SOMAIYA VIDYAVIHAR UNIVERSITY

K J Somaiya College of Engineering

Syllabus
First Year B. Tech
(Common to All)

From
Academic Year 2023-24
(SVU-KJSCE 2.0)

Presented and Approved in the 9th Meeting of the Academic Council of Somaiya Vidyavihar University held on 5th April, 2023

It is notified for information of all concerned that the Boards of Studies of various departments at their meeting held on following dates, and the subsequent meeting of the Academic Council held on 05 April 2023 amended the syllabus of FY B Tech (Common to all disciplines) and same be brought in to force from Academic Year 2023-24.

- **Dates of Approvals and Amendments:**

1. 1st Meeting of the Board of Studies in Robotics and Artificial Intelligence held on 20/03/2023
2. 8th Meeting of the Board of Studies in Information Technology (for IT and AI-DS programs) held on 21/03/2023
3. 8th Meeting of the Board of Studies in Mechanical Engineering held on 23/03/2023
4. 8th Meeting of the Board of Studies in Electronics and Telecommunications Engineering held on 23/03/2023
5. 8th Meeting of the Board of Studies in Computer Engineering held on 24/03/2023
6. 8th Meeting of the Board of Studies in Electronics and Computer Engineering held on 24/03/2023
7. FoET dated --/--/2023 (presented by the Dean, Faculty of Technology by mail dated 31 March 2023)
8. 9th Meeting of the Academic Council held on 05/04/2023

- **Preamble**

With Academic Year 2023-24, we bring the second revision of the curriculum of our UG programs in Engineering and Technology. K J Somaiya College of Engineering, as an autonomous college earlier and now as a part of the Somaiya Vidyavihar University has always tried to provide an environment for the students to learn fundamentals, share knowledge, get the latest trends in Technology and create facts from fictions. Acknowledging the penetration of Computer Technology and Data Science into all sectors of Engineering, we are launching three new UG programs namely Artificial Intelligence & Data Science, Computer & Communication Engineering and Robotics & Artificial Intelligence from Academic Year 2023-24.

Even before the NEP-2020 guidelines, the approach of KJSCE towards curriculum designing has always been towards the 360-degree development of students focusing on both, academic as well as extracurricular skills. This has given us an advantage over other institutions in implementation of NEP-2020 guidelines as now we are in a process of fine-tuning our curricular framework with the NEP, which is a smooth transition for us rather than making an abrupt change in the academic policies of our college. The features like skill and ability enhancement courses, value added courses, and foundation courses etc. are introduced in the curriculum in a systematic manner.

In the First Year, students are encouraged to select from a wide variety of exposure courses from music to mountaineering, from badminton to broadcasting and from film-making to football. Keeping with the current needs, every student will learn programming skills using python programming in the first semester while they will learn C-programming, which forms the backbone of embedded systems, in the second semester. The contents and tutorials of Mathematics are deigned to imbibe the real feel of mathematical concepts and methods in engineering applications. Apart from the strong foundations of basic and engineering sciences, courses like AutoCAD will develop design skills and courses like presentation and communication skills will develop proficiency of formal and public communication in students. The basic workshop practice course is redesigned and new branch-specific trades are introduced in the second semester.

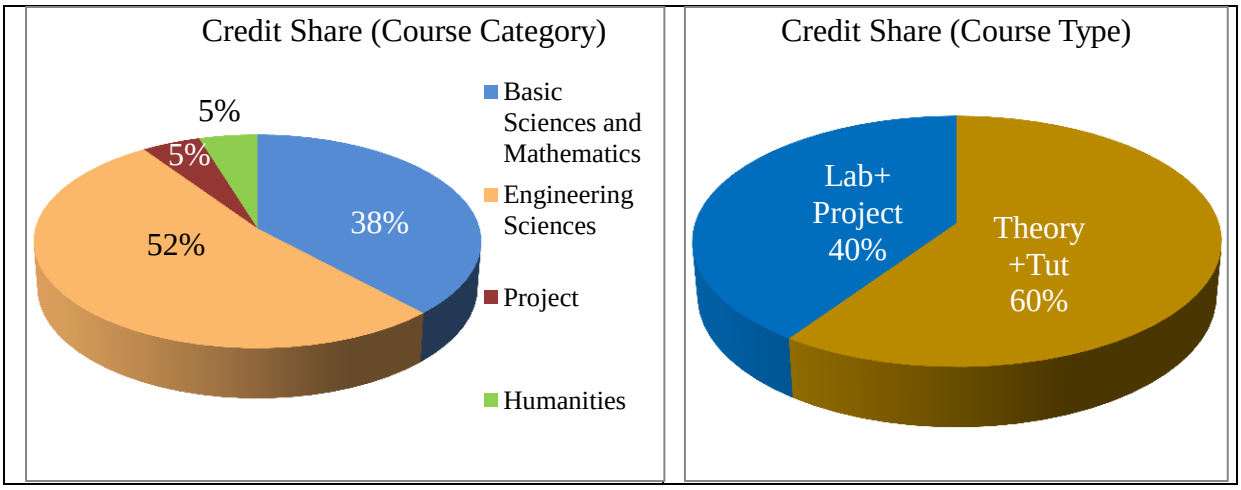
Perhaps, the most important part of engineering education has been the project work, which trains students not only to become technically sound but also to build-up his/her social and societal connect. Keeping this in mind, we have introduced a new course called the Project-Based Learning from first year itself to orient students to an interdisciplinary environment. The experiential learning students get through this course will be more important than the technical learning they get through traditional courses. In this course, students are given a freedom to select their project topic on solutions of some real-life problems from engineering, healthcare, environment and sustainability, energy-efficiency, agriculture etc. Through this course, they will learn life-skills such as team-building, design thinking, engineering ethics, project management, methodologies, product development and so on. The course is completely hands-on type covering Arduino-based applications development and introduces robotics and automation techniques through simple toys and kits. I am sure students would be excited to learn this revised curriculum SVU-R2023!

Dr. Shubha Pandit,
Principal,
K J Somaiya College of Engineering

- **Salient features and changes with respect to SVU R-2020:**

1. Introduced Project-based learning course
2. Python Programming is shifted to semester I and C Programming in semester II
3. Communication Skills is modified to Presentation and Communication Skills with more stress on contemporary methods of communication instead of focusing only on language skills
4. Chemistry syllabus is modified by about 50% to include foundations of new courses added in higher semesters.
5. Basic Workshop Practice course is modified to add discipline-specific jobs/hands-on skills in the second semester.
6. Term work, Oral/Practical Exam is replaced by Lab/Tutorial CA (continuous Assessment)
7. Relative grading system will be implemented on progressive basis
8. End semester examination will be conducted for 50 marks
9. Term work defaulter policy (semester penalty) removed

- **Aspects of NEP-2020 guidelines covered during First Year:**
- Inclusion of credit-based courses and projects in the areas of community engagement and service and environmental education to include areas such as climate change, pollution, waste management, sustainable development etc. – covered through PBL course
- Ability Enhancement Compulsory course – covered through Presentation and Communication Skills
- Skill Enhancement Compulsory Course – covered through Computer Programming, Engineering Drawing, Workshop Practice
- Value Added Course – A variety of courses offered under "Exposure courses" such as Yoga, Sports, Indian Classical Music etc.



- **Program Outcomes (PO) – Common to all Disciplines**

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, review 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 modeling 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, cultural, environmental, health, safety and legal issues relevant to the professional engineering practice; understanding the need of sustainable development

PO7 **Multidisciplinary Competence:** Recognize/study/analyze/provide solutions to real-life problems of multidisciplinary nature from diverse fields

PO8 **Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice.

PO9 **Individual and Teamwork:** 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.

- **Acronyms use:**

1. Acronyms for category of courses and syllabus template

Acronym	Description	Acronym	Description
BS	Basic Science Courses	**CA**	Continuous Assessment (Theory Course)
ES	Engineering Science	**ESE**	End Semester Exam
HS	Humanities, Social Sciences and Management Courses	**IA**	Internal Assessment
PC	Professional Core Courses	**LAB/TUT CA**	Continuous Assessment of Laboratory/Tutorial
PE	Professional Elective courses	**TH**	Theory
OET	Open Elective – Technical	**TUT**	Tutorial
OEHM	Open Elective – Humanities and Management	**ISE**	In- Semester Examination
LC	Laboratory Courses	**CO**	Course Outcome
PR	Project	**PO**	Program Outcome
EX	Exposure Course	**PSO**	Program specific Outcome

2. Type of Course

Acronym	Description
C	Core Course
E	Elective Course
O	Open Elective Technical
H	Open Elective - Humanities/ Management/ SWAYAM-NPTEL/ Coursera
P	Project
L	Laboratory Course
T	Tutorial
X	Exposure course
W	Workshop
V	Values Based Course

3. Eight Digit Course code e.g. 216U06C101

Acronym Serially as per code	Description
2	SVU R-2023 (Second revision)
16	College code
U	Alphabet code for type of program
05/06	Program/Department code
C	Type of course
1	Semester number (Semester I)
01	Course serial number

