SOMAIYA
VIDYAVIHAR

K J Somaiya Institute of Technology
Formerly known as K J Somaiya Institute of Engineering and Information Technology
An Autonomous Institute Permanently Affiliated to the University of Mumbai

Item No: 02

A.C.Date:21/07/2023

Autonomy Syllabus Scheme III (2023-24)

(As per NEP 2020 Guidelines)

for

Four-Year Multidisciplinary Bachelors of Technology (B. Tech.) Program with Multiple Entry and Multiple Exit Options

FIRST YEAR ENGINEERING

(Effective from A.Y. 2023-24)

From the Principal's Desk:

To address the changing demands of the digital era, it is required to create a future-ready workforce that can navigate the complexities of an interconnected world, drive innovation, and contribute to the nation's growth. The **National Educational Policy 2020 (NEP 2020)** framed by the Government of India recommends a holistic, inclusive, and flexible approach to ensure equitable access to quality education across all levels, promote multidisciplinary research, and impart skill-based education with integration of technology. As per guidelines by the Department of Higher and Technical Education, Government of Maharashtra, the salient features of NEP 2020 aligned curriculum should include:

- Major (Core) Mandatory and Elective Courses
- Open Elective Courses
- Vocational and Skill Enhancement Courses
- Ability Enhancement Courses, Indian Knowledge System, and Value Education Courses
- Co-curricular Courses and Field Projects / Community Engagement Projects / Internship
- Multidisciplinary Minor Courses
- Option for Bachelor's Degree with Honours (based on Additional Credits)
- Option for Bachelor's Degree – Honours with Research (based on Additional Credits)
- Multiple Entry and Multiple Exit Options

Being an **autonomous institute** since the Academic Year 2021-22, **K. J. Somaiya Institute of Technology (KJSIT)**, has well-adapted newer approaches to reach higher levels of excellence in engineering education. Ahead of its time, the academic reforms at KJSIT have already addressed majority of these NEP 2020 aspects through its existing **Syllabus Scheme I & II** implemented under the academic autonomy. For a complete alignment with NEP 2020, the **KJSIT Autonomy Syllabus Scheme III** is introduced herewith, to be effective from Academic Year 2023-24 across all the branches, progressively from First Year Engineering.

Specifically, the existing curriculum already comprise state-of-the-art **Major (Core) courses** in theory and practical. With an ideology that the root of innovation is 'interest', the curriculum offers wide range of Elective courses — grouped into **Major-related Electives** and **Inter-disciplinary / Open Electives**. At par with international engineering education, it follows a learner-centric approach as well as promotes MOOCs, where the students can choose to study courses concerning areas of their interests, and the same is continued in Scheme III.

Further, under the theme of "Learning by Doing", the existing curriculum includes Skill-Based Learning (SBL), Activity-Based Learning (ABL), and Technology-Based Learning (TBL) as eXposure (SAT) courses — that assure X factor in all the students of the institute. The SAT courses are practiced across the first three years of engineering, focusing on responsibilities towards society, problem-solving abilities, communication skills, ethics, leadership and teamwork, motivation for life-long learning, skills on emerging areas of technology, skills on different languages, etc. In the Syllabus Scheme III, these SAT courses are now aligned and offered as **Vocational Skill - SAT (VS - SAT) courses**, **Skill Enhancement - SAT (SE - SAT) courses**, **Ability Enhancement - SAT (AE - SAT) courses**, and **Value Education - SAT (VE - SAT) courses**.

Further, **Indian Knowledge System - SAT (IKS - SAT) course** is newly introduced in Scheme III that emphasizes on drawing insights from ancient wisdom to address modern challenges. Also, as an extension to the induction program for the First Year students, the introduced **Co-curricular - SAT**

(CC - SAT) course aims to induct incumbents with the institutional practices, culture, and values, as well as encourage participation in co-curricular activities.

The component of **Project-Based Learning (PBL)** included in the Syllabus Scheme II is carried forward to Scheme III, wherein the students develop **Community Engagement / Field Projects** in Second, Third, and Last Year as Mini, Minor, and Major Projects respectively. Scheme III also retains the **Internship** component, offered with credits, to equip graduates with the industry trends, practices, and skills required at national and global level. The duality of PBL and Internship enables student involvement in research, innovation, and entrepreneurship, which are the fulcrums of higher education.

As a new introduction in line with NEP 2020, the Syllabus Scheme III incorporates mandatory **Multidisciplinary Minor courses** in Robotics / Biotechnology / Innovation and Entrepreneurship / Very Large Scale Integration (VLSI). These courses promote interdisciplinary thinking and broaden the career prospects, enabling students to develop solutions to real-world problems by combining expertise from multiple domains.

Aligned with NEP 2020, the Scheme III retains the initiative taken through Scheme – II of offering **Honours courses** for students who are desirous of pursuing focused interest in 06 emerging areas of technology recognized by AICTE: Internet of Things, Artificial Intelligence & Machine Learning, Cyber Security, Virtual and Augmented Reality, Data Science, and Blockchain. These Honours courses correspond to high-end industry standards and offer multi-fold opportunities of specialization.

As per NEP 2020, the above curricular aspects of Four Years UG Engineering Programme shall be offered with **Multiple Entry and Multiple Exit options**, leading to the conferment of:

- **One Year UG Certificate in Technology:** Awarded after completing First Year of Engineering and acquiring additional 08 credits immediately after First Year.
- **Two Years UG Diploma in Technology:** Awarded after completing Second Year of Engineering and acquiring additional 08 credits immediately after Second Year.
- **Three Years Bachelor's Degree in Vocation (B.Voc.):** Awarded after completing Third Year of Engineering and acquiring additional 08 credits immediately after Third Year.
- **Four Years Bachelor's Degree in Technology (B.Tech.) with Multidisciplinary Minor:** Awarded after completing Fourth Year of Engineering.
- **Four Years Bachelor's Degree in Technology (B.Tech.) Honors with Multidisciplinary Minor:** Awarded after completing Fourth Year of Engineering and acquiring additional 18 credits through Honours courses in respective major discipline over Third & Fourth Year of Engineering.
- **Four Years Bachelor's Degree in Technology (B.Tech.) Honors with Research and Multidisciplinary Minor:** Awarded after completing Fourth Year of Engineering and acquiring additional 18 credits through a research project in respective major discipline during Fourth Year of Engineering.

Through the implementation of Autonomy Syllabus Scheme III (as per NEP 2020 Guidelines), strategic planning, and joint efforts of all stakeholders, KJSIT is endeavouring to enhance the quality of engineering education and set a benchmark for all the autonomous institutes nationwide.

Dr. S. K. Ukarande
Principal and Chairman - Academic Council

Preamble by Member Secretary, Academic Council :

K J Somaiya Institute of Technology (KJSIT) has been granted academic autonomy by University Grants Commission (UGC) from Academic Year 2021-22 for 10 years. UGC states the benefits of granting academic autonomy to higher educational institutes as 'the freedom to modernize curricula, making it globally competent, locally relevant and skill oriented to promote employability'.

