
8. Programs on Dynamic memory allocation.
9. Programs on structures, union.
10. Programs on File Handling.
11. Preparing makefile.
12. A project.

Books/ Reference Books:

1. Brian W. Kernighan & Dennis M. Ritchie, "The C Programming Language," Second edition, Prentice Hall Inc.
2. Herbert Schildt, "C: The Complete Reference," 4th edition, McGraw Hill Education, 2017.
3. R.G. Dromey, How to solve it by Computers? Prentice Hall, 2007.
4. J.R.Hanly and E.B. Koffmann, Problem Solving and Program design in C, 6th Edition, Pearson Education, 2009.
5. E.Balagurusamy, "Programming in ANSI C", McGraw Hill Education India Private Limited; Seventh edition, July 2017.
6. Byron Gottfried, Programming with C, 4th Edition, Tata McGraw Hill Education, 2018.
7. Yashavant Kanetkar, Let Us C, 15th Edition, BPB Publications, 2016.

Course Code	Course Name	L	T	P	Credits
EE101	Basics of Electrical Engineering Lab	0	0	2	1* (Half-Semester Course)

Course Objective

To familiarise with equipments, and components used in electrical engineering and analyse simple circuits.

Course Outcomes

At the completion of this course, the student shall acquire knowledge and ability

CO1. to familiarize with different equipments, components, measuring instruments, and power supply systems used in electrical.
CO2. to investigate electrical circuits-and-systems behaviour during excitations
CO3. to analyse the operation and performance of a transformer

Relationship of Course Outcomes to Program Outcomes

H = High correlation; M = Medium correlation; L = Low correlation

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M										
CO2		M	L									
CO3	M	M	L									

Syllabus

1. Familiarisation of Electrical Components & Equipment.
2. Study of Network theorems.
3. Transient analysis of a first order dc circuit.
4. Real and reactive power and energy measurement for an AC load.
5. Determine Voltage regulation and efficiency of a single phase transformer by direct loading.

Course Code	Course Name	L	T	P	Credits
ME101	Engineering Drawing	1	0	3	3

Course Objective

The main objective of studying this course is to understand the theoretical concepts of engineering drawing and draw various projections of points, lines, planes, and solids.

Course Outcomes

At the completion of this course, the student shall acquire knowledge and ability

CO1. to identify and understand the use of various geometrical instruments, concepts of orthographic projections, and conventions used in engineering drawing

CO2. to explain the different types of engineering drawings, types of lettering, dimensioning

CO3. to draw the orthographic and isometric projections of various geometric entities

CO4. to demonstrate the competency of computer aided drawing (CAD) software for drawing various orthographic projections

Relationship of Course Outcomes to Program Outcomes
H = High correlation; M = Medium correlation; L = Low correlation

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H											
CO2	M	M										
CO3	M	H	H		L					L		
CO4					H					M		

Syllabus

1. Drawing instruments and their uses, Different types of lines, Lettering and dimensioning, Basics of Orthographic Projection
2. Projection of Points and lines, Traces of lines.
3. Projection of plane lamina of geometric shapes, Traces of planes.
4. Projection of solids, Isometric projection.
5. Sections of solid
6. Introduction to Development of Surfaces.
7. Introduction to Drafting Software

Reference Books/Material

1. Bhatt, N. D., Engineering Drawing - Plane and Solid Geometry, 15th Ed, Charotar Publication, 2011.
2. Parthasarathy, N. S., Vela, M., Engineering drawing, Oxford University Press, 2015.
3. Gopalkrishna, K. R., Engineering Drawing (Volume I and II Combined), 27th Ed, Subhas Publication, 2017.
4. Shah, M. B., Rana, B. C., Engineering Drawing, 2nd Ed, Pearson Education, 2009.
5. Giesecke, F. E., Lockhart, H., Goodman, M., Johnson, C. M., Technical Drawing with Engineering Graphics, 16th Ed, Pearson Education, 2016.
6. Jensen, C., Helsel, J. D., and Short, D. R., Engineering Drawing and Design, 7th Ed, McGraw Hills, 2007.
7. Benton, B. C., and Omura, G., *Mastering AutoCAD 2021 & AutoCAD LT 2021*, 2nd Ed, Sybex, 2021.
8. Dhananjay A Jolhe, Engineering Drawing, McGraw Hill Education (India) Private Limited; 1st edition (1 July 2017)