Teaching, Credit and Evaluation Scheme

SEMESTER I

Course-Group C

Teaching and Credit Scheme

Course Code	Name of the Course	Teaching Scheme TH-PR-TUT	Total (hrs.)	Credit Scheme TH-PR-TUT	Total Credits	Course Category
216U06C101	Applied Mathematics – I	3 – 0 – 1	4	3 – 0 – 1	4	BS
216U06C103	Engineering Chemistry	3 – 0 – 0	3	3 – 0 – 0	3	BS
216U06C105	Engineering Drawing	2 – 0 – 1	3	2 – 0 – 1	3	ES
216U06C106	Elements of Electrical and Electronics Engineering	3 – 0 – 0	3	3 – 0 – 0	3	ES
216U06L101	Python Programming	0 – 2 – 2	4	0 – 1 – 2	3	ES
216U06L103	Engineering Chemistry Laboratory	0 – 2 – 0	2	0 – 1 – 0	1	BS
216U06L105	Engineering Drawing Laboratory	0 – 2 – 0	2	0 – 1 – 0	1	ES
216U06L106	Elements of Electrical and Electronics Engineering Laboratory	0 – 2 – 0	2	0 – 1 – 0	1	ES
216U06P101	Project-Based Learning	0 – 0 – 2	2	--	--	PR
216U06W101	Basic Workshop Practice – I	0 – 2 – 0	2	0 – 2 – 0	2	ES
216U06X101	Exposure Course	0 – 2 – 0	2	--	--	EX
	Total		**29**		**21**	

Evaluation Scheme*

Course Code	Name of the Course	LAB/ TUT CA#	CA		ESE	Total
			IA	ISE		
216U06C101	Applied Mathematics – I	25	20	30	50	125
216U06C103	Engineering Chemistry	--	20	30	50	100
216U06C105	Engineering Drawing	--	20	30	50	100
216U06C106	Elements of Electrical and Electronics Engineering	--	20	30	50	100
216U06L101	Python Programming	75	--	--	--	075
216U06L103	Engineering Chemistry Laboratory	50	--	--	--	050
216U06L105	Engineering Drawing Laboratory	50	--	--	--	050
216U06L106	Elements of Electrical and Electronics Engineering Laboratory	50	--	--	--	050
216U06P101	Project-Based Learning	--	--	--	--	--
216U06W101	Basic Workshop Practice – I	50	--	--	--	050
216U06X101	Exposure Course	--	--	--	--	--
	Total	**300**	**080**	**120**	**200**	**700**

*Starting from A.Y.2023-24, relative grading system will be implemented for FY B Tech on progressive basis
#Lab/Tut CA will comprise of a variety of components such as quizzes, onscreen exam, viva-voce, journal, GDs etc. throughout the semester. Details will be shared by course teachers at the beginning of every semester

SEMESTER I

Course-Group P

Teaching and Credit Scheme

Course Code	Name of the Course	Teaching Scheme TH-PR-TUT	Total (hrs.)	Credit Scheme TH-PR-TUT	Total Credits	Course Category
216U06C101	Applied Mathematics – I	3 – 0 – 1	4	3 – 0 – 1	4	BS
216U06C102	Engineering Physics	3 – 0 – 0	3	3 – 0 – 0	3	BS
216U06C104	Engineering Mechanics	3 – 0 – 0	3	3 – 0 – 0	3	ES
216U06L101	Python Programming	0 – 2 – 2	4	0 – 1 – 2	3	ES
216U06L102	Engineering Physics Laboratory	0 – 2 – 0	2	0 – 1 – 0	1	BS
216U06L104	Engineering Mechanics Laboratory	0 – 2 – 0	2	0 – 1 – 0	1	ES
216U06P101	Project-Based Learning	0 – 0 – 2	2	--	--	PR
216U06T101	Presentation and Communication Skills	0 – 0 – 2	2	0 – 0 – 2	2	HS
216U06W101	Basic Workshop Practice – I	0 – 2 – 0	2	0 – 2 – 0	2	ES
216U06X101	Exposure Course	0 – 2 – 0	2	--	--	EX
	Total		**26**		**19**	

Evaluation Scheme*

Course Code	Name of the Course	Lab/ TUT CA#	CA		ESE	Total
			IA	ISE		
216U06C101	Applied Mathematics – I	25	20	30	50	125
216U06C102	Engineering Physics	--	20	30	50	100
216U06C104	Engineering Mechanics	--	20	30	50	100
216U06L101	Python Programming	75	--	--	--	075
216U06L102	Engineering Physics Laboratory	50	--	--	--	050
216U06L104	Engineering Mechanics Laboratory	50	--	--	--	050
216U06P101	Project-Based Learning	--	--	--	--	--
216U06T101	Presentation and Communication Skills	50	--	--	--	050
216U06W101	Basic Workshop Practice – I	50	--	--	--	050
216U06X101	Exposure Course	--	--	--	--	--
	Total	**300**	**060**	**090**	**150**	**600**

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#Lab/Tut CA will comprise of a variety of components such as quizzes, onscreen exam, viva-voce, journal, GDs etc. throughout the semester. Details will be shared by course teachers at the beginning of every semester

SEMESTER II

Course-Group C

Teaching and Credit Scheme

Course Code	Name of the Course	Teaching Scheme TH-PR-TUT	Total (hrs.)	Credit Scheme TH-PR-TUT	Total Credits	Course Category
216U06C201	Applied Mathematics – II	3 – 0 – 1	4	3 – 0 – 1	4	BS
216U06C102	Engineering Physics	3 – 0 – 0	3	3 – 0 – 0	3	BS
216U06C104	Engineering Mechanics	3 – 0 – 0	3	3 – 0 – 0	3	ES
216U06L102	Engineering Physics Laboratory	0 – 2 – 0	2	0 – 1 – 0	1	BS
216U06L104	Engineering Mechanics Laboratory	0 – 2 – 0	2	0 – 1 – 0	1	ES
216U06L201	Programming in C	0 – 2 – 2	4	0 – 1 – 2	3	ES
216U06P101	Project-Based Learning	0 – 2 – 0	2	0 – 2 – 0	2	PR
216U06T101	Presentation and Communication Skills	0 – 0 – 2	2	0 – 0 – 2	2	HS
216U06W201	Basic Workshop Practice – II	0 – 2 – 0	2	0 – 2 – 0	2	ES
216U06X101	Exposure Course	0 – 2 – 0	2	--	--	EX
	Total		**26**		**21**	

Evaluation Scheme*

Course Code	Name of the Course	Lab/ TUT CA#	CA		ESE	Total
			IA	ISE		
216U06C201	Applied Mathematics – II	25	20	30	50	125
216U06C102	Engineering Physics	--	20	30	50	100
216U06C104	Engineering Mechanics	--	20	30	50	100
216U06L102	Engineering Physics Laboratory	50	--	--	--	050
216U06L104	Engineering Mechanics Laboratory	50	--	--	--	050
216U06L201	Programming in C	75	--	--	--	075
216U06P101	Project-Based Learning	50	--	--	--	050
216U06T101	Presentation and Communication Skills	50	--	--	--	050
216U06W201	Basic Workshop Practice – II	50	--	--	--	050
216U06X101	Exposure Course	--	--	--	--	--
	Total	**350**	**060**	**090**	**150**	**650**

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#Lab/Tut CA will comprise of a variety of components such as quizzes, onscreen exam, viva-voce, journal, GDs etc. throughout the semester. Details will be shared by course teachers at the beginning of every semester

Note: As per college internship policy, it is mandatory for every student to complete 10 weeks of internship spanning over the four years of B. Tech Programme over and above the academic credits. Students can take up internships in community services / socially relevant projects (optional and limited to 4 weeks) and in the technical domain (minimum 6 weeks or more). Students will be awarded an internship completion certificate along with their graduation.

SEMESTER II

Course-Group P

Teaching and Credit Scheme

Course Code	Name of the Course	Teaching Scheme TH-PR-TUT	Total (hrs.)	Credit Scheme TH-PR-TUT	Total Credits	Course Category
216U06C201	Applied Mathematics – II	3 – 0 – 1	4	3 – 0 – 1	4	BS
216U06C103	Engineering Chemistry	3 – 0 – 0	3	3 – 0 – 0	3	BS
216U06C105	Engineering Drawing	2 – 0 – 1	3	2 – 0 – 1	3	ES
216U06C106	Elements of Electrical and Electronics Engineering	3 – 0 – 0	3	3 – 0 – 0	3	ES
216U06L103	Engineering Chemistry Laboratory	0 – 2 – 0	2	0 – 1 – 0	1	BS
216U06L105	Engineering Drawing Laboratory	0 – 2 – 0	2	0 – 1 – 0	1	ES
216U06L106	Elements of Electrical and Electronics Engineering Laboratory	0 – 2 – 0	2	0 – 1 – 0	1	ES
216U06L201	Programming in C	0 – 2 – 2	4	0 – 1 – 2	3	ES
216U06P101	Project-Based Learning	0 – 2 – 0	2	0 – 2 – 0	2	PR
216U06W201	Basic Workshop Practice – II	0 – 2 – 0	2	0 – 2 – 0	2	ES
216U06X101	Exposure Course	0 – 2 – 0	2	--	--	EX
	Total		**29**		**23**	

Evaluation Scheme*

Course Code	Name of the Course	Lab/ TUT CA#	CA		ESE	Total
			IA	ISE		
216U06C201	Applied Mathematics – II	25	20	30	50	125
216U06C103	Engineering Chemistry	--	20	30	50	100
216U06C105	Engineering Drawing	--	20	30	50	100
216U06C106	Elements of Electrical and Electronics Engineering	--	20	30	50	100
216U06L103	Engineering Chemistry Laboratory	50	--	--	--	050
216U06L105	Engineering Drawing Laboratory	50	--	--	--	050
216U06L106	Elements of Electrical and Electronics Engineering Laboratory	50	--	--	--	050
216U06L201	Programming in C	75	--	--	--	075
216U06P101	Project-Based Learning	50	--	--	--	050
216U06W201	Basic Workshop Practice – II	50	--	--	--	050
216U06X101	Exposure Course	--	--	--	--	--
	Total	**350**	**080**	**120**	**200**	**750**

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#Lab/Tut CA will comprise of a variety of components such as quizzes, onscreen exam, viva-voce, journal, GDs etc. throughout the semester. Details will be shared by course teachers at the beginning of every semester

Note: As per college internship policy, it is mandatory for every student to complete 10 weeks of internship spanning over the four years of B. Tech Programme over and above the academic credits. Students can take up internships in community services / socially relevant projects (optional and limited to 4 weeks) and in the technical domain (minimum 6 weeks or more). Students will be awarded an internship completion certificate along with their graduation.