KJSITs Boards of Studies in Computer Engineering (CE), Artificial Intelligence and Data Science (AI-DS), Electronics and Telecommunication (ET) and Information Technology (IT) have prepared Autonomy Scheme-I curricula from Academic Year 2021-22, updated it with Scheme II in 2022-23 and further updates as per National Education Policy 2020 (NEP 2020) Implementation Guidelines for Autonomous Institutes in 2023-23, for 4 years undergraduate (UG) and 2 years of post-graduation (PG) in Engineering and Technology disciplines, exercising academic freedom, meeting the needs of Industry 4.0, addressing the world wide challenges and providing globally required exposure to learners, focusing sound theoretical background supported by practical experiences.

Industry 4.0 demands modern and industry-oriented education, up-to-date knowledge of analysis, interpretation, designing, implementation, validation, and documentation of not only computer software and systems but also electronics and communication systems, hardware devices and tools, trained professionals, ability to work in teams on multidisciplinary projects, etc from engineering graduates. Similarly NEP 2020 Implementation Plan for Autonomous engineering institutes focuses on equitable access to holistic, quality and multidisciplinary higher education, with multiple entry and multiple exit options with vocational, skill based, ethical, research based, field work and project development education to all. Thus KJSITs Scheme-III syllabus is framed looking at the overall demands of Industry 4.0, NEP 2020 and society to successfully acquaint learners with life-long experiential learning, professional ethics with universal human values, needed skill sets, in line with the objectives of higher and technical education, AICTE, UGC and various accreditation and ranking agencies, by keeping an eye on the technological developments and innovations.

Scheme III provides unique learning experiences to learners through extracurricular activities, innovations, and research with training of required skill sets, ability enhancement based activities, technology based on field trainings, Project Based learning, showcasing learners' creativity, interest and talent by developing additional proficiency by social involvement and contributions through case studies, creative learning. This helped in strengthening learners' profile with increased chances of employability and avenues for start-ups and Internship modules will channelize learners' working experience with Industries, Government Sectors, NGO, MSMEs, Long term Rural Developments, and Research, Innovation, IPRs and Entrepreneurial setup. It is also provided with Value addition learning through MOOCs platforms such as IBM-ICE, Coursera, NPTEL, SWAYAM, Spoken Tutorial, Udemy etc.

We are happy to present the additional exposure to our learners under the Autonomy Academic Scheme-III, implemented w.e.f academic year 2023-2024 for developing the intellectual climate of our country, bringing academic excellence in higher education system with the introduction of additional Honours Degree Programs in 6 emerging areas of technologies along with the existing regular B.Tech degree will boost the knowledge of graduating engineers in emerging areas of technologies contributing largely for industrial and personal automation, cyber, digitization, digital currency, security and artificial intelligence sector.

We would like to place on record our gratitude to the faculty, alumni, students, industry experts and stakeholders, helping KJSIT to be one of best engineering colleges across nation and top choice of engineering aspirants.

Dr. Sunita R Patil
Member Secretary, Academic Council,
Vice Principal, KJSIT, Sion

From BS BoS Chairman's Desk: -

Dear Students, Teachers & Stakeholders,

The Department of Basic Sciences & Humanities (BS) of KJ Somaiya Institute of Technology, with the Board of Studies Members, as an 'Autonomous' Institute are committed for the all-inclusive careerist goals of at the First-Year students. The autonomous status has accorded the BS department the academic freedom to float its own syllabus and customize it as per the cutting-edge global technical trends. With credit-based scheme, we embark on a fresher vision to be competent with prime focus on 'employment-centric' syllabus with dynamic reformations in the syllabus. The core engineering undergraduate branches encompass—Computer Technology (CE), Information Technology (IT), Artificial Intelligence and Data Science (AI-DS) & Electronics and Telecommunication (ET).

The major shift in the First-Year syllabus has been set on the quality benchmark—a solid foundation on the core fundaments—the pre-requisite engineering holistic skills viz. the Applied Math, Sciences and Humanities curriculum with multiple prospects as per the industry requirements.

A significant highlight of the BS department syllabus is as below:

- An assortment of 6 SAT courses being equally distributed in two semesters are supposed to acquaint the students individually for developing their vocational, co-curricular and communication abilities. **Vocational Skill** based learning **SAT I** (Workshop I) & **SAT V** (Workshop II) would help them to sharpen their technical skills.
- In order to create awareness among the students about the existing societal, environmental and other related problems within the premise of viable technological solutions, the content of **SAT II** (**Value Education**) is purposefully designed to meet these requirements.
- The perennial desire of the corporate sector for improvising communication skills of their prospective candidates is met under the aegis of **Ability Enhancement Course-SAT IV** as Professional Communication Skills.
- The Induction Training as per the directives of AICTE centers on imparting exclusively subject domain skills with experts from various industries, experienced academicians from reputed institutes to offer guidance on community service, extension activities, projects for the benefit of the society at large with the scope of providing internships in Industries in the direction of campus placements. For the first time, co-curricular activities, namely the Induction programs are brought under the purview of credit points (2) so as to help the students to gain a foresight of various advancements under **SAT III**.
- In **SAT VI**, India's rich and diversified ancient knowledge and its relevance in the modern times is identified against the background of Indian Knowledge System in II semester. The students have the options to enroll for either of the prescribed domains.
- Physics & Nanotechnology, Material Chemistry, the syllabus is floated as per latest and relevant technologies with dedicated laboratories and a focus on experiential learning for the learners.
- Apart from regular trades practices in workshop, a new trade "Electro mechanical workshop" has been introduced in workshop-I syllabus. This will aid students to design & develop models on their own.

As a First Year Engineering Department, the syllabus strives to make a positive difference in the society through the education for quality engineers, innovators, leaders and contributing citizens we produce. The autonomy initiative has been a great teamwork and involvement of all faculty and staff members in various activities during the process. We wish to thank the Management, Governing Body, Faculties, Staff, Students, Alumni and all the stakeholders for their contribution to create a national impact through a progressive education.

Dr. Harsha Mishra
Chairperson, BoS, BS Department
KJSIT, Sion

Program Structure for First Year UG CE/IT/AI/ET Technology (Common for all branches)

Semester- I-Credit Scheme

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		Course Category
		TH – P – TUT	Total	TH – P – TUT	Total	
BSC101	Engineering Mathematics I	3 – 0 – 1	04	3 – 0 – 1	04	BS
BSC102	Engineering Physics	2 – 0 – 0	02	2 – 0 – 0	02	BS
BSC103	Engineering Chemistry	2 – 0 – 0	02	2 – 0 – 0	02	BS
BSC104	Engineering Mechanics	3 – 0 – 0	03	3 – 0 – 0	03	ES
BSC105	Basics of Electrical Engineering	3 – 0 – 0	03	3 – 0 – 0	03	ES
BSL102	Engineering Physics Laboratory	0 – 1 – 0	01	0 – 0.5 – 0	0.5	BS
BSL103	Engineering Chemistry Laboratory	0 – 1 – 0	01	0 – 0.5 – 0	0.5	BS
BSL104	Engineering MechanicsLaboratory	0 – 2 – 0	02	0 – 1 – 0	01	ES
BSL105	Basics of Electrical Engineering Laboratory	0 – 2 – 0	02	0 – 1 – 0	01	ES
BSXS11	Vocational Skill - SAT I: Skill-Based Learning (Workshop-I)	0 – 2* – 0	02	0 – 1 – 0	01	VS-SAT
BSXA12	Value Education - SAT II: Activity-Based Learning(Contemporary Concerns)	0 – 2* – 0	02	0 – 1 – 0	01	VE-SAT
BSXA13	Co-Curricular - SAT III: Activity-Based Learning (Induction)	0 – 4* – 0	04	0 – 2 – 0	02	CC-SAT
Total		**13 – 14 – 1**	**28**	**13 – 7 – 1**	**21**	