Course Code	Course Name	L	T	P	Credits
MA150	Differential Equations and Vector Calculus	3	1	0	4

Course Objective

This course offers the essential foundation and relevant background knowledge needed to comprehend other significant engineering mathematics courses provided to engineers and scientists. It covers important topics in applied mathematics, including multiple integrals, vector calculus, ordinary and partial differential equations, as well as Laplace transforms.

Course Outcomes

At the completion of this course, the student shall acquire knowledge and ability

- **CO1.** Develop a solid foundation in multiple integrals and vector calculus, enabling them to understand their significance in engineering such as Fluid Dynamics and Electromagnetic fields.
- **CO2.** Gain proficiency in handling ordinary and partial differential equations through analytical methods and grasp their application in modelling.
- **CO3.** To solve these equations effectively using Laplace transforms.,

Relationship of Course Outcomes to Program Outcomes

H = High correlation; M = Medium correlation; L = Low correlation

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	M	L			L	L		M	H
CO2	H	H	H	M							M	H
CO3	H	H	H	M	L			L	L		M	H

Syllabus

Module 1: Vector Calculus: Double and Triple integrals; Scalar and Vector fields; Vector Differentiation; directional derivative - Gradient of scalar field; Divergence and Curl of a vector field - Laplacian - Line and surface integrals; Green's theorem in plane; Gauss Divergence theorem; Stokes' theorem.

Module 2: Ordinary Differential Equations and Applications:- First -order linear ODE: Introduction and motivation to differential equations, geometrical Interpretation of solution, equations reducible to separable form, exact equations, integrating factor, linear equations, orthogonal trajectories, Picard's theorem for IVP (without proof) , examples on non-uniqueness. Second and higher order linear ODE: Linear dependence and Wronskians, linear ODE's with constant coefficients, the characteristic equations. Cauchy-Euler equations. Method of undetermined coefficients. Method of variation of parameters, Power series method.

Module 3: Laplace Transforms and Applications:- Laplace transform - Inverse Laplace transform - properties of Laplace transforms - Laplace transforms of unit step function, impulse function and periodic function - convolution theorem - Solution of ordinary differential equations with constant coefficients and system of linear differential equations with constant coefficients.

Module 4: Partial Differential Equations and Applications:- Introduction to PDE; basic concepts, second order PDE and classification, Solutions using separation of variables

Reference Books/Material

1. G. B. Thomas and R. L. Finney, *Calculus and Analytic Geometry* (14thEdition), ISE Reprint, Addison-Wesley, Pearson, 2018.
2. E. Kreyszig, *Advanced Engineering Mathematics* (8th Edition), JohnWiley, 1999.
3. W. E. Boyce and R. DiPrima, *Elementary Differential Equations* (8thEdition), John Wiley (2005).
4. R. K Jain and S.R.K. Iyengar, *Advanced Engineering Mathematics*,3rdedition, Narosa publications (2007)

Course Code	Course Name	L	T	P	Credits
CY150	Engineering Chemistry	3	0	0	3

Course Objective

To refurbish the understanding of fundamental chemistry and to provide certain concepts and its application towards engineering.

Course Outcomes

At the completion of this course, the student shall acquire knowledge and ability.

- **CO1.** Understand the basic concepts of chemistry in compliance with the requirements for the undergraduate engineering program
- **CO2.** Familiarize with analytical instrumental methods
- **CO3.** Awareness of the basics chemistry involved in electrochemical cells and corrosion
- **CO4.** Knowledge on basics of polymer chemistry and advanced polymers
- **CO5.** Understand the phase diagram of multi-component systems and its application.