Course-wise Detailed Syllabus

Course Code	Name of the Course			
216U06C101	Applied Mathematics - I			
Teaching Scheme (Hrs./Week)	TH	P	TUT	Total
	03	--	01	04
Credits Assigned	03	--	01	04

Evaluation Scheme	Marks				
	LAB/TUT CA	CA (TH)		ESE	Total
		IA	ISE		
	25	20	30	50	125

Course pre-requisites:
Basics of Matrices, Inverse and Adjoint, Differentiation Techniques, Basics of Complex numbers, Basics of Differential Equations

Course Objectives:
The objective of the course is to impart knowledge of De-Moivre's theorem, hyperbolic functions and logarithm of complex numbers. The course introduces the concept of partial differentiation and its applications to find extreme values of a function and Jacobian. The concept of rank of matrix, solving system of linear equations is explained in detail. The course communicates the methods of solving linear differential equations.

Course Outcomes (CO):
At the end of successful completion of the course the student will be able to

CO1. Solve problems involving different forms and properties of complex numbers, hyperbolic functions and logarithm of complex numbers.
CO2. Apply the concept of rank of a matrix and numerical methods to solve system of linear equations.
CO3. Find partial derivatives of multivariable functions, apply the concept of partial differentiation to find maxima and minima of 2-variable functions
CO4. Apply Euler's theorem to prove results related to Homogeneous functions.
CO5. Identify and solve different types of ordinary differential equations using various methods.

Module No.	Unit No.	Contents	No of Hrs	CO
1	**Complex Numbers, Hyperbolic Functions and Logarithm of Complex Number**		**12**	**CO1**
	1.1	Statement of De Moivre's theorem and related examples		
	1.2	Powers and roots of complex numbers		
	1.3	Circular functions and hyperbolic functions of complex number		
	1.4	Inverse circular and inverse hyperbolic functions		
	1.5	Logarithm of complex numbers		
	1.6	Separation of real and imaginary parts of a function		
		#Self-learning topics: Expansion of $sinn\theta$, $cosn\theta$ in terms of sine and cosine of multiples of angle θ and expansion of $sinn\theta$, $cosn\theta$ in powers of $sin\theta$, $cos\theta$		
2	**Rank of Matrix and System of Equations**		**08**	**CO2**
	2.1	Types of matrices: Hermitian, Skew-Hermitian, Unitary and Orthogonal matrix		
	2.2	Rank of a matrix using row echelon forms, reduction to normal form		
	2.3	System of homogeneous and non-homogeneous equations, their consistency and solutions		
	2.4	Linearly dependent and independent vectors		
	2.5	Solution of system of linear algebraic equations by (a) Gauss Seidal method (b) Jacobi iteration method		
		#Self-learning topics: Symmetric, Skew-symmetric matrices and properties, Properties of adjoint and inverse of a matrix		
3	**Partial Differentiation and Application**		**09**	**CO3**
	3.1	Functions of several variables, Partial derivatives of first and higher order (definition using limits and simple problems)		
	3.2	Differentiation of composite functions		
	3.3	Maxima and minima of a function of two independent variables		
	3.4	Introduction of Jacobian of two and three independent variables (simple problems)		
4	**Homogeneous Functions**		**04**	**CO4**
	4.1	Euler's theorem on homogeneous functions with two and three independent variables (statement only) and problems		
	4.2	Deductions(Corollaries) from Euler's theorem (statements only) and problems		
5	**Linear Differential Equations of First and Higher Order**		**12**	**CO5**
	5.1	Differential Equation of first order and first degree- Exact differential equations, Equations reducible to exact equations by integrating factors.		
	5.2	Linear differential equations (Review), Equation reducible to linear form. Applications of Differential Equation of first order and first degree		
	5.3	Linear Differential Equation with constant coefficients: Complimentary 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^n, $e^{ax}V$		

	5.4	Method of variation of parameters		
		#Self-learning topic: Bernoulli's equation. Equation reducible to Bernoulli's equation. Cauchy's homogeneous linear Differential Equation		
			Total	**45**	**--**

#Students should prepare all self-learning topics on their own. Self-learning topics will enable students to gain extended knowledge of the topic. Assessment of these topics may be included in Tutorials.

References

Sr. No	**Name/s of Author/s**	**Title of Book**	**Publisher**	**Edition/ Year**
1	B. S. Grewal	Higher Engineering Mathematics	Khanna Publications, India	43rd/e, 2014
2	Shanti Narayan	A text book of Matrices	S. Chand, India	10th/e, 2004
3	Erwin Kreyszig	Advanced Engineering Mathematics	Wiley Eastern Limited, India	10th/e 2015
4	Ramana B.V.	Higher Engineering Mathematics	Tata Mcgraw Hill New Delhi, India	34th/e, 2019 Reprint
5	Glyn James	Advanced Modern Engineering Mathematic	Pearson Publication India	4th/e, 2010

Course Code	Name of the Course			
216U06C102	Engineering Physics			
Teaching Scheme	TH	P	TUT	Total
	03	--	--	03
Credits Assigned	03	--	--	03

Evaluation Scheme	Marks				
	LAB/TUT CA	CA (TH)		ESE	Total
		IA	ISE		
	--	20	30	50	100

Course pre-requisites:

Physics: Metric units and conversions, basic concepts and laws of optics, electricity and magnetism, basic mechanical and thermal properties of solids, electrical properties of conductors and semiconductors, particle properties of radiation, quantum theory prior to de' Broglie hypothesis

Mathematics: A good grasp of differential equations and integration, vectors and vector operations, trigonometric operations and identities, logarithms, coordinate system (Cartesian), complex numbers, probability, basic matrix operations

Course Objectives:

- This Physics course is designed to establish strong foundations of Engineering Sciences by using a problem-solving approach to learn fundamental physical concepts and mathematical foundations of a variety of real-life applications.
- The course covers areas of both, pure and applied Physics such as laser and fibre optics, electromagnetism, plasma physics, semiconductors, dielectrics, liquid crystals, and Physics of sensors used in IoT applications.
- The course is also aimed to convey the importance of quantum mechanics for futuristic engineering and computing applications.

Course Outcomes (CO):

At the end of successful completion of the course the student will be able to

CO1. Explain a variety of optical phenomena using concepts of wave optics and photonics
CO2. Analyse basic physical properties of technologically important engineering materials
CO3. Identify the scope of quantum mechanics in engineering and computing applications
CO4. Solve engineering problems using mathematical foundations of electromagnetism and plasma physics
CO5. Correlate physics of different types of sensors used in IoT applications

Module No.	Unit No.	Contents	Hrs/ week	CO
1	**Photonics**		**09**	**CO1**
	1.1	Principles of Lasers: Laser properties and parameters, Interaction of radiation with matter, Rate equations and Einstein's coefficients, population inversion, pumping, metastable states, optical resonator, threshold condition		
	1.2	Optical Fibres: Total internal reflection, numerical aperture, type of optical fibres, modes of propagation, V-number, attenuation and dispersion, bit rate, optical window		
2	**Engineering Materials**		**10**	**CO2**
	2.1	Physics of Semiconductors: Carrier concentration in intrinsic and extrinsic semiconductors, charge carrier transport and current mechanisms, Fermi-Dirac statistics, temperature dependence of Fermi-Dirac function, Fermi level and effect of doping		
	2.2	Dielectrics: Dielectric parameters, types of polarization and their expressions, frequency dependence of dielectric constant		
	2.3	Liquid crystals: Liquid crystal phases, properties, application in displays		
3	**Introductory Quantum Mechanics**		**10**	**CO3**
	3.1	De' Broglie hypothesis and illustrative examples		
	3.2	Uncertainty principle and illustrative examples		
	3.3	Wave function, time dependent Schrodinger equation (1-dimensional), time-independent form, illustrative application to particle in a box problem		
	3.4	Basics of quantum computing – qubits, quantum logic gates, quantum circuits, proposed applications		
4	**Electromagnetism and Introduction to Plasma Physics**		**09**	**CO4**
	4.1	Gradient, divergence, curl, physical interpretations, fundamental theorems of vector calculus		
	4.2	basic laws of electricity and magnetism in differential and integral forms		
	4.3	Electromagnetic wave equation (1-dimensional), speed of light		
	4.4	Plasmas and their characterization, Basic plasma concepts, Plasma parameters, waves in plasmas		
5	**Physics of Sensors for IoT Applications**		**07**	**CO5**
	5.1	Review of different types of sensors used in IoT		
	5.2	Electro-optic Sensors: IR sensors, Image sensors		
	5.3	Mechanical Sensors: Pressure and Motion Sensors		
	5.4	Environmental Sensors: Temperature and Humidity Sensors		
		Total	**45**	**--**