***SAT courses can be conducted as TH or P or both as required**.

Semester- I-Examination Scheme

Course Code	Course Name	CA Marks		ESE		TW / O / P Marks				Total Marks
		T1	T2	Marks	Duration (in Hrs)	TW	O	P	P&O	
BSC101	Engineering Mathematics I	20	20	60	2.5	25	-	-	-	125
BSC102	Engineering Physics	15	15	45	2.0	-	-	-	-	75
BSC103	Engineering Chemistry	15	15	45	2.0	-	-	-	-	75
BSC104	Engineering Mechanics	20	20	60	2.5	-	-	-	-	100
BSC105	Basics of Electrical Engineering	20	20	60	2.5	-	-	-	-	100
BSL102	Engineering Physics Laboratory	-	-	-	-	25	-	-	-	25
BSL103	Engineering Chemistry Laboratory	-	-	-	-	25	-	-	-	25
BSL104	Engineering MechanicsLaboratory	-	-	-	-	25	-	-	-	25
BSL105	Basics of Electrical Engineering Laboratory	-	-	-	-	25	-	-	-	25
BSXS11	Vocational Skill - SAT I: Skill-Based Learning (Workshop-I)	-	-	-	-	50	-	-	-	50
BSXA12	Value Education - SAT II: Activity-Based Learning(Contemporary Concerns)	-	-	-	-	25	-	-	-	25
BSXA13	Co-Curricular - SAT III: Activity-Based Learning (Induction)	-	-	-	-	50	-	-	-	50
Total		**90**	**90**	**270**	**-**	**250**	**-**	**-**	**-**	**700**

Program Structure for First Year UG CE/IT/AI/ET/EX Technology (Common for all branches)

Semester- II-Credit Scheme

Course Code	Course Name	Teaching Scheme (Hrs.) TH – P – TUT	Total (Hrs.)	Credits Assigned TH – P – TUT	Total Credits	Course Category
BSC201	Engineering Mathematics II	3– 0 – 1	04	3 – 0 – 1	04	BS
BSC202	Physics and Nanotechnology	2 – 0 – 0	02	2 – 0 – 0	02	BS
BSC203	Materials Chemistry	2– 0 – 0	02	2 – 0 – 0	02	BS
BSC204	Engineering Graphics	2 – 0 –0	02	2 – 0 – 0	02	ES
BSC205	Computer Programming	3 – 0 – 0	03	3 – 0 – 0	03	ES
BSL202	Physics and Nanotechnology Laboratory	0 – 1 – 0	01	0 – 0.5 – 0	0.5	BS
BSL203	Material Chemistry Laboratory	0 – 1– 0	01	0 – 0.5– 0	0.5	BS
BSL204	Engineering Graphics Laboratory	0 – 4 – 0	04	0 – 2– 0	02	ES
BSL205	Computer Programming Laboratory	0 – 2 – 0	02	0 – 1 – 0	01	ES
BSXS24	Ability Enhancement- SAT IV: Skill-Based Learning (Professional Communication Skills)	0 – 4[$] –0	04	0 – 2 – 0	02	AE-SAT
BSXS25	Vocational Skill – SAT V: Skill Based Learning (Workshop II)	0 – 2[*] – 0	02	0 – 1 – 0	01	VS-SAT
BSXA26	Indian Knowledge System- SAT VI: Activity Based Learning	0 – 2[*] – 0	02	0 – 1 – 0	01	IK-SAT
Total		**12-16-1**	**29**	**12- 8 –1**	**21**	--

[*]SAT courses can be conducted as TH or P or both as required [$]2 hours class-wise and 2 hours batch-wise

Semester- II-Examination Scheme

Course Code	Course Name	CA Marks		ESE		TW / O / P Marks				Total Marks
		T1	T2	Marks	Duration (in Hrs)	TW	O	P	P&O	
BSC201	Engineering Mathematics II	20	20	60	2.5	25	-	-	-	125
BSC202	Physics and Nanotechnology	15	15	45	2.0	-	-	-	-	75
BSC203	Materials Chemistry	15	15	45	2.0	-	-	-	-	75
BSC204	Engineering Graphics	20	20	60	3.0	-	-	-	-	100
BSC205	Computer Programming	20	20	60	2.5	-	-	-	-	100
BSL202	Physics and Nanotechnology Laboratory	-	-	-	-	25	-	-	-	25
BSL203	Material Chemistry Laboratory	-	-	-	-	25	-	-	-	25
BSL204	Engineering Graphics Laboratory	-	-	-	-	25	-	25	-	50
BSL205	Computer Programming Laboratory	-	-	-	-	25	-	25	-	50
BSXS24	Ability Enhancement – SAT IV: Skill-Based Learning (Professional Communication Skills)	-	-	-	-	50	-	-	-	50
BSXS25	Vocational Skill – SAT V: Skill-Based Learning (Workshop II)	-	-	-	-	50	-	-	-	50
BSXA26	Indian Knowledge System – SAT VI: Activity-Based Learning	-	-	-	-	25	-	-	-	25
Total		**90**	**90**	**270**	**-**	**250**	**-**	**50**	**-**	**750**

***Term work is based on Presentation/Group discussion/Case studies/Assignment/Technical writing etc.**

Course Code	Course Name	Credits (TH+P+TUT)
BSC101	**Engineering Mathematics-I**	**3+ 0+ 1**

Prerequisites:	1. Basics of trigonometry 2. Basics of differential calculus 3. Binomial expansion
Course Objectives:	1. To introduce fundamental concepts of complex numbers and its algebra 2. To determine the logarithm of complex numbers and study hyperbolic functions 3. To demonstrate the concepts of partial differentiation 4. To study successive differentiation and the applications of partial differentiation 5. To explain and interpret the fundamental concepts of Matrices for solving engineering problems 6. To use numerical methods and study expansion of functions
Course Outcomes:	After taking this course the learners will be able to.. 1. solve engineering problems using the concepts of Complex Numbers. 2. apply hyperbolic functions and logarithms in subjects like Electrical Circuits, Electromagnetic Wave Theory. 3. evaluate the problems of Electromagnetic Theory, Heat and Mass Transfer etc. by using the basic concepts of partial differentiation of functions of several variables. 4. find out the Maxima and Minima of multivariable functions using partial differentiation and evaluate nth order derivatives using Successive differentiation. 5. determine the rank of matrices and determine solutions to systems of linear equations. 6. analyse problems using various Numerical Methods along with expansion of functions.