Relationship of Course Outcomes to Program Outcomes
H = High correlation; M = Medium correlation; L = Low correlation

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	M	M	L							
CO2	H	H	H	H	L							
CO3	H	M	H	M	H		H			L		L
CO4	H	H	M	H	L		L					L
CO5	H	H	M	M	M							

Syllabus

Module1 : Electrochemistry and Corrosion: Review of concepts of electrode potential, EMF measurement and applications, Types of electrodes, Concentration cell: electrode and electrolyte concentration cell, concentration cell with and without transference, Corrosion: Dry corrosion and wet corrosion, mechanisms, Types of corrosion, Differential metal corrosion, differential aeration corrosion, intergranular, Pitting, Passivity, Polarization, Corrosion control methods: Chemical conversion coatings and organic coatings- Paints, enamels.

Module2 : Instrumental Methods of Analysis: Colorimetry, UV-visible spectroscopy, Infra-red spectroscopy, Magnetic resonance spectroscopy, Qualitative and quantitative analysis, Conductometry and Potentiometry

Module 3: Water Technology: The hardness of water, Boiler troubles, Internal and external treatments, Desalination, Sewage water analysis- Dissolved oxygen (OD), Biological oxygen demand, Chemical oxygen demand and their determination, Sewage water treatment

Module 4: Phase Rules: Definition of terms, phase components, degree of freedom, derivation of Gibbs phase rule, one-component system: H_2O, CO_2, Sulfur, Two-component system: Eutectic systems, reduced phase rule, Pb-Ag system, Compound Formation with congruent melting, Zn- Mg Alloy system, Copper-nickel alloy system, systems with incongruent melting, Na_2SO_4- H_2O system, simple three-component systems.

Module 5: High Polymers: Basic definitions, Addition, Condensation and Coordination polymerization, Co-polymerisation, Molecular weights and their determinations, Methods of polymerization, Tg & Tm and factors affecting them, Teflon, PMMA and UF

Reference books:

1. P. C. Jain, M. Jain, *Engineering Chemistry*, Dhanpat Rai & Sons, 16th edition, 2015
2. P. Atkins, J.D. Paula, Physical Chemistry, 9th Edition, Oxford University Press, 2010.
3. G. Chatwal, S. Anand, *Instrumental Methods of Chemical Analysis*, S. D. Himalaya Publishing House, 2003
4. B. R. Puri, L. R. Sharma, M. S. Pathania, *Principles of Physical Chemistry*, Vishal Publishing Co., 47th edition, 2020
5. O. G. Palanna, Engineering Chemistry, Tata McGraw Hill Publishing Co. Ltd., 2012
6. S. Rattan, *Comprehensive Engineering Chemistry*, S.K. Kataria & Sons, Delhi, 2011
7. V. R. Gowariker, N. V. Viswanathan, J. Sreedhar, *Polymer Science*, New Age International (P) Limited, 2005

Course Code	Course Name	L	T	P	Credits
HU150	Professional Communication	2	0	3	4

Course Objective

It aims at developing the four skills of Language learning: LSRW skills and also aims at developing the skill of effective communication.

Course Outcomes

CO1.The students should be able to comprehend, speak and write in English language.

CO2. The students should be able to use Body Language

CO3. The students will be able to use Professional Etiquette

Relationship of Course Outcomes to Program Outcomes

H = High correlation; M = Medium correlation; L = Low correlation

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										H		
CO2										H		
CO3										H		

Syllabus

Module 1: a. Definition & Process of Communication-Classification-Types of Verbal & Non-Verbal Communication, Proxemics, Chromatics, Haptics, Chronemics, Communication Network, Grapevine, Noise-Types & how to get rid of it. Feedback- Types, Process with examples, Listening-Types, Process and essentials for good listening

Module 2: Video Lecture (without subtitles) followed by the oral presentation of the content