References

Sr. No	Name/s of Author/s	Title of Book	Publisher	Edition/ Year
1	M N Avadhanulu, P G Kshirsagar, TVS Arun Murthy	A Textbook of Engineering Physics	S Chand	11th/e, 2018
2	Gaur, Gupta	Engineering Physics	Dhanpat Rai, India	8/e, 2018
3	Ajoy Ghatak	Optics	McGraw Hill India	6th Edition, 2017
4	Arthur Beiser	Concepts of Modern Physics	McGraw Hill India	7th Edition, 2017
5	David Griffiths	Introduction to Electrodynamics	PHI	5th Edition, 2015
6	Kourosh Kalantar-zadeh	Sensors: An Introductory Course	Springer	2013
7	F.F. Chen	Introduction to Plasma physics and controlled fusion	Springer	2016

Course Code	Name of the Course			
216U06C103	Engineering Chemistry			
Teaching Scheme (Hrs./Week)	**TH**	**P**	**TUT**	**Total**
	03	--	--	03
Credits Assigned	03	--	--	03

Evaluation Scheme	**Marks**				
	LAB/TUT CA	**CA (TH)**		**ESE**	**Total**
		IA	**ISE**		
	--	20	30	50	100

Course pre-requisites: Nil

Course Objectives:

The objective of course is to appreciate the basic concepts of chemistry behind the development of futuristic materials and their applications in engineering and technology. The course objective is to understand chemical processes involved in development of sustainable energy sources. To analyse the knowledge of analytical techniques involved in the analysis and characterization of chemical compounds, nanomaterial.

Course Outcomes (CO):

CO1. Identify and evaluate emerging technologies and best practices in water treatment and monitoring to continuously improve process.

CO2. Identify and select different types of engineering materials including polymer ceramic, composite and metals for different application based on properties applications and limitations.

CO3. Design and evaluate sustainable energy system such as solar, hydrocarbon, biodiesel, power alcohol including power generation and storage system.

CO4. Understand and apply basic concepts of spectroscopy and electro-analytical technique in characterizing chemical compounds

CO5. Understand the applications and limitations of computer applications in chemistry and identify the best practices for e waste management

Module No.	Unit No.	Contents	No of Hrs.	CO
1	**Technologies in Water Quality Monitoring**		**09**	**CO1**
	1.1	Introduction, Types of Hardness, Equivalence of $CaCO_3$, Experimental determination of hardness		
	1.2	Emerging Technology for Sustainable Water Treatment: Lime soda method Zeolite method, Ion Exchange process, Methods to determine extent of water pollution, BOD, COD, Treatment of industrial wastewater.		
	1.3	Artificial Intelligence & Internet of Things in Water Management: artificial intelligence and machine learning in integrated water system		
2	**Materials in Engineering Applications**		**11**	**CO2**
	2.1	Polymers: Polymers as Industrials Materials, Conducting polymers, Fabrications of Polymers, Biodegradable Polymers		
	2.2	Nanomaterials: Introductions, Classifications, Growth Techniques for Nanomaterials, Applications		
	2.3	Common Materials used in Biomedical Applications: Metals & Alloys, Bio Ceramics, Composites, new materials in prosthetics		
	2.4	Materials for MEMS and microsystem: Introduction, Active substrate materials, Silicon as substrate materials, Working principle of Bio sensors and Chemical Sensors		
3	**Chemistry for Sustainable Energies**		**09**	**CO3**
	3.1	Energy & Sustainable Development, Renewable Energy, Solar Energy, solar Photovoltaic, solar heater		
	3.2	Unit of Energy, Definition, characteristic of good fuel, Calorific value of fuel Hydrocarbon as Fuel, Bio Diesel, Power Alcohol		
	3.3	Rechargeable Batteries: Lead acid battery, Lithium ion battery, Nickel based battery, other battery technology		
4	**Spectroscopy and Instrumental methods of Analysis**		**09**	**CO4**
	4.1	UV spectroscopy, Principle, Instrumentation and application		
	4.2	IR spectroscopy, Basic Principle, Instrumentation and applications		
	4.3	1H NMR Spectroscopy: Principle, Instrumentation, Chemical Shift, Factors affecting chemical shift, Applications		
	4.4	Electroanalytical techniques, pH-metry, Conductometry, Potentiometry		
5	**Chemistry & Computers**		**07**	**CO5**
	5.1	Introduction: Philosophy of Computational Chemistry, tools of Computational Chemistry, Software and Hardware, Applications of Computational Chemistry		
	5.2	Computational approach in Cheminformatics and Bioinformatics		
	5.3	E-waste Management: Sustainable Development & e-waste management, impact of legislations on materials used in electronics, printed circuit boards, Socio-economic factors		
		Total	**45**	**--**

References

Sr. No	Name/s of Author/s	Title of Book	Publisher	Edition/ Year
1	Dr. S.S.Dara, Dr. S.S. Umare	A textbook of Engineering Chemistry	S.Chand,	India Revised edition, 2015
2	Shashi Chawla	A textbook of Engineering Chemistry	Dhanpat Rai & Co	3rd edition, 2017
3	O G Palanna	Enginnering Chemistry	Mc Graw Hill, India	2nd edition, 2017

Course Code	Name of the Course			
216U06C104	Engineering Mechanics			
Teaching Scheme (Hrs./Week)	TH	P	TUT	Total
	03	--	--	03
Credits Assigned	03	--	--	03

Evaluation Scheme	Marks				
	LAB/TUT CA	CA (TH)		ESE	Total
		IA	ISE		
	--	20	30	50	100

Course pre-requisites:
Basics of units and conversions, Basics of Trigonometry, Newton's Laws of Motion

Course Objectives:
Engineering mechanics is the application of physics to solve problems involving common engineering elements. This course introduces system of forces and its effect on stationary and moving objects. The goal of this course is to expose students to problems in real-world scenarios and respond accordingly.

Course Outcomes (CO):
At the end of successful completion of the course the student will be able to

- **CO1.** Evaluate resultant and moment of a force system
- **CO2.** Analyse the concept of kinematics of particle and rigid body.
- **CO3.** Determine centre of gravity of wires (rods), lamina and solids
- **CO4.** Analyse applications of equilibrium using free body diagram
- **CO5.** Analyse the dynamic system using D'Alembert, work energy and impulse momentum principle.

Module No.	Unit No.	Contents	No of Hrs.	CO
1	**System of forces**		**07**	**CO1**
	1.1	System of coplanar forces: Resultant of concurrent forces, parallel forces, non-concurrent non parallel system of forces, moment of force about a point, couples, Varignon's theorem, Principle of transmissibility of forces (Vector and analytical approach).		
	1.2	Resultant of forces in space.		
2	**Kinematics of Particles and Rigid Bodies**		**11**	**CO2**
	2.1	Variable motion, motion curves (a-t, v-t, s-t) (acceleration curves restricted to linear acceleration only), motion along plane curved path, velocity & acceleration in terms of rectangular components, tangential & normal component of acceleration		
	2.2	Introduction to general plane motion, problems based on ICR method for general plane motion of bodies (up to 2 linkage mechanism and no relative velocity method).		
3	**Centroid of Wires and Laminas**		**05**	**CO3**
	3.1	Centroid of wires/rods.		
	3.2	Centroid of plane laminas: Plane lamina consisting of primitive geometrical shapes.		
4	**Equilibrium of Force System and Friction**		**13**	**CO4**
	4.1	Equilibrium of system of coplanar forces: Condition of equilibrium for concurrent forces, parallel forces and non-concurrent, non-parallel force system (general force system), Free body diagram.		
	4.2	Types of support, loads, beams, determination of reactions at supports for various types of loads on beams (excluding internal hinge and compound beam problems).		
	4.3	Laws of friction, cone of friction, angle of repose, equilibrium of bodies on inclined plane, application to problems involving wedges and ladders.		
5	**Kinetics of particle**		**09**	**CO5**
	5.1	Force and acceleration: Introduction to basic concepts, equations of dynamic equilibrium, Newton's second law of motion (only rectilinear motion).		
	5.2	Work energy principle.		
	5.3	Impulse and Momentum: Principle of linear impulse and momentum, law of conservation of momentum, impact and collision, direct central and oblique central impact.		
		Total	**45**	

References

Sr. No	Name/s of Author/s	Title of Book	Publisher	Edition/ Year
1	Tayal, A.K.	Engineering Mechanics, Statics and Dynamics	Universal Publication, India	14th Edition 2011
2	Bhavikatti S. S.	Engineering Mechanics	New Age international, India	Revised Edition 2019
3	Hibbeler, H. C. and Gupta	Engineering Mechanics, Statics and Dynamics	Prentice Hall Private limited, India	Revised Edition 2017
4	Bhattacharyya B.	Engineering Mechanics	Oxford University Press, India	2nd Edition 2014
5	Ram H.D. and Chauhan A.K.	Foundations and Applications of Engineering Mechanics	Cambridge University Press, UK	1st Edition 2015

Course Code	Name of the Course			
216U06C105	Engineering Drawing			
Teaching Scheme (Hrs./Week)	**TH**	**P**	**TUT**	**Total**
	02		01	03
Credits Assigned	02		01	03

Evaluation Scheme	**Marks**				
	LAB/TUT CA	**CA (TH)**		**ESE**	**Total**
		IA	**ISE**		
	--	20	30	50	100

Course pre-requisites:
Knowledge of various geometric constructions, Basics of trigonometry.