Module No.	Sub Topics	CO mapped	Hrs/Subtopic	Total Hrs/Module
i.	**Prerequisite Concepts and Course outline**		**2**	**2**
1.	**Complex Numbers** 1.1 Pre-requisite: Review of Complex Numbers- Algebra of Complex Number, Cartesian, polar and exponential form of complex number.	**CO1**	**2**	**6**
	1.2 Statement of D'Moivre's Theorem. Expansion of $\sin^n\theta$, $\cos^n\theta$ in terms of sines and cosines of multiples of θ and Expansion of sinnθ, cosnθ in powers of sin θ, cos θ,		**2**	
	1.3 Powers and Roots of complex number.		**2**	

2.	**Hyperbolic function and Logarithm of Complex Numbers** 2.1. Circular functions of complex number and Hyperbolic functions. Inverse Circular and Inverse Hyperbolic functions. Separation of real and imaginary parts of all types of Functions.	**CO2**	**4**	**6**
	2.2 Logarithmic functions, Separation of real and Imaginary parts of Logarithmic Functions. **#Self-learning topics:** Applications of complex number in Electrical circuits.		**2**	
3.	**Partial Differentiation** 3.1 Partial Differentiation: Function of several variables, Partial derivatives of first and higher order. Differentiation of composite function.	**CO3**	**3**	**7**
	3.2. Euler's Theorem on Homogeneous functions with two independent variables (with proof). Deductions from Euler's Theorem. **# Self learning topics:** Total differentials, implicit functions, Euler's Theorem on Homogeneous functions with three independent variables.		**4**	
4.	**Applications of Partial Differentiation and Successive differentiation.** 4.1 Maxima and Minima of a function of two independent variables, Lagrange's method of undetermined multipliers with one constraint.	**CO4**	**4**	**7**
	4.2 Successive differentiation: nth derivative of standard functions. Leibnitz's Theorem (without proof) and problems. **# Self learning topics**: Jacobian of two and three independent variables (simple problems), Gradient, Directional derivatives, divergence, curl.		**3**	
5.	**Matrices** **Prerequisite:** Inverse of a matrix, addition, multiplication and transpose of a matrix 5.1. Types of Matrices (symmetric, skew-symmetric, Hermitian, Skew Hermitian, Unitary, Orthogonal Matrices and properties of Matrices).Rank of a Matrix using Echelon forms, reduction to normal form and PAQ form.	**CO5**	**4**	**7**
	5.2. System of homogeneous and non – homogeneous equations, their consistency and solutions. **#Self-learning topics**: Application of inverse of a matrix to coding theory.		**3**	

6.	**Numerical Solutions of Transcendental Equations and System of Linear Equations and Expansion of Function**. 6.1 Solution of Transcendental Equations: Solution by Newton Raphson method and Regula –Falsi method.	**CO6**	**2**	**6**
	6.2 Solution of system of linear algebraic equations , by(1)Gauss Jacobi Iteration Method, (2)Gauss Seidal Iteration Method.		**2**	
	6.3 Taylor's Theorem (Statement only) and Taylor's series, Maclaurin's series(Statement only). Expansion of e^xsin(x), cos(x) ,tan(x), sinh(x), cosh(x),tanh(x),log(1+x), $\sin^{-1}(x)$, $\cos^{-1}(x)$, $\tan^{-1}(x)$. **# Self learning topics:** Indeterminate forms, L-Hospital Rule, Gauss Elimination Method, Gauss Jordan Method.		**2**	
ii	**Course conclusion:** Recap of Modules, Outcomes, Applications, and Summarization.	**-**	**1**	**1**

Books:

Text Books	1.Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication 2. Matrices, Shanti Narayan, .S. Chand publication. 3. Elementary Linear Algebra with Application by Howard Anton and Christ Rorres. 6th edition. John Wiley & Sons,INC.
Reference Books	1. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited, 9th Ed. 2.Engineering Mathematics by Srimanta Pal and Subodh, C. Bhunia, Oxford University Press
Useful Links	1. e-PGPathshala (inflibnet.ac.in) 2. https://nptel.ac.in/noc/courses/111/ 3. https://www.coursera.org/courses?query=mathematics 4. https://ndl.iitkgp.ac.in/

Assessment
Continuous Assessment (CA):

The distribution of Continuous Assessment marks will be as follows –

1.	Test 1	20 marks
2.	Test 2	20 marks

Tests:

Two tests of 20 marks each should be conducted in a semester. The first test is to be conducted when approx. 40% syllabus is completed and second test when additional 40% syllabus (but excluding contents covered in Test I) is completed. Duration of each test shall be 1 hour and addition of both tests will be considered as a head of passing.

Term Work (TW): 25 Marks

1. Term work should consist of a minimum of 6 class tutorials

2. Journal must include at least 2 assignments on content of theory of the course.

The distribution of term work marks will be as follows –

1.	Tutorials	20 marks
2.	Assignment	05 marks

End Semester Theory Examination:

End Semester Theory Examination will of 60-Marks and duration 2 hours 30 minutes.

Course Code	Course Name	Credits (TH+P+TUT)
BSC102	Engineering Physics	2 + 0 + 0

Prerequisites:	1. Dual nature of radiation, Photoelectric effect, Matter waves, Davisson-Germer experiment 2. Basics of Crystal Physics (Unit cell, Space lattice, Crystal systems, X-rays 3. Intrinsic and extrinsic semiconductors, Semiconductor diode 4. Wave front and Huygens principle, reflection and refraction, Interference by division of wave front 5. Electric current, flow of electric charges in a metallic conductor, Ohm's law, electrical resistivity and conductivity temperature dependence of resistance
Course Objectives:	1. To understand basic physics concepts and founding principles of technology 2. To develop scientific temperament for scientific observations, recording, and inference drawing essential for technology studies
Course Outcomes:	Learners will be able to.. 1. relate the foundations of quantum mechanics with the development of modern technology. 2. illustrate determination of crystal structure using X-ray diffraction techniques. 3. comprehend the concepts of semiconductor physics and applications of semiconductors in electronic devices. 4. apply the concept of interference in thin films in measurements. 5. describe working principle of Superconductors and identify their applications. 6. describe working principle of Super capacitors and identify their applications.