Module 3: 7 Cs of Professional Communication (Principles)
What are the 7Cs Professional Communication? Usage in communication:
1. Credibility, 2. Courtesy, 3. Clarity, 4. Correctness, 5. Consistency, 6. Concreteness, 7. Conciseness (added as per Suggestions)

Module 4: Different types of letters-Sales, Order, Inquiry, Notice, Memo, Agenda, Minutes, Circular

Module 5: Technical Presentation, GD & Debate

Reference Books/Material

1. Kaul, Asha. Effective Business Communication, Prentice Hall, New Delhi, 2007
2. Dhanvel, P.S. English & Soft Skills, Hyderabad: Orient Black Swan, 2010
3. High School Grammar, Wren & Martin, 2012
4. Fundamental Concepts of Language Teaching, H.H. Stern, OUP, 1983
5. Business Communication Essentials, Courtland L Bovee & John V Thill, 2006 (Activity Based Book)

Course Code	Course Name	L	T	P	Credits
EC150	Basics of Electronics Engineering	2	0	0	2

Course Objective

1. To introduce Electronics Engineering in a nutshell
2. To explain the role of Electronics Engineering in all other engineering disciplines
3. To explain the basic building blocks of digital and analog electronic circuits
4. Understand the behavior and operation of several non-linear electronic devices: the operational amplifier, the PN junction diode, the field-effect transistor, and the bipolar junction transistor.

Course Outcomes

At the completion of this course, the student shall acquire knowledge and ability

CO1. Analyze different electronics circuits, transistor characteristics and amplifiers.
CO2. Simplify and realize Boolean expressions, analyze and implement logic circuits.
CO3. Analyze operational amplifier circuits.
CO4. Understanding communication principles and analyzing different modulation techniques.

Relationship of Course Outcomes to Program Outcomes

H = High correlation; M = Medium correlation; L = Low correlation

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		H	M	L							
CO2	H		H	M								
CO3	H		M		L							
CO4	H			H	L							

Syllabus

Module1: Fundamentals of Electronic Systems, diode circuit models and applications: - Introduction to circuit models, rectifiers.

Transistors:- Construction and operation of BJT and MOSFETs & introduction to various biasing schemes. Application of transistor as a basic building block of amplifier and switch.

Module2: Introduction to Digital Electronics:- Review of number systems, logic gates, Boolean algebra, k-Map, design of digital logic circuits.

Module3: Operational Amplifier (Op-amp) and application: - Op-amp: Introduction, Op-amp Characteristics. Inverting and Non-inverting amplifiers.

Module4: Basic Principles of Communication System, Over view on analog modulation schemes (Amplitude, Frequency and Phase Modulation) along with associated modulation and demodulation circuits.

Course Code	Course Name	L	T	P	Credits
ME150	Basics of Mechanical and Civil Engineering	3	0	0	3

Course Objective

The main objective of studying this course is to provide students with a strong foundation in the principles and concepts of Mechanical and Civil Engineering consisting of Thermodynamics, Mechanical Systems Design, Production Technology, surveying and building plans.

Course Outcomes

At the completion of this course, the student shall acquire knowledge and ability

CO1. to explain/desrcibe principles of Thermodynamics, including concepts such as energy, heat transfer, work, and the laws of Thermodynamics.

CO2. to solve problems based on principles and techniques involved in the analysis of mechanical systems including power transmission mechanisms.

CO3. to illustrate the basics of production technology, including conventional and non-conventional manufacturing techniques.

CO4. to explain/desrcibe various aspects of Civil Engineering, encompassing surveying and building plans.