Course Objectives:
The students will be able to
1. Familiarize with the conventions and standards along with the principles of projections applied to points and lines.
2. Apply the principles of orthographic projections to draw elevation, plan, end view, isometric views etc.
3. Apply the principles of orthographic projections to draw various views of regular solid objects.
4. Apply the fundamentals of solid geometry and develop lateral surfaces of solids

Course Outcomes (CO):
At the end of successful completion of the course the student will be able to
- **CO1.** Able to visualize and draw projection of lines and planes
- **CO2.** Able to visualize and draw orthographic projection and sectional views of given 3D object.
- **CO3.** Able to visualize and draw isometric drawing.
- **CO4.** Able to draw projection of regular solids
- **CO5.** Able to draw sectional views and lateral development of regular solids

Module No.	Unit No.	Contents	No of Hrs.	CO
1	**Projection of points, lines and planes**		**08**	**CO1**
	1.1	Introduction to Engineering Drawing, Standard sizes of drawing sheets, Types of lines, Dimensioning, Scales, Drawing pencils etc.		
	1.2	Projection of points, Projection of lines inclined to both the reference planes. (Line in 1st quadrant ONLY)		
	1.3	Projection of Planes: Triangular, Square, Rectangular, Pentagonal, Hexagonal and Circular planes inclined to one reference plane only and perpendicular to other.		
2	**Orthographic Projection**		**06**	**CO2**
	2.1	Orthographic projections of simple machine parts by first angle method as recommended by Indian standards		
	2.2	Sectional views of simple machine parts (full section ONLY).		
3	**Isometric View/Drawing**		**04**	**CO3**
	3.1	Introduction to isometric view/drawing, isometric projection		
	3.2	Construction of isometric drawing of simple machine parts		
4	**Projection of Solids**		**06**	**CO4**
	4.1	Introduction to Projection of Solids, Classification of Solids		
	4.2	Projection of right regular solids (prism, pyramid, cylinder, and cone) inclined to one reference plane only (excluding spheres, hollow and composite solids)		
5	**Section and Development of Solids**		**06**	**CO5**
	5.1	Projection of sectional views of solids (prism, pyramid, cylinder, and cone) cut by the plane perpendicular to one and inclined to other reference plane only (excluding curved cutting planes).		
	5.2	Lateral surface development of solids (prism, pyramid, cylinder, and cone) cut by the section plane inclined to one reference plane only. (excluding reverse development)		
		Total	**30**	**--**

References

Sr. No	Name/s of Author/s	Title of Book	Publisher	Edition/ Year
1	N.D. Bhatt	Engineering Drawing	Charotar Publishing House Pvt. Ltd	53rd Revised 2014
2	P. S. Gill	Engineering Graphics and Drafting	S.K. Kataria & Sons	Revised Edition, India, 2014
3	Lakhwinder Pal Singh	Engineering Drawing Principles And Applications	Cambridge University Press	2021

Course Code	Name of the Course			
216U06C106	Elements of Electrical and Electronics Engineering			
Teaching Scheme (Hrs./Week)	**TH**	**P**	**TUT**	**Total**
	03	--	--	03
Credits Assigned	03	--	--	03

Evaluation Scheme	**Marks**				
	LAB/TUT CA	**CA (TH)**		**ESE**	**Total**
		IA	**ISE**		
	--	20	30	50	100

Course pre-requisites:
Knowledge of Basic Electrical parameters: Resistance, Inductance, Capacitance, Frequency, Voltage, Current and Power and Energy, basic laws of magnetism

Course Objectives: It is difficult to imagine life without electricity and electronics. Electricity plays a major role in the working of all minor and major devices used in our day to day life. In this course students acquire fundamental knowledge to understand the design of electrical and electronics systems.

Course Outcomes (CO):

CO1. Analyse resistive networks excited by DC sources using various network theorems
CO2. Demonstrate and analyse steady state response of single phase and three phase circuits
CO3. Understand principles and working of AC and DC machines with their applications.
CO4. Explain rectifier-filter circuits using PN junction diode and voltage regulator circuits using Zener diode
CO5. Understand Bipolar Junction transistor and its applications

Module No.	Unit No.	Contents	No of Hrs.	CO
1	**DC circuits**		**12**	**CO1**
	1.1	Concept of dependent and independent sources, ideal and practical voltage and current sources, Kirchhoff's Laws, source transformation and network terminology.		
	1.2	Resistive network simplification, Series, parallel connection and Star-Delta transformations		
	1.3	Mesh and nodal analysis, concept of super mesh and super node (Analysis only with independent sources)		
	1.4	Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem (Analysis only with independent sources)		
2	**AC circuits**		**15**	**CO2**
	2.1	Generation of alternating voltage, average value, RMS value, form factor, crest factor, phasor representation in rectangular and polar form.		
	2.2	Steady state behaviour of single phase AC circuits with pure R, L, and C, concept of inductive and capacitive reactance, phasor diagram of impedance, phase relationship in voltage and current.		
	2.3	RL, RC and RLC series and parallel circuits, concept of impedance and admittance, power triangle, power factor, active, reactive and apparent power, concept of power factor improvement.		
	2.4	Series and parallel resonance, Q-factor and bandwidth		
	2.5	Three-phase balanced circuits, voltage and current relations in star and delta connections.		
	2.6	Measurement of power in 3-phase system using two wattmeter method		
3	**Electrical Machines**		**12**	**CO3**
	3.1	Single phase transformer construction and principle of working, emf equation of a transformer, losses in transformer, equivalent circuit of Ideal and practical transformer, voltage regulation and efficiency of transformer, phasor diagram at various loading condition (No numerical expected)		
	3.2	Construction and working principle of DC motors such as series, shunt and compound, torque-speed characteristics, selection criteria and applications (no derivations and numerical expected)		
	3.3	Single phase induction motor: Construction, working principle, double field revolving theory, split phase, capacitor start and shaded pole motor. applications (no derivations and numerical expected)		
	3.4	Three phase induction motor: Construction, working principle, Generation of rotating magnetic field, applications. (no derivations and numerical expected)		
4	**Diodes and their applications**		**04**	**CO4**
	4.1	**P-N Junction diode:** Construction and working of PN junction diode, current voltage characteristics. Application as Rectifier: Half wave rectifiers with resistive load,		

		full wave center tap and bridge rectifier with resistive load with their parameters such as ripple factor, rectification efficiency, transformer utilization factor. Filter circuits		
	4.2	**Zener Diode:** Construction and working, current voltage characteristics. **Application of Zener diode:** Voltage regulator		
	4.3	**Light emitting diode (LED) and Photo Diode:** Construction and working, current voltage characteristics and applications		
5	**Bipolar Junction Transistor and their applications**		**03**	**CO5**
	5.1	**Bipolar Junction Transistor (BJT):** BJT construction and operation, Common-Base (CB), Common-Emitter (CE) and Common-Collector (CC) configurations and input and output characteristics, operating point, DC biasing (No Numerical expected)		
	5.2	Application of BJT-CE configuration: Voltage amplifier, Electronic Switch (No Numerical expected)		
	Self-learning topics#		--	--
		Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB Types of Wires and Cables, Earthing Types of Batteries, Important Characteristics for Batteries, Elementary calculations for energy consumption, power factor improvement and battery backup Lamps- fluorescent, CFL, LED Electrical measuring instruments principle and applications- energy meter, megger, tong tester.		
		Total	**45**	**--**

Students should prepare all self-learning topics on their own. Self-learning topics will enable students to gain extended knowledge of the topic. Assessment of these topics may be included in IA.

References

Sr. No	Name/s of Author/s	Title of Book	Publisher	Edition/ Year
1	B. L. Thereja	Electrical Technology Vol-1 and Vol-II	S. Chand	25th Edition 2014
2	Mittle and Mittle	Basic Electrical Engineering	Tata McGraw Hill, India	2nd edition (New) 2001
3	Singh Ravish R	Basic Electrical Engineering	S. Chand	1st Edition, 2023
4	B.R. Patil	Basic Electrical Engineering	Oxford University Press	2nd Edition, 2022
5	Donald Neamen	Microelectronics: Circuit Analysis and Design	Tata McGraw Hill India	4th Edition 2021

Course Code	Name of the Course			
216U06L101	Python Programming			
Teaching Scheme (Hrs./Week)	**TH**	**P**	**TUT**	**Total**
	--	02	02	04
Credits Assigned	--	01	02	03

Evaluation Scheme	**Marks**				
	LAB/TUT CA	**CA (TH)**		**ESE**	**Total**
		IA	**ISE**		
	75	--	--	--	75

Course pre-requisites:
Basic knowledge of computer peripheral devices

Course Objectives:
The objective of the course is to impart knowledge of python programming. The course mainly introduces basic in python programming language concepts like data structures, Decision Making statements and Functions. Further the course also covers the concept of file handling and python packages. This first course in programming enables students to develop domain specific software based solutions..