Module No.	Sub Topics	CO mapped	Hrs/ Subtopic	Total Hrs/Module
i	**Prerequisite Concepts and Course outline**	**----**	**1**	**1**
1.	**QUANTUM PHYSICS** 1.1 De Broglie hypothesis of matter waves, Properties of matter waves, Justification using Bohr's postulate	**CO1**	**1**	**6**
	1.2 Wave packet, phase velocity and group velocity Heisenberg uncertainty principle, non-existence of electron in nucleus, Wave function, Physical interpretation of wave function		**2**	
	1.3 Schrodinger's time dependent and time independent wave equation, Particle trapped in one dimensional infinite potential well		**2**	
	1.4 Applications of Quantum Physics – Tunnelling effect, Light Amplification, Electron Microscope, Quantum Computing.		**1**	
2.	**CRYSTALLOGRAPHY** 2.1 Miller indices of lattice planes and directions		**1**	
	2.2 Inter-planar spacing		**1**	

	X-ray diffraction and Bragg's law Determination of Crystal structure using Bragg's diffractometer	**CO2**	**1**	**4**
	2.3 Liquid crystals : Nematic, Smectic and cholesteric phases, Liquid crystal display		**1**	
3.	**SEMICONDUCTOR PHYSICS** 3.1 Formation of Energy Bands, Energy bands in conductors, semiconductors and insulators, Direct & indirect band gap semiconductor	**CO3**	**1**	**6**
	3.2 Fermi level, Fermi Dirac distribution, Fermi energy level in intrinsic & extrinsic semiconductors, effect of impurity concentration and temperature on Fermi level		**2**	
	3.3 Mobility, current density, Conductivity, Hall Effect, Significance of Effect, Use of Hall effect to calculate carrier concentration		**1**	
	3.4 Fermi Level diagram for p-n junction (unbiased, forward bias, reverse bias)		**1**	
	3.5 Semiconductor devices: LED, Zener diode, Photovoltaic cell		**1**	
4.	**INTERFERENCE IN THIN FILM** 4.1 Interference by division of amplitude, Interference in thin film of constant thickness due to reflected and transmitted light, origin of colours in thin film, Anti-reflecting films and Highly reflecting film.	**CO4**	**2**	**6**
	4.2 Wedge shaped film Experiment and Newton's Rings		**2**	
	4.3 Applications of interference - Determination of thickness of very thin wire or foil, Determination of refractive index of liquid, Determination of wavelength of incident light, Determination of radius of curvature of lens, testing of surface flatness		**2**	
5.	**SUPERCONDUCTORS** **5.1** Superconductors : Critical temperature, critical magnetic field, Meissners effect,	**CO5**	**1**	**2**
	5.2 Type I and Type II and high Tc superconductors		**1**	
6.	**SUPERCAPACITORS** 6.1 Supercapacitors : Principle, construction, materials and applications, Types of Supercapacitors,	**CO6**	**1**	**2**
	6.2 Comparison with capacitor and batteries : Energy density, Power density		**1**	

ii	**Course conclusion:** Recap of Modules, Outcomes, Applications, and Summarization.	**-**	**1**	**1**

Books:

Text Books	1. A Text book of Engineering Physics - Dr. M. N. Avadhanulu, Dr. P. G. Kshirsagar, S. Chand, Revised Edition 2014 2. Modern Engineering Physics - A. S. Vasudeva, S. Chand, Revised Edition 2013 3. Engineering Physics - D. K Bhattacharya, PoonamTandon, Oxford Higher Education, 1st Edition 2015 4. Engineering Physics - R. K. Gaur,S. L. Gupta, DhanpatRai Publications, 2012 5. Engineering Physics - V. Rajendran, McGraw Hill Educations, 2017
Reference Books	1. Concepts of Modern Physics - ArtherBeiser, ShobhitMahajan, S. Choudhury, McGraw Hill, 7th Edition 2017 2. Solid State Electronic Devices - Ben G. Streetman, Prentice Hall, 6th Edition 2006 3. Introduction to Solid State Physics - Charles Kittle, Wiley, 10th Edition 4. Fundamentals of optics - Francis A. Jenkins, Harvey E. White, McGraw Hill Publication, India, 4th Edition 5. Ultra capacitors: The future of energy storage - R.P Deshpande, McGraw Hill

Useful Links:

1. https://nptel.ac.in/courses/115/101/115101107/
2. https://nptel.ac.in/courses/112/106/112106227/
3. https://nptel.ac.in/courses/115/102/115102025/
4. https://nptel.ac.in/courses/115/103/115103108/

Assessment

Continuous Assessment (CA) :

Continuous Assessment will be done on the following basis-

Weightage	Assessment Method	Time of Conduction	Process
15 Marks	Test 1 (T1)	Will be conducted after completing approx. 40% syllabus	Duration of each test shall be 45 minutes and addition of both tests will be considered as a head of passing
15 Marks	Test 2 (T2)	Will be conducted when additional 35% syllabus is completed	

End Semester Examination:

End Semester Theory Examination will of 45-Marks and duration 2 hours.

Course Code	Course Name			Credits (TH+P+TUT)
BSC103	**Engineering Chemistry**			**2+ 0+ 0**
Prerequisites:	1. Concept of Electrochemistry 2. Atomic & Molecular Structures 3. Fundamentals of Green Chemistry			
Course Objectives:	1. To gain knowledge about types, factors and prevention of corrosion 2. To determine the processes of purifying water by ion exchange and membrane methods 3. To study various types of conventional fuels 4. To identify various non-conventional energy sources 5. To demonstrate principles of green chemistry viz less hazardous chemical synthesis 6. To interpret the concepts of spectroscopy techniques for sample analysis			
Course Outcomes	Learners will be able to… 1. identify methods for corrosion control in industries based on knowledge of different types of corrosion and factors affecting the rate of corrosion. 2. analyze the quality of water and suggest suitable methods of treatment to industries. 3. determine the quality of fuel and able to quantify the oxygen requirement for combustion of fuels. 4. compare the availability, constitution, efficiency of performance and environmental impact of non-conventional energy sources. 5. apply knowledge of green chemistry in the interest of health and environmental aspects. 6. distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.			
Module	**Detailed Contents**	**CO Mapped**	**Hr/ Subtopic**	**Total Hours**
i	**Prerequisite Concepts and Course outline**	**----**	**1**	**1**
1.	**Corrosion** **1.1** -Definition, Electrochemical series, Mechanism of Corrosion- (I) Dry or Chemical Corrosion-i) Due to oxygen ii)Due to other gases. (II)Wet or Electrochemical corrosion-Mechanism i) Evolution of hydrogen type ii) Absorption of oxygen. Types of Corrosion-Galvanic cell corrosion, Concentration cell corrosion (differential aeration principle), Intergranular corrosion, Stress corrosion. Significance of galvanic series for corrosion	**CO1**	**3**	**6**

	1.2 Factors affecting the rate of corrosion- (i)Nature of metal, (ii)Nature of corroding environment. Methods of corrosion control- (I) Material selection and proper designing,(II) Cathodic protection- i) Sacrificial anodic protection ii)Impressed current method, (III), anodic protection. Metallic coatings- only Cathodic coating (tinning) and anodic coatings (Galvanising), Organic coating-Paint- Constituents & functions	**CO1**	**3**	
2	**Water** **2.1** Introduction - Impurities in water, hardness of water- units (no conversions), types and numerical problems, determination of hardness of water by EDTA method and numerical problems.	**CO2**	**3**	**6**
	2.2 Softening of water by Ion Exchange process and numerical problems, BOD, COD- definition, significance and Numerical problems. Water purification-membrane technology- Electrodialysis, Reverse osmosis, and Ultra filtration		**3**	
3	**Fuels and Combustion** **3.1** Definition and classification of fuels, Calorific value: Definition, Gross or Higher calorific value & Net or lower calorific value, Dulong's formula for calculations of Gross and Net calorific values.	**CO3**	**1**	**5**
	3.2 Solid Fuel: Proximate and Ultimate Analysis of coal with Numerical problems, Liquid fuel: Refining of crude petroleum, Petrol -Knocking, Octane number, Cetane number, Antiknock agents, unleaded petrol, Gaseous fuel: Natural Gas and CNG Combustion- Calculations for requirement of only oxygen and air (by weight and by volume only) for given solid & gaseous fuels.		**4**	
4	**Non-Conventional Energy Sources** **4.1** Disadvantages of fossil fuels, Solar energy, Power alcohol, Biomass, Biogas, Biodiesel, Renewable Hydrogen	**CO4**	**2**	**2**
5	**Green Chemistry & synthesis of drugs** **5.1 -** Introduction – Definition, significance Twelve Principles of Green chemistry, ,	**CO5**	**1**	**4**
	5.2 Numerical problems on% atom economy. Green Solvents (Water, Ionic Liquids, Supercritical Fluids)		**1**	