Relationship of Course Outcomes to Program Outcomes

H = High correlation; M = Medium correlation; L = Low correlation

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L										
CO2	H	H										
CO3	H		L									
CO4	H		L									

Syllabus

Part A. Basics of Mechanical Engineering

- **Introduction to Thermodynamics:** Fundamentals of Thermodynamics (I law, SFEE, II law), Fluid Mechanics and Heat Transfer.
- **Energy and Energy Sources:** Energy Scenario – Present and Future Trends, Conventional and Non-Conventional Energy Sources.
- **Energy Conversion:** Energy Conversion Systems, Refrigeration, and Air Conditioning. (12)
- **Basics of Mechanics of Solids:** Concept of Stress, Stresses and Strain under Axial Loading
- **Power Transmission in Mechanical Systems:** Belt Drives, Gear Drives: Types, Gear Trains, Velocity Ratio (12)
- **Manufacturing Processes:** Classification, Casting, Metal Forming, Metal Joining Processes, Machining.
- **Advanced Manufacturing Processes:** Non-Traditional Machining, Additive Manufacturing, Robotics and Automation, Industry 4.0.

Part B. Basics of Civil Engineering

- **General Introduction to Civil Engineering:** Relevance of Civil Engineering in the overall infrastructural development of the country, National building code, Terminologies: Plinth area, Carpet area, Floor area, Build up area, Floor space index, Types of buildings.
- **Surveying:** Classification, Principles, Measurements of Distances, elevation and angles.
- Conventional and modern building materials, Waterproofing Materials, Prefabricated Building components, Green buildings
- Building Plans, Setting out of a Building, Types of foundations, Brick Masonry, Stone Masonry, Beams, Columns, Lintels, Roofing, Flooring, Plastering
- Rain Water Harvesting, Solid Waste Management, Introduction to Highways and Railways, Introduction to Hydropower Engineering, Introduction to Water supply Engineering.

Reference Books/Material

1. Cengel, Y. A. and Boles, M. A., *Thermodynamics: An Engineering Approach*, McGraw Hill, 5th Ed., 2006.
2. Beer, F. P. & Johnston Jr, E. R. et al. *Mechanics of Materials*, 8th Ed, McGraw Hill, 2020.
3. Rattan, S. S., *Theory of Machines*, 5th Ed, McGraw Hill, 2019.
4. Hajra Choudhary, S. K., Hajra Choudhary, A. K. Roy, N., *Elements of Workshop Technology. Vol. I and II*, Media promoters and publishers Pvt Ltd, 2007.
5. Nag, P. K., *Engineering Thermodynamics*, Tata McGraw Hill, 3rd Ed., 2005.

6. Kalpakjian, S., Schmid, S. R., *Manufacturing Engineering & Technology*, 4th Ed, Pearson Education, 2000.
7. Groover, M. P., *Introduction to Manufacturing Processes*, Wiley, 2011.
8. Rao, P. N., *Manufacturing Technology. Vol. I and II*, 2nd Edition. TMH Education, 2006.
9. Groover, M. P., & Weiss, M., *Industrial Robotics, Technology, Programming, and Applications*, McGraw Hill, 1986
10. Famili, A.F., Dana S. Nau, D.S., Kim S.H., *Artificial Intelligence Applications in Manufacturing*, AAAI Press, 1992.
11. Misra, S., Roy, C., and Mukherjee, A., *Introduction to Industrial Internet of Things and Industry 4.0*, CRC Press, 2020.
12. Chen, W. F., & Liew, J. Y. R. (Eds), *The Civil Engineering Handbook*. 2nd Ed, CRC Press, 2002.
13. Chudley, R., & Greeno, R., *Building Construction Handbook*, Addison Wesley, 2020.
14. Kandya, A. A., *Elements of Civil Engineering*, 3rd Ed, Charotar Publishing House, 2017.
15. Mamlouk, M. S., & Zaniewski, J. P., *Materials for Civil and Construction Engineering*, Pearson.
16. Rangwala, S. C., & Dalal, K. B., *Building Construction*, Charotar Publishing House.
17. Shanmugam, G., Palanichamy, M. S., *Basic Civil and Mechanical Engineering*, McGraw Hill.

Course Code	Course Name	L	T	P	Credits
HU151	Health & Happiness	2	0	0	2

Course Objective

The main objective of studying this course is to give overview on importance of food, nutrition and yogic practices to understand holistic view of personality, health and wellness.