Course Outcomes (CO):
At the end of successful completion of the course the student will be able to

CO1. Formulate problem statement and develop the logic (algorithm/flowchart) for its solution.
CO2. Understand the concepts of data structures in python.
CO3. Use different Decision Making statements and Functions in Python.
CO4. Apply the concept of exception handling and file handling in python.
CO5. Illustrate the use of python packages.

Module No.	Unit No.	Contents	No of Hrs. (Tutorial + Lab)	CO
1	Introduction to Python		**06**	**CO1**
	1.1	Problem solving skill development: Problem Definition, fundamentals of algorithms and flowcharts		
	1.2	Features of python programming		
	1.3	Applications of python programming in real world		
	1.4	Execution of python program: Compilation, interpreter		
	1.5	Introduction to various python IDE and its installation. Introduction to Command interface and Graphical interface of python execution		
2	Data types and data structures in python		**14**	**CO2**
	2.1	Data Types in Python, Whitespace, Code Block Indentation, Comments, Variables, reserved key words, Naming conventions, Python's built-in type		
	2.2	Operators in Python, Basic built-in Math functions		
	2.3	Strings , format(), print(), type casting in python		
	2.4	**Data Structures**: Tuples, List, Dictionaries, Set, Arrays, Conversion of data structures methods		
3	Decision Making and Functions in python		**16**	**CO3**
	3.1	If statement: if, if-else, elif, Nested if, pass statement		
	3.2	Repetition using While loop, for loop & range function, break, continue and pass statement		
	3.3	Defining a Function, Checking & Setting Parameters Types of arguments: Required arguments, Keyword arguments Default arguments, Variable-length arguments		
	3.4	Pass statement in function, Nested Functions, Scope of variables		
	3.5	Recursion, Lambda and Filter, Map		
4	Python exception and file handling		**12**	**CO4**
	4.1	Error, Types of error: Runtime error, compile type error, logical error, Exceptions Handling and Assertions		
	4.2	Types of Files in Python, Opening a File: File opening modes, Closing a File, Writing Text Files, Appending in Text Files		
	4.3	Working with Binary Files, File Exceptions		
5	Python packages		**12**	**CO5**
	5.1	Introduction to packages, Installation, Use		
	5.2	Introduction to Numpy, ndarray, datatypes, shape, reshape, iterating, join, split, search, sort, filter, slice, Mathematical and string functions		
	5.3	Introduction to Python Matplotlib, Markers, line, labels, grid, subplot, scatterplot, histogram, bar chart, pie charts		
		Self-learning: Seaborn library		
		Total	**60***	**--**

*Laboratory+Tutorial

References

Sr. No	Name/s of Author/s	Title of Book	Publisher	Edition/ Year
1	Reema Thareja	Python Programming: Using Problem Solving Approach	Oxford University Press	First Edition 2017, India
2	Dr. R. Nageswara Rao	Core Python Programming	Wiley Publication.	Second Edition 2018,India
3	Sheetal Taneja and Naveen Kumar	Python Programing: A Modular Approach	Pearson India	Second Edition 2018, India
4	Yashavant Kanetkar	Let us Python	Let us Python	4th edition 2022
5	Official documentation of Python	https://docs.python.org/3/tutorial/	Python Officials	-
6	Python Tutorial website	https://realpython.com/	Python web URL	-

Course Code	Name of the Course			
216U06L102	Engineering Physics Laboratory			
Teaching Scheme (Hrs./Week)	TH	P	TUT	Total
	--	02	--	02
Credits Assigned	--	01	--	01

Evaluation Scheme	Marks				
	LAB/TUT CA	CA (TH)		ESE	Total
		IA	ISE		
	50	--	--	--	50

Course Code	Name of the Course			
216U06L103	Engineering Chemistry Laboratory			
Teaching Scheme (Hrs./Week)	TH	P	TUT	Total
	--	02	--	02
Credits Assigned	--	01	--	01
Evaluation Scheme	Marks			
	LAB/TUT CA	CA (TH)		ESE	Total
		IA	ISE		
	50	--	--	--	50

Course Code	Name of the Course			
216U06L104	Engineering Mechanics Laboratory			
Teaching Scheme (Hrs./Week)	TH	P	TUT	Total
	--	02	--	02
Credits Assigned	--	01	--	01
Evaluation Scheme	Marks			
	LAB/TUT CA	CA (TH)		ESE	Total
		IA	ISE		
	50	--	--	--	50

Course Code	Name of the Course			
216U06L105	Engineering Drawing Laboratory			
Teaching Scheme (Hrs./Week)	TH	P	TUT	Total
	--	02	--	02
Credits Assigned	--	01	--	01
Evaluation Scheme	Marks			
	LAB/TUT CA	CA (TH)		ESE	Total
		IA	ISE		
	50	--	--	--	50

Course Code	Name of the Course			
216U06L106	Elements of Electrical and Electronics Engineering Laboratory			
Teaching Scheme (Hrs./Week)	TH	P	TUT	Total
	--	02	--	02
Credits Assigned	--	01	--	01
Evaluation Scheme	Marks			
	LAB/TUT CA	CA (TH)		ESE	Total
		IA	ISE		
	50	--	--	--	50

Course Code	Name of the Course							
216U06P101	Project Based Learning							
Teaching Scheme (Hrs./Week)	**TH**		**P**		**TUT**		**Total***	
	SEM I	SEM II	SEM I	SEM II	SEM I	SEM II	SEM I	SEM II
	--	--	--	02	02	--	02	02
Credits Assigned	--	--	--	02	--	--	--	02

Evaluation Scheme	**Marks**				
	LAB/TUT CA	**CA (TH)**		**ESE**	**Total**
		IA	**ISE**		
	50	--	--	--	50

*Course will run in both the semesters. Lab/Tutorial activities in semester I and Project in semester II. Credits and evaluation for the course will be done collectively at the end of semester II.

Course pre-requisites: Nil

Course Objectives:

This course aims at promoting creativity, collaborative work, problem-solving approach in students from an early stage. It establishes strong foundations for students' development as Engineering graduates with skills of project based learning and awareness about environment and sustainability while solving real world problems.

Course Outcomes (CO):

At the end of successful completion of the course the student will be able to

CO1. Understand the engineering design process for a real life application

CO2. Apply the engineering design process to build a product using simple mechanisms, controllers and software development approaches.

CO3. Explore the scope of robotics and automation in various applications

CO4. Understand the notion of sustainability and design the product, system, or process in accordance with the United Nations' sustainable development goals.

Trade No	Unit No.	Contents	No of Hrs.	CO
1	**Introduction to Project Based Learning (PBL)**			
	1.1	Introduction to Engineering and Engineering Study, Introduction to Engineering Projects, and design thinking. Significance of teamwork, Ethics in Engineering Activity based on design thinking	**04**	**CO1**
	1.2	Introduction to Project management : Life cycle of project Activity based on Team building	**02**	**CO1**
2	**Engineering Explorations**		**06**	**CO2**
	2.1	Engineering Design Process, Need statement finalization, Problem statement formulation, Pairwise comparison chart. Activity for problem statement formation		
	2.2	Basic Components of a Mechanism, Introduction to mechatronics system, Degrees of Freedom or Mobility of a Mechanism 4 Bar Chain, Crank Rocker Mechanism, Slider Crank Mechanism Simple Robotic Arm building Introduction of biomechanics: Musculoskeletal biomechanics, Cardiovascular Mechanisms, Case studies on applications of biomechanics on bones, joints, muscles, tissues etc.		
	2.3	Introduction to sensors, transducers and actuators Interfacing of Arduino with various sensors like temperature, humidity, IR sensor, Bio sensors and materials		
3	**Robotics/Automation**		**06**	**CO3**
	3.1	Introduction to industrial revolutions, Components of Industrial revolution, Robot components, Common robot applications.		
	3.2	Introduction to various platform based development (Arduino) programming and its essentials		
	3.3	Introduction to automation in manufacturing, Automation techniques, Case studies of industrial automation.		
4	**Sustainability Solutions**		**06**	**CO4**
	4.1	SDG 7 : Affordable and clean energy - Renewable / alternative energy resources, Waste to energy technology, zero waste technology and circular economy		
	4.2	SDG 9 & 11 : Industry, innovation and infrastructure - Sustainable building design criteria and certification system, green building materials, urban infrastructure & smart cities Community outreach (water, sanitation, Agriculture)		
	4.3	SDG 13 : Climate action Climate action plan, Ecological footprint, product life cycle analysis		
	4.4	SDG 14 & 15 : Life below water and Life on land Underwater sensing and detection (physical / chemical / biological parameters) Remote sensing and GIS for environment assessment		
		Total	**24**	**--**

Note: During Semester II, students need to do the project work. However, there may be laboratory sessions for the first 2-3 weeks.