	5.3 Conventional and green synthesis of Adipic acid, Indigo, Carbaryl, Ibuprofen, Benzimidazole, Benzyl alcohol		**2**	
6	**Principle of spectroscopy-** **6.1** Definition, Origin of spectrum, Classification of spectroscopy – atomic and molecular, selection rules. Table of relation between electromagnetic spectrum,	**CO6**	**1**	**3**
	6.2 Types of spectroscopy and energy changes. Principle and application of Flame photometer and Flourescence spectroscopy		**2**	
ii	**Course conclusion:** Recap of Modules, Outcomes, Applications, and Summarization.	**-**	**1**	**1**

Books:

Text Books	1.Engineering Chemistry - Jain & Jain (DhanpatRai) 2. Engineering Chemistry – Dara&Dara (S Chand) 3. Engineering Chemistry - Wiley India (ISBN – 9788126519880) 4. A Text Book of Engineering Chemistry – ShashiChawla (DhanpatRai) 5. Engineering Chemistry -Payal Joshi &Shashank Deep (Oxford University Press) 6. Engineering Chemistry-OG Palanna(McGraw Hill Education)
Reference Books	1.Green Chemistry: A textbook – V.K.Ahluwalia, Alpha Science International 2. Fundamentals of Molecular Spectroscopy (4th Edition) - C.N.Banwell, Elaine M. McCash, Tata McGraw Hill. 3.Elementary Organic Spectroscopy- Y.R.Sharma, S.Chand and Co

Useful Links:

https://onlinecourses.nptel.ac.in/noc20_cy08/preview

https://www.chemguide.co.uk/

https://nptel.ac.in/courses/103/105/103105110/

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

1	Test 1	15 marks
2	Test 2	15 marks

Tests: Two tests of 15 marks each should be conducted in a semester. The first test is to be conducted when approx. 35-40% syllabus is completed and second test when additional 35-40% syllabus (but excluding contents covered in Test I) is completed. Duration of each test shall be 45 minutes and addition of both tests will be considered as a head of passing.

End Semester Theory Examination:
End Semester Theory Examination will of 45-Marks and duration 2 hours.

Course Code	Course Name	Credits (TH+P+TUT)
BSC104	**Engineering Mechanics**	**3+ 0+ 0**

Prerequisites:	1. Basics of Trigonometry. 2. Newton's Laws of motion. 3**.** Basics of units and conversions.
Course Objectives:	1. To acquaint the concept of equilibrium. 2. To learn about the centroid of composite plane lamina. 3. To study friction and its applications. 4**.** To study and analyze motion of moving particles/bodies.
Course Outcomes:	Learners will be able to… 1. illustrate the effect of force, moment and apply the same along with the concept of equilibrium systems with the help of FBD. 2. demonstrate the understanding of Centroid and its significance and locate the same. 3. correlate real life application to specific type of friction and estimate required force to overcome friction. 4. establish relation between velocity and acceleration of a particle and Analyze the motion by plotting the relation. 5. analyze general plane motion of rigid bodies using the Instantaneous Centre of Rotation. 6. analyze particles in motion using force and acceleration, work-energy and impulse-momentum principles.

Module No.	Sub Topics	CO mapped	Hrs/Sub topic	Total Hrs/Module
i	**Prerequisite Concepts and Course outline**	**----**	**2**	**2**
1.	**System of Coplanar Forces:** Classification of force systems, Principle of transmissibility, composition and resolution of forces. Resultant of coplanar force system (Concurrent forces, parallel forces and non-concurrent Non-parallel system of forces). Moment of force about a point, Couples, Varignon's Theorem. Force couple system.	**CO1**	**5**	**5**
2.	**Centroid:** First moment of Area, Centroid of composite plane Laminas.	**CO2**	**3**	**3**
3.	**Equilibrium of System of Coplanar Forces**: Conditions of equilibrium for concurrent forces, parallel forces and non-concurrent non- parallel general forces and Couples. Equilibrium of rigid bodies-free body diagrams. Types of beams, type of supports and reaction. Determination of reactions at supports for various types of loads on beams. (Excluding problems on internal hinges).	**CO1**	**7**	**7**
4.	**Friction**: Revision of Static Friction, Dynamic/ Kinetic	**CO3**	**5**	**5**

	Friction, Coefficient of Friction, Angle of Friction, Laws of friction. Concept of Cone of friction. Equilibrium of bodies on an inclined plane. Application to problems involving wedges and ladders.			
5.	**5.1 Kinematics of Particle**: Rectilinear motion of particles with uniform and variable acceleration. Motion curves (a-t, v-t, s-t curves). Motion along a plane curved path. Tangential & Normal component of acceleration. Application of concepts of projectile motion and related numerical.	**CO4**	**6**	**9**
	5.2 Kinematics of Rigid Body: Translation, Rotation and General Plane motion of Rigid body. The concept of Instantaneous center of rotation (ICR) for the velocity. Location of ICR for 2 link mechanism. Velocity analysis of rigid body using ICR.	**CO5**	**3**	
6.	**6.1 Kinetics of a Particle: Force and Acceleration:** D'Alemberts Principle, concept of Inertia force, Equations of dynamic equilibrium, Newton's second law of motion. (Analysis limited to simple rectilinear systems only).	**CO6**	**4**	**10**
	6.2 Kinetics of a Particle: Work and Energy: Work Energy principle for a particle in motion. Application of Work – Energy principle to a system consisting of connected masses and springs.	**CO6**	**3**	
	6.3 Kinetics of a Particle: Impulse and Momentum: Principle of linear impulse and momentum. **Impact and collision:** Law of conservation of momentum, Coefficient of Restitution. Direct Central Impact and Oblique Central Impact. Loss of Kinetic Energy in collision of inelastic bodies.	**CO6**	**3**	
ii	**Course conclusion:** Recap of Modules, Outcomes, Applications, and Summarization.	**-**	**1**	**1**
Books:				
Text Books	1. Ramamrutham., S. "Textbook of Applied Mechanics", Dhanpat Rai Publishing Company Limited, 2008. 2. Bhavikatti., S. S. and Rajashekarappa., K. G. "Engineering Mechanics", New Age International Publishers, 2017, 6th Edition. 3. Khurmi. R. S., "Textbook of Applied Mechanics", Tata McGraw Hill Publishing Company, 2013, 20th Revised Edition. 4. Tayal A.K., "Engineering Mechanics", Umesh Publications, 2011,14th Edition.			
Reference Books	1. Beer, F. P. and Johnston, E. R. "Vector Mechanics for Engineers Vol. I and II", McGraw Hill Company Publication, 2011, 9th Edition. 2. Singer, F. L. "Engineering Mechanics Statics & Dynamics", B. S. Publications, 2011. 3. Timoshenko, S. and Young, D. H. "Engineering Mechanics", McGraw Hill Companies, 2013, 5th Edition.			