Course Outcomes

At the completion of this course, the student shall acquire knowledge and ability

CO1. To develop the attitude of fairness and team spirit

CO2. To promote good health, comradeship and spirit of healthy competition

CO3. To improve positive and deep impact on the holistic development of the personality

CO4. To spread a strong message of peace, friendship and understanding among the people.

Relationship of Course Outcomes to Program Outcomes
H = High correlation; M = Medium correlation; L = Low correlation

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								H	L	H		H
CO2								H	L	H		H
CO3								M		M		H
CO4								M	L	L		H

Syllabus

Module 1: Introduction to Food & Nutrition, Human Biology, Vital Parameters and Health Check, BMI Calculation, Nutrients, Water, Carbohydrates, Nutrients – Proteins – Structure & Classification, Lipids and Fats, Source of Fats and Oil, Fat Soluble Vitamins, Water Soluble Vitamins, Nutrients – Minerals, Food Groups, concept of Balanced Diet, Phytochemicals and health benefits, Spices and Health Benefits, Cooking Methods. Introduction to quality attributes of food, factors affecting it, methods of quality evaluation. Food Adulteration: Contaminants & Detection, Basic Food Laws and Regulations, Nutrition Labelling and Food Laws. Food Additives- application & safety aspects, Genetically Modified Foods, Issues in GM foods, Food Safety Tools. Food Contamination, Post Harvest Losses of Fruits, Vegetables & its Safety, Food safety Hazards, Expiry Date/Shelf Life.

Module2: Health- definition, signs of health, Healthy lifestyle: Carcadian rhythm, early awakening, dantdhavan, nasya, gandusha, abhyanga, vyayam, urvartan, snan. selection of occupation, Sharira Manas prakriti. Aahar (Diet): ideal diet, Aahar varg: (groups of food): group of cerials, group of pulses, vegetables, fruits, milk and milk products, spices, sugar and jaggery, non- veg diet, cooked/processed food, effect of fast food and junk food on body, preservatives etc. Ahara vidhi:(how to eat), GI motility disorders. Timings of food, digestion, Carcadian rhythm related to digestion. Rutujacharya: 6 seasons, changes in body according to season, change in diet and regimen according to seasonal changes, diet and regimen for each season. Natural urges: diseases due to restrain of natural urges, urges to be with hold. Sleep:effects of good sleep and irregular sleeping habits. Mental health: Sadvrutta:- Rules of good conduct, measures to improve concentration, memory- meditation, tratak, yoga and yogic kriyas.

Module3: Introduction to Hatha yoga-benfits, Basics of Yoga, Ashtang Yoga: yama, niyama, asana, pranayama, pratyahara, dharana, dhyana and Samadhi. Yogic exercises for eyes, Meditation asanas: Vajrasana and Padmasana etc.

Module4: Introduction to Forward bending, Backward bending, Spinal twisting, inverted and Balancing asanas, Surya namaskara. Chandra namaskar, Introduction to Pranayama, Mudra, Bandha, Shatkarma. Yoga and Mental Health, Yoga Related Practical Work,

Reference Books/Material

1. "Food and Nutrition" course at SWAYAM By Dr. Asna Urooj, University of Mysore
2. N. Shakuntala Manay & M. Shadaksharaswamy. (2001). Food: facts and principles. New Age International.
3. Norman, N. Potter. (2013). Food science. Springer.
4. Saraswati, Swami Satyananda, and Janez Kristijan Hiti. (1996). Asana pranayama mudra bandha. Bihar, India: Yoga Publications Trust, 1996.
5. Krishnamacharya, Tirumalai. (1935). "Yoga Makaranda." The Nectar of Yoga.
6. Iyengar, Bellur Krishnamukar Sundara. (1965). "Light on yoga: the definitive guide to yoga practice."
7. Shankar, Sri Sri Ravi. Patanjali Yoga Sutras. Arktos, 2014.
8. Online resource: https://vikaspedia.in/health/ayush/

Course Code	Course Name	L	T	P	Credits
CY151	Engineering Chemistry Lab	0	0	3	2

List of Experiments:

1) Estimation of Iron in Hematite
2) Estimation of copper in brass
3) Determination of pKa and Ka of a weak acid
4) Conductometric titration of strong acids with Strong base
5) Estimation of total chromium by colorimetry
6) Verification of Nernst Equation
7) Determination of molecular weight of the polymer by Viscometry
8) Determination of COD in a given water sample
9) Estimation of total hardness of water
10) Estimation of chloride content in water
11) Determination of percentage of composition by using Abbe's refractometer
12) Study of three component system
13) Estimation of dissolved oxygen in the given water sample
14) Estimation of N_2 in ammonium fertilizer

Note: Any 8 experiments have to be done

References

1) A. I. Vogel, Textbook of quantitative chemical analysis, Prentice Hall, 2000
2) Laboratory Manual, Department of Applied Sciences, National Institute of Technology Goa
3) S. Rattan, Experiments in applied chemistry, 3rd edition, S. K.Kataria & Sons, 2011.

Course Code	Course Name	L	T	P	Credits
EC151	Basics of Electronics Engineering Lab	0	0	3	1* (Half-Semester Course)

Course Objective

To provide hand on experience on electronic systems and to experimentally demonstrate basic electronic circuit design and analysis.

Course Outcomes

At the completion of this course, the student shall acquire knowledge and ability

1. Plot the characteristics of semiconductor diodes and transistors to understand their behavior.
2. Design, construct and test amplifier circuits and interpret the results.
3. Operate electronic test equipment and hardware tools to characterize the behavior of devices and circuits
4. Design and test basic digital logic gates based circuits

Relationship of Course Outcomes to Program Outcomes

H = High correlation; M = Medium correlation; L = Low correlation

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		H	M	L							
CO2	H		H	M								
CO3	H		M		L							
CO4	H			H	L							

Syllabus (Any 5 Experiments)

1. Identification of different passive and active components and familiarization with basic electronic Instruments.
2. Study of Electronic equipment's - Power supply, Multimeter, Function generator, UWS and Digital storage Oscilloscope (DSO)
3. Measurement of AC & DC voltage, Current & resistance by digital multimeter, connection, display & measurement of various types of periodic signals (Sine, square & Triangular).
4. Study of static V-I characteristics of semiconductor diode & Zener diode.
5. Study of Halfwave and Full Wave rectifiers using junction diode and filter circuit.
6. Study of transistor characteristics, Op amp as inverting & amp; non-inverting amplifier.
7. Truth table verification of basic logic gates and design of a simple combinational circuit using logic gates.

References

1. S. Sedra and K. C. Smith, *Microelectronic Circuits*, Oxford University Press , 6th edition
2. Leach , Malvino, Saha, *Digital Principles and Applications*, McGraw Hill Education , 8th edition
3. Boylestad, Robert L., Louis Nashelsky, *Electronic Devices and Circuit*, Pearson , 11th edition
4. B Razavi, *Microelectronics*, Wiley India Pvt. Ltd , student edition.

Course Code	Course Name	L	T	P	Credits
ME151	Workshop Practices	0	0	3	2

Course Objective

The main objective of studying this course is to develop a comprehensive understanding of carpentry, fitting, Machining and joining techniques.

Course Outcomes

At the completion of this course, the student shall acquire knowledge and ability

CO1. to demonstrate different workshop skills including carpentry, fitting, and welding methods.

CO2. to produce different jobs using carpentry, fitting, and welding techniques.

CO3. to explain advance manufacturing techniques including CNC, Casting, and Power tools

Relationship of Course Outcomes to Program Outcomes

H = High correlation; M = Medium correlation; L = Low correlation

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L	M									
CO2	M	L	M						H			
CO3	H											

Syllabus

1. **Carpentry:** Use and setting of hand tools like hacksaws, Jack planes, chisels and gauges for construction of various joints, planning, chiselling, marking and sawing practice
2. **Fitting:** Demonstration of various tools and equipment used in fitting shop, filing, cutting, tapping, male and female joints, stepped joints
3. **Welding:** Demonstration of various welding machines and equipment, Practice on Butt joint and Lap joint using electric arc welding
4. Demonstration of work on lathe, drilling machines, CNC Machine
5. Demonstration of casting practices and mould making.
6. Demonstration and practices on Power tools and Safety Practices.