Course Code	Name of the Course			
216U06T101	Presentation and Communication Skills			
Teaching Scheme	TH	P	TUT	Total
	--	--	02	02
Credits Assigned	--	--	02	02

Evaluation Scheme	Marks				
	LAB/TUT CA	CA (TH)		ESE	Total
		IA	ISE		
	50	--	--	--	50

Course pre-requisites:
Grammar of English Language, Reading and Listening Comprehension, Letter Writing

Course Objectives: The focus of this course is to improve presentation and soft skills. The course aims to inculcate in students, self-management and interpersonal skills for enhanced workplace communication. The course also focuses on developing soft skills and business writing skills of the students.

Course Outcomes (CO):

At the end of successful completion of the course the student will be able to

CO1. Use basic communication and behavioural skills in day-to-day communication.

CO2. To present themselves effectively in business meetings and group discussions.

CO3. Perform confidently and effectively in campus placements.

CO4. Compose business letters, technical proposals and e-communication messages.

CO5. Manage the self for a successful career.

Module No.	Unit No.	Contents	No of Hrs.	CO
1	**Soft Skills**		**06**	**CO1**
	1.1	Non-verbal Communication		
	1.2	Assertiveness		
		Barriers to communication		
	1.3	Emotional Intelligence		
2	**Effective Business Presentations**		**08**	**CO2**
	2.1	Business Meetings: Notice, Agenda, Minutes, and Mock Meetings		
	2.2	Presentations: Language and Style		
	2.3	Debates		
	2.4	Group Discussion		
3	**Employment Skills**		**08**	**CO3**
	3.1	Mock Interviews		
	3.2	SOP Writing		
	3.3	Job Application and Resume		
	3.4	Corporate Ethics		
4	**Professional Writing Skills**		**04**	**CO4**
	4.1	Business Letters: Inviting Quotations, Sending Quotations, Placing Orders		
	4.2	Writing Escalation Letters and Emails		
	4.3	Proposal Writing: Language, Style and Types		
5	**Self-Management**		**04**	**CO5**
	5.1	Developing a Growth Mind-Set		
	5.2	Time Management		
	5.3	Stress Management		
		Total	**30**	**--**

Reference Books

Sr. No	Name/s of Author/s	Title of Book	Publisher	Edition/ Year
1	Sharma, R C. and Krishna Mohan	Basic Correspondence and Report Writing: A Practical Approach to Business and Technical Communication	Tata McGraw- Hill, India	1st Edition, 2017
2	Wallace, Harold R. and Ann Masters	Personal Development for Life and Work.	Cengage, USA	10th Edition, 2012
3	Sullivan, Jay	Simply Said: Communicating Better at Work and Beyond	Wiley	1st Edition, 2018 (reprint)
4	Petes S. J., Francis.	Soft Skills and Professional Communication.	Tata McGraw-Hill, India	1st Edition, 2011
5	--	DLM software (Language Lab)	Thaliyola Infotech	--

Course Code	Name of the Course			
216U06W101	Basic Workshop Practice - I			
Teaching Scheme (Hrs./Week)	TH	P	TUT	Total
	--	02	--	02
Credits Assigned	--	02	--	02

Evaluation Scheme	Marks				
	LAB/TUT CA	CA (TH)		ESE	Total
		IA	ISE		
	50	--	--	--	50

Course pre-requisites: Nil

Course Objectives: The main objective of the engineering workshop is to provide all engineering students with theoretical and practical knowledge of the manufacturing environment. The workshop is the foundation of the real industrial environment, and it helps students develop and improve relevant technical hand skills. It teaches the fundamentals of various hand tools, power tools, machine tools, and their applications in various areas of manufacturing. The workshop experiences would help in developing an understanding of the complexity of the industrial job, as well as the time and skill requirements.

Course Outcomes (CO):

At the end of successful completion of the course the student will be able to

- **CO1.** Apply the safety measures practiced while using the tools, equipment, devices, etc.
- **CO2.** Understand the functions and uses of various tools, machines, and devices used in engineering practice to create objects out of raw materials.
- **CO3.** Know various operations and processes carried out in basic engineering shops.
- **CO4.** Interpret job drawings, plan the processes, and carry out the operations to manufacture basic components from raw materials.
- **CO5.** Work with confidence and communicate effectively.

Module No.	Unit No.	Contents	No. of Hrs.	CO
1	**Carpentry shop (Compulsory trade)**		**06**	**CO1 to CO5**
	1.1	Introduction to carpentry shop, Demonstration of measuring instruments, cutting tools used in Carpentry shop, and Planning a job using Jack plane.		
	1.2	One simple job consisting of lap joints is to be performed in a group consisting of Two students.		
2	**Welding shop (Compulsory trade)**		**06**	**CO1 to CO5**
	2.1	Introduction to the Welding shop. Demonstration of welding tools and equipment, arc welding practice.		
	2.2	One simple job involving Lap, Butt, and Vertical joints is to be performed in a group consisting of Four students.		
3	**Printed circuit board (PCB) shop (Compulsory trade)**		**06**	**CO1 to CO5**
	3.1	Introduction to PCB shop. Demonstration of tools, and material used for PCB making.		
	3.2	Demonstration of PCB making.		
4	**Fitting shop***		**04**	**CO1 to CO5**
	4.1	Introduction to Fitting shop, Demonstration of measuring instruments, cutting tools, etc. used in Fitting shop.		
	4.2	One simple job involving filing, right angle making, and cutting to-size operations.		
5	**Machine shop***		**04**	**CO1 to CO3 & CO5**
	5.1	Introduction of all machines available in a machine shop. Demonstration of assembling and disassembling of tools.		
	5.2	One demonstration job includes turning, facing, grooving, threading, and other operations on a lathe machine.		
6	**Electrical Wiring shop***		**04**	**CO1 to CO3 & CO5**
	6.1	Introduction to Electrical wiring. Demonstration of Electrician tools like Tester, pliers, screwdriver, multimeter, etc.		
	6.2	Hands-on experience in House wiring or staircase wiring or godown wiring. Exposure to connecting solar panels with battery and tube light.		
7	**Computer hardware and assembly***		**04**	**CO1 to CO3 & CO5**
	7.1	Introduction to various PC hardware components		
	7.2	Demonstration of PC assembly		
8	**Sheet metal working***		**04**	**CO1 to CO5**
	8.1	Introduction to sheet metal working tools, operations		
	8.2	Demonstration of various sheet metal operations		
		Total	**30**	**--**

*Any Three from Module No 4 to 8

Reference Books

Sr. No.	Name/s of Author/s	Title of Book	Publisher	Edition/Year
1	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy	Elements of Workshop Technology, Vol. I & II.	Media Promoters, India	16th Edition, 2015
2	Raghuwanshi B.S.	A Course in Workshop Technology, Vol. I &II.	Dhanpat Rai and Co. India	10th Edition, 2012 Reprint 2017
3	Khurmi R.S. and Gupta J.K.	Textbook of Workshop Technology	S. Chand Publications India	16th Edition, 2021

Course Code	Name of the Course			
216U06C201	Applied Mathematics - II			
Teaching Scheme (Hrs./Week)	TH	P	TUT	Total
	03	00	01	04
Credits Assigned	03	00	01	04

Evaluation Scheme	Marks				
	LAB/TUT CA	CA (TH)		ESE	Total
		IA	ISE		
	25	20	30	50	125

Course pre-requisites:
Rank of Matrix, system of Equations, Basics of Integration, Basics of Differentiation, Knowledge of standard curves

Course Objectives:
The objective of the course is to impart knowledge of Eigen Values and Eigen vectors of a matrix, concept of diagonalization, minimal polynomial and singular value decomposition. The course introduces the concept of successive differentiation and helps students to find series of some standard functions. The course communicates various techniques to solve improper integrals. The concept multiple integration is introduced and applications to find Area and Volume are discussed.

Course Outcomes (CO):
At the end of successful completion of the course the student will be able to

- **CO1.** Apply the concept of Eigen values, Eigen vectors of a matrix to diagonalisation of a matrix, singular value decomposition, Cayley-Hamilton theorem, and functions of square matrices.
- **CO2.** Solve problems involving Successive derivatives of real variable functions. Expand a function as an infinite series using Taylor's and Maclaurin's series.
- **CO3.** Apply concept of Beta – Gamma function and DUIS to solve improper integrals
- **CO4.** Find length of a curve using Cartesian, Polar and Parametric equations of curves.
- **CO5.** Evaluate multiple integrals and use it to find Area and Volume.