	4. Meriam, J. L. and Kraige, L.G., "Engineering Mechanics – Statics", John Wiley & Sons, 2006, 7th Edition. 5. Meriam, J. L. and Kraige, L.G., "Engineering Mechanics – Dynamics", John Wiley & Sons, 2006, 7th Edition. 6. Hibbeler, R.C. , "Engineering Mechanics", Pearson, 2016, 14th Edition.

Useful Links:

1. https://nptel.ac.in/courses/112/106/112106286/
2. https://nptel.ac.in/courses/112103108/3
3. https://nptel.ac.in/courses/115/104/115104094/
4. https://nptel.ac.in/courses/122104015/

Assessment:
Continuous Assessment (CA):

Continuous Assessment will be done on the following basis-

Weightage	Assessment Method	Time of Conduction	Process
20 Marks	Test 1 (T1)	Will be conducted after completing approx. 35%-40% syllabus	Duration of each test shall be 1 hour and addition of both tests will be considered as a head of passing.
20 Marks	Test 2 (T2)	Will be conducted when additional 40% syllabus is completed	

End Semester Examination:

End Semester Theory Examination will of 60-Marks and duration 2 hours 30 minutes.

Course Code	Course Name	Credits (TH+P+TUT)
BSC105	**Basics of Electrical Engineering**	**3 + 0+ 0**
Prerequisites:	Resistance, inductance, capacitance, series and parallel connections of resistance, concepts of voltage, current, power and energy and its units. Working of wattmeter, Magnetic circuits, MMF, Magnetic field strength, reluctance, series and parallel magnetic circuits, BH Curve, Time domain analysis of first order RL and RC circuits	
Course Objectives:	1. To provide knowledge on fundamentals of D.C. circuits and single phase and three phase AC circuits and its applications 2. To inculcate knowledge on the basic operation and performance of 1-Φ transformer 3. To provide knowledge on fundamentals of DC and AC machines	
Course Outcomes:	Learner will be able to… 1. apply various network theorems to determine the circuit response / behaviour. 2. analyze 1-Φ circuits. 3. analyze 3-Φ AC circuits. 4. describe the constructional features and operation of 1-Φ transformer. 5. illustrate the working principle of 3-Φ induction motor. 6. illustrate the working principle of 1-Φ induction motor.	

Module No	Sub Topics	CO mapped	Hrs / Subtopic	Total Hrs /Module
i	**Prerequisite Concepts and Course outline**		**2**	**2**
1:	**DC Circuits** 1.1(Only independent source) Ideal and practical Voltage and current Sources, Source Transformation, Kirchhoff's Laws	**CO1**	**2**	**14**
	1.2 Star-Delta / Delta-Star Transformations, Mesh and Nodal Analysis		**4**	
	1.3 Superposition, Thevenin's Theorem		**4**	
	1.4 Norton's Theorem and Maximum Power Transfer Theorem		**4**	
2.	**AC Circuits :** 2.1 Generation of alternating voltage, representation of sinusoidal alternating voltage and current, average and RMS values, phase angle, phasor and phase difference, addition and subtraction of alternating quantities	**CO2**	**7**	**10**

	2.2 Analysis of single-phase ac series and parallel circuits consisting of R, L, C, RL, RC, RLC combinations, real, reactive and apparent power, admittance (Y), Series and parallel resonance, Q factor.		**3**	
3.	**Three phase circuits** 3.1 Generation of Three-Phase Voltages, Interconnection of three phases, voltage & current relationships in Star and Delta Connections	**CO3**	**3**	**5**
	3.2 Power measurement in three phase balanced circuit (Only two wattmeter method)		**2**	
4.	**Transformers:** 4.1Working principle of single-phase transformer, EMF equation of a transformer	**CO4**	**2**	**6**
	4.2 Transformer losses, Actual (practical) and ideal transformer, Phasor diagram (considering winding resistance and magnetic leakage), Equivalent circuit.		**2**	
	4.3 Open-circuit test (no-load test), short circuit (SC) test, regulation (no derivation), efficiency, condition for maximum efficiency.		**2**	
5.	**Three-phase induction motor** 5.1 Rotating magnetic field produced by three phase ac, principle of operation of Three-phase induction motor, Concept of Slip, constructional details and classification of Induction machines (Numerical not expected).	**CO5**	**2**	**2**
6.	**Single-phase Induction motor:** 6.1 Principle of operation of Single-Phase induction motors, stepper motor (Single stack variable reluctance and permanent magnet)	**CO6**	**2**	**2**
Self study Topic	Principle of operation of DC generators and DC motors, constructional details and classification of DC machines, Applications of all DC Motors, EMF equation of generator.	**---**	**---**	**---**
ii	**Course conclusion:** Recap of Modules, Outcomes, Applications, and Summarization.	**-**	**1**	**1**
Books:				
Text Books	1.V. N. Mittal and Arvind Mittal "Basic Electrical Engineering" Tata McGraw Hill, (Revised Edition) 2.Vincent Del Toro "Electrical Engineering Fundamentals", PHI Second edition, 2011 3.Edward Hughes "Hughes Electrical and Electronic Technology", Pearson Education (Tenth edition) 4.D P Kothari and I J Nagrath "Theory and Problems of Basic Electrical Engineering",			

	PHI 13th edition 2011. 5.M.Naidu, S.Kamakshaiah “Introduction to Electrical Engineering” McGraw-Hill Education, 2004 6.B.R. Patil “Basic Electrical Engineering” Oxford Higher Education
Reference Books	1.B.L.Theraja “Electrical Engineering “ Vol-I and II. 2.S.N.Singh, “Basic Electrical Engineering” PHI , 2011Book

Useful Links:

1. https://onlinecourses.nptel.ac.in/noc21_ee73/preview
2. https://nptel.ac.in/courses/108/108/108108076/

Assessment

Continuous Assessment (CA) :

Continuous Assessment will be done on the following basis-

Weightage	Assessment Method	Time of Conduction	Process
20 Marks	Test 1 (T1)	Will be conducted after completing approx. 40% syllabus	Duration of each test shall be 1 hour and addition of both tests will be considered as a head of passing.
20 Marks	Test 2 (T2)	Will be conducted when additional 40% syllabus is completed	

End Semester Examination:

End Semester Theory Examination will of 60-Marks and duration 2 hours 30 minutes.