Reference Books/Material

1. Hajra Choudhary, S. K., Hajra Choudhary, A. K. Roy, N., *Elements of Workshop Technology. Vol. I and II*, Media promoters and publishers Pvt Ltd, 2007.
2. Rao, P. N., *Manufacturing Technology. Vol. I and II*, 2nd Edition. TMH Education, 2006.

Course Code	Course Name	L	T	P	Credits
PE150	Physical Education	1	0	2	0# (Non-credit course)

Course Objective

The main objective of studying this course is to acquire knowledge about the human body as its functioning is influenced by physical activities and to develop positive health-related fitness habits which can be practiced lifelong so as to prevent degenerative diseases.

Course Outcomes

At the completion of this course, the student shall acquire knowledge and ability

CO1. to understand the fitness components and their relation to sports performance.
CO2. The Students are aware of a balanced mind and body development. They also develop social relationships with others, leadership qualities and their own personality improvement.
CO3. to execute physical movements correctly and execute them in a perfect way in relation to the functional aspect of various systems.
CO4. Students learn the basic nutritional guidelines and plans related to macro, micronutrients and a healthy diet to control obesity to lead a healthy life.
CO5. to understand the cultural knowledge and the skills necessary for their personal and social survival.

Relationship of Course Outcomes to Program Outcomes

H = High correlation; M = Medium correlation; L = Low correlation

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M			H			
CO2						L		H				M
CO3												H
CO4						M						H
CO5						M			H			

Syllabus

Module 1: Fitness: Definition and meaning of Physical fitness, Role and scope of physical fitness, Components of physical fitness, Types of physical fitness, Health related physical fitness, Skill related physical fitness, General and specific warming up. (Practical)

Module 2: Sports for Technical Field: Relaxing techniques, Stress management, Sports for relax, Benefits of Exercise-Psychological and Physiological aspects, Self Confidence and Motivation.

Module 3: Anatomy and Physiology: Basic anatomy, Exercise physiology, Body type, Sports Injury and prevention and their management.

Module 4: Lifestyle Disease and Sports: Diet, Heart attack, Blood pressure, Cholesterol, Obesity, Stress.

Module 5: Indigenous Sports: Kabaddi and Kho Kho - Introduction to the game and historical development with special reference to India, Rules and their interpretations, Fundamental Skills, General Skills of the games

Reference Books/Material

1. Mood, D, Musker, F and Rink, J. (1999). *Sports and recreational activities.* Boston: McGraw-Hill.
2. Rink, J.E. (1998). *Teaching physical education for learning (3rd Ed.).* Boston: McGraw-Hill.
3. Dey Swapan Kumar (2012). *A Textbook of Sports and Exercise Physiology, New Delhi*: JaypeeBrothers Medical Publications.ISBN: 9789350258736.
4. Nick Draper and Helen Marshall. (2013), *Exercise Physiology: For Health and Sports Performance,* Harlow/GB: Pearson Education Publication Limited. ISBN 13: 9780273778721ISBN 10: 0273778722.
5. William D. McArdle, Frank I. Katch, Victor L. Katch. (2009). *Exercise Physiology: Nutrition, Energy and Human Performance.* United States: Lippincott Williams and Wilkins ISBN:1608318591.
6. Robert Weinberg and Daniel Gould (2010). *Foundations of Sport and Exercise Psychology*. USA:Human Kinetics ISBN: 0736083235.
7. Aidan.P.Moran (2012). *Sport and Exercise Psychology A Critical Introduction*, 2nd Edition, Newyork:Routledge, ISBN: 978041543430.

राष्ट्रीय प्रौधोगिकी संस्थान गोवा

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