Module No.	Unit No.	Contents	No of Hrs	CO
1	**Eigen values & Eigen vectors**		**12**	**CO1**
	1.1	Characteristic equation, Eigen values and Eigen vectors, Properties of Eigen values and Eigen vectors		
	1.2	Statement of Cayley-Hamilton theorem, Examples based on verification and application of Cayley-Hamilton theorem		
	1.3	Similarity of matrices, Diagonalization of a matrix		
	1.4	Functions of square matrix, Derogatory and non-derogatory matrices, Minimal polynomial		
	1.5	Singular Value Decomposition		
2	**Successive Differentiation, Expansion Of Functions**		**6**	**CO2**
	2.1	Successive differentiation: nth derivative of standard functions. Leibnitz's Theorem (without proof) and problems.		
	2.2	Taylor's Theorem (only statement) and Taylor's series, Maclaurin's series(only Statement) Expansion of e^x , $sinx$, $cosx$,$tanx$		
		#Self-learning topic: Expansion of sinh(x), cosh(x), tanh(x), log (1 + x) , Indeterminate forms, L'Hospital Rule, problems involving series		
3	**Integration : Review And Some New Techniques**		**8**	**CO3**
	3.1	Beta and Gamma functions with properties		
	3.2	Differentiation under integral sign with constant limits of integration.(without proof)(simple examples)		
		#Self-learning topic: Differentiation under integral sign with variable limits of integration.		
4	**Rectification**		**4**	**CO4**
		Pre-requisite: Idea of Curve tracing in Cartesian, Parametric and polar forms. (Straight lines, Circles, Parabolas, Ellipse, Hyperbola, Catenary, Cissoid, Astroid, Cycloid, Lemniscate of Bernoulli, Cardiode).		
	4.1	Rectification of plane curves in Cartesian form		
	4.2	Problems of Rectification in parametric and polar forms		
5	**Multiple Integration and their Applications**		**15**	**CO5**
	5.1	Double integration- Introduction, Evaluation of Double Integrals with given limits and over the given region.(Cartesian and Polar coordinates)		
	5.2	Change of order of integration, Evaluation of double integrals by changing order of integration		
	5.3	Application of double integrals to compute Area		
	5.4	Triple integration- Introduction and evaluation of integral in Cartesian form		
	5.5	Problems of Triple integration using cylindrical and spherical Polar coordinates		
	5.6	Application of triple integral to compute volume.		
		# Self-learning topic: Mass of Lamina		
		Total	**45**	**--**

#Students should prepare all self-learning topics on their own. Self-learning topics will enable students to gain extended knowledge of the topic. Assessment of these topics may be included in Tutorials.

Reference Books

Sr. No	Name/s of Author/s	Title of Book	Publisher	Edition/Year
1	B. S. Grewal	Higher Engineering Mathematics	Khanna Publications, India	43rd Edition 2014
2	Shanti Narayan	A text book of Matrices	S. Chand, India	10th Edition 2004
3	Erwin Kreyszig	Advanced Engineering Mathematics	Wiley Eastern Limited, India	10th Edition 2015
4	Ramana B.V.	Higher Engineering Mathematics	Tata Mcgraw Hill New Delhi, India	34th Edition (reprint) 2019
5	Glyn James	Advanced Modern Engineering Mathematic	Pearson Publication India	4th Edition 2010
6	M. D. Raisinghania	Ordinary and Partial Differential Equations	S. Chand, India	18th Edition 2013

Course Code	Name of the Course			
216U06L201	Programming in C			
Teaching Scheme (Hrs./Week)	TH	P	TUT	Total
	--	02	02	04
Credits Assigned	--	01	02	03

Evaluation Scheme	Marks				
	LAB/TUT CA	CA (TH)		ESE	Total
		IA	ISE		
	75	--	--	--	75

Course pre-requisites:
Basic knowledge of computer peripheral devices, software concepts, Programming concepts

Course Objectives:
The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.

Course Outcomes (CO):
At the end of successful completion of the course the student will be able to

CO1. Understand the concepts of data types and operators
CO2. Illustrate the use of control structures.
CO3. Apply the concepts of arrays and strings.
CO4. Design modular programs using functions and the use of structure and union.
CO5. Apply concepts of pointers in dynamic memory allocation and file handling.

Module No.	Unit No.	Contents	No of Hrs. (Tutorial + Lab)	CO
1	Introduction to C			
	1.1	C Program execution process, Structure of C program and its Elements: Keywords and Identifiers, Literals, Variables		
	1.2	Data Types and its qualifiers, Declaration and Initialization of Variables, Local and Global Variables, Declaring Constants, Comments, Formatted Input/output functions and unformatted input/output functions, printf and scanf function	**08**	**CO1**
	1.3	Types of Operators: Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator , Bitwise Operators, Special Operators Comma Operator, dereferencing operator, Expressions and Evaluation of Expressions, Operator Precedence and Associativity, Type Conversions		
2	Control Structures			
	2.1	Decision Making and Branching Control Structures: if Statement, Multiple, Statements within if, if – else Statement, Nested if – else, else if Ladder,	**12**	**CO2**
	2.2	Decision making using Swich-Case		
	2.3	Looping Control Structures: While Loop, For Loop, Do While Loop		
	2.3	Jump Statements: Break and Continue, goto Statement		
3	Arrays and Strings			
	3.1	Arrays: Introduction to One Dimensional Arrays, Multidimensional Arrays, Declaration and Initialization of Arrays, Reading and Displaying arrays, introduction string and various operation on strings, string handling inbuilt functions	**12**	**CO3**
	3.2	Character Arrays and Strings: Introduction, Declaring and Initializing String Variables, Reading Character and Writing Character, Reading and Writing Strings, String Handling Functions		
4	User defined function and Structures			
	4.1	User Defined Functions: Need, Function Declaration and Definition, Return Values, Function Calls, Passing Arguments to a Function by Value, Recursive functions	**14**	**CO4**
	4.2	Structures and Unions: Introduction, Declaring and defining Structure, Structure Initialization, Accessing and Displaying Structure Members, Array of Structures, Introduction to Unions, Structure Vs Unions		
5	Pointers and dynamic memory allocation and C pre-processor			
	5.1	Introduction to pointers: Pointer declaration and initialization, Pointer addition and subtraction, Evaluating pointer expressions Pointers and Functions: Pass by Reference, Returning pointers from functions, File Handling	**14**	**CO5**
	5.2	Dynamic Memory Allocation using Pointers: Dynamic memory		

		allocation using malloc(), calloc() and realloc() and deallocation of memory using free()		
	5.3	C Pre-processor, Directives, Macros		
		Total	**60***	**--**

*Laboratory+Tutorial

Reference Books

Sr. No	Name/s of Author/s	Title of Book	Publisher	Edition/Year
1	E. Balagurusamy	Programming in ANSI C	McGraw-Hill Education, India	8th Edition, 2019
2	Yashwant Kanetkar	Let Us C	BPB Publications, India	16th Edition, 2017
3	Brian W. Kernighan and Dennis Ritchie	The C programming Language	Prentice Hall	2nd Edition, 2015
4	Pradeep Dey and Manas Ghosh	Structured Programming Approach	Oxford University Press, India	1st Edition, 2016

Course Code	Name of the Course			
216U06W201	Basic Workshop Practice - II			
Teaching Scheme (Hrs./Week)	TH	P	TUT	Total
	--	02	--	02
Credits Assigned	--	02	--	02

Evaluation Scheme	Marks				
	LAB/TUT CA	CA (TH)		ESE	Total
		IA	ISE		
	50	--	--	--	50

Course pre-requisites: Nil

Course Objectives: The main objective of the engineering workshop is to provide all engineering students with theoretical and practical knowledge of the manufacturing environment. The workshop is the foundation of the real industrial environment, and it helps students develop and improve relevant technical hand skills. It teaches the fundamentals of various hand tools, power tools, machine tools, and their applications in various areas of manufacturing. The workshop experiences would help in developing an understanding of the complexity of the industrial job, as well as the time and skill requirements.

Course Outcomes (CO):

At the end of successful completion of the course the student will be able to

CO1. Fabricate products on their own.
CO2. Enhance creativity by exploring new ideas.
CO3. Understand the entire product development and manufacturing process.
CO4. Work as a team member, learn new skills, and develop leadership qualities.
CO5. Maintain safety standards and dimensional accuracy in different manufacturing processes.

Module No.	Unit No.	Contents	No of Hrs.	CO
1	**Computer hardware and assembly**		**10**	**CO1 to CO5**
	1.1	Identify the different PC components, Assemble a Desktop PC from its components, Install any operating systems on the PC, and Troubleshoot.		
	1.2	Introduction to computer-controlled machines.		
2	**Printed circuit board (PCB) shop**		**10**	**CO1 to CO5**
	2.1	Read the given circuit drawing, create a process plan, and Identify the different tools required.		
	2.2	Manufacture the product according to the given specifications.		
3	**Welding shop**		**10**	**CO1 to CO5**
	3.1	Read the given drawing, create a process plan, and Identify the different tools required.		
	3.2	Manufacture the product according to the given specifications.		
4	**Carpentry shop**		**10**	**CO1 to CO5**
	4.1	Read the given drawing, Prepare the process plan, and Identify the different tools required.		
	4.2	Manufacture the product as per the given specifications.		
5	**Sheet metal shop**		**10**	**CO1 to CO5**
	5.1	Read the given drawing, create a process plan, and Identify the different tools required.		
	5.2	Manufacture the product according to the given specifications.		
		Total	**30**	**--**

Note: Based on the department, the compulsory trades are
Computer hardware and assembly: Computer and Information Technology Departments
Printed Circuit Board: Electronics and Computer Engineering, Electronics and Telecommunications Engineering Departments
Welding shop: Mechanical Engineering Department
Students will be allotted to any **TWO** trades apart from compulsory trade.

Reference Books

Sr. No.	Name/s of Author/s	Title of Book	Publisher	Edition/Year
1	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy	Elements of Workshop Technology, Vol. I & II.	Media Promoters, India	16th Edition, 2015
2	Raghuwanshi B.S.	A Course in Workshop Technology, Vol. I &II.	Dhanpat Rai and Co. India	10th Edition, 2012 Reprint 2017
3	Khurmi R.S. and Gupta J.K.	Textbook of Workshop Technology	S. Chand India	6th Edition, 2007 Reprint 2012

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