Lab Code	Lab Name	Credits (P+TUT)
BSL102	**Engineering Physics Laboratory**	**0.5 +0**

Lab Prerequisite:	1.Interference in thin films 2.Crystallography basics 3.Semiconductor Physics
Lab Objectives:	1. To improve the knowledge about the theory concepts of Physics learned in the class. 2. To improve ability to analyse experimental result and write laboratory report.
Lab Outcomes (LOs):	Learners will be able to.. 1. perform experiments based on interference in thin film and determine radius of curvature of lens / diameter of wire / thickness of paper. 2. identify and draw lattice planes in a space lattice. 3. verify the Characteristics of Semiconductor Diode. 4. calculate basic parameters / constants using semiconductors. 5. measure capacitance of a Supercapacitor.

Lab No.	Experiment Title	LO mapped	Hrs/Lab
i.	**Lab Prerequisites**	**--**	**1**
1.	Determination of radius of curvature of a lens using Newton's ring set up	**1**	**1**
2.	Determination of diameter of wire/hair or thickness of paper using wedge shape film method.	**1**	**1**
3.	Study of Miller Indices.	**2**	**1**
4.	Study of I / V characteristics of semiconductor diode	**3**	**1**
5.	Study of I/V characteristics of LED	**3**	**1**
6.	Study of Zener diode as voltage regulator.	**3**	**1**
7.	To determine resistivity of semiconductors using four probe method	**4**	**1**
8.	Study of Hall Effect.	**4**	**1**
9.	Determination of energy band gap of semiconductor.	**4**	**1**
10.	Determination of Planck's constant using Photo cell.	**4**	**1**
11.	Determination of Planck's constant using LED	**4**	**1**
12.	To measure capacitance of a Super-capacitor by charging discharging method	**5**	**1**
13.	Comparative study of charging and discharging characteristics in Super-capacitor and normal capacitor	**5**	**1**

14.	Any other experiment based on syllabus may be included, which would help the learner to understand concept. Virtual lab may be developed and used for performing the experiments.	--	**1**

Virtual Lab Links:

1 https://vlab.amrita.edu/?sub=1

Term work: 25 Marks

1.Term work should consist of a minimum of 8 experiments

2. Journal must include at least 2 assignments on content of theory and practical of the course.

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

4 Total 25 Marks (Experiments: 20-marks, Assignments: 05-marks)

Lab Code	Lab Name	Credits (P+TUT)
BSL103	**Engineering Chemistry Laboratory**	**0.5+0**

Lab Prerequisites:	1. Knowledge of volumetric analysis 2. Knowhow of gravimetric analysis 3. Understanding of properties of lubricants
Lab Objectives:	1. To enhance knowledge about the theory learned in the class 2. To analyse experimental results and write laboratory report
Lab Outcomes (LOs)	After experimentation, the learners will be able to: 1. infer analytical techniques (complexometric and neutralization titrations) for various purposes like chemical parameters of water and lubricants. 2. make use of instruments like pH meter, conduct meter, etc .to determine the physical parameters of water. 3. estimate key properties of lubricants like flash point, viscosity. 4. examine the solid and gaseous fuels for its composition.

Suggested Experiments-

Lab No	Experiment Title	LO mapped	Hrs/Lab
i.	**Lab Prerequisites**	**--**	**2**
1.	To determine Chloride content of water by Mohr's Method	**LO1**	**1**
2.	To determine total, temporary and permanent hardness of water	**LO1**	**1**
3.	To determine free acid pH of different solutions using pH meter	**LO2**	**1**
4	To determine COD of waste water samples.	**LO1**	**1**
5	Determination of Viscosity of oil by Redwood Viscometer	**LO3**	**1**
6	Determination of flash point of lubricant by Abel's Flash point apparatus	**LO3**	**1**

7	Determination of acid value of lubricants	**LO1**	**1**
8	Determination of conductance by conductometer	**LO2**	**1**
9	Determination of saponification value of lubricants	**LO1**	**1**
10	Analysis of Flue gas for its composition (by Orsat's Apparatus)	**LO4**	**1**
11	Determination of Moisture content of coal.	**LO4**	**1**
12	Determination of Ash content of coal.	**LO4**	**1**

Virtual Lab Links:

1 https://vlab.amrita.edu/

2 http://vlabs.iitb.ac.in/vlab/labscs.html

Term work: 25 Marks

1. Term work should consist of a minimum of 8 experiments

2. Journal must include at least 2 assignments on content of theory and practical of the course

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

4. Total 25 Marks (Experiments: 20-marks, Assignments: 05marks.)

Lab Code	Lab Name	Credits (P+TUT)
BSL104	**Engineering Mechanics Laboratory**	**1+0**

Lab Prerequisites:	1. Basics of Trigonometry. 2. Newton's Laws of motion 3. Basics of units and conversions.
Lab Objectives:	1.To apply the concepts of Engineering Mechanics and develop analytical skills for applications in engineering 2. To study and analyse motion of moving particles/bodies 3. To learn about the centroid of composite plane lamina
Lab Outcomes (LOs):	Learners will be able to… 1. verify equations of equilibrium of the coplanar force system. 2. verify the law of moments. 3. determine the centroid of plane lamina. 4. evaluate the coefficient of friction between the different surfaces in contact. 5. demonstrate the experiments on Kinematics and Kinetics of particles.

Lab No.	Experiment Title	LO mapped	Hrs/Lab
i.	**Lab Prerequisites**	**--**	**2**
1.	Verification of the equations of equilibrium for the Concurrent force system.	**LO1**	**2**
2.	Verification of the equations of equilibrium for Non-concurrent non-parallel (General) force system.	**LO1**	**2**
3.	Determination of support reactions of a simply supported beam.	**LO1**	**2**
4.	Verification of Principle of Moments (Bell Crank Lever).	**LO2**	**2**
5.	Determination of centroid of a plane lamina.	**LO3**	**2**
6.	Determination of coefficient of friction using inclined plane apparatus.	**LO4**	**2**
7.	Determination of coefficient of restitution for Collision of elastic bodies (Law of conservation of momentum).	**LO5**	**2**
8.	Verification of Lami's theorem (Jib Crane Apparatus).	**LO1**	**2**
9.	Verification of Polygon law of coplanar forces.	**LO1**	**2**
10.	Kinetics of particles. (collision of bodies)	**LO5**	**2**
11.	Study of Projectile Motion	**LO5**	**2**

12.	Study of Motion Under Gravity	**LO5**	**2**
13.	Determination of coefficient of friction using coil friction apparatus.	**LO4**	**2**

Any other experiment based on syllabus may be included, which would help the learner to understand concepts.

Virtual Lab Link:

1. http://amrita.vlab.co.in/?sub=1&brch=74

Term work: 25 Marks

1. Term work should consist of a minimum of 8 experiments.
2. Journal must include at least 2 assignments on content of theory and practical of the course.
3. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks (Experiments: 20-marks, Assignments: 05-marks**)**

Lab Code	Lab Name	Credits (P+TUT)
BSL105	Basics of Electrical Engineering Laboratory	1 + 0

Lab Objectives:	1. To impart the basic concept of network analysis and its application 2. To provide the basic concept of ac circuits analysis and its application 3. To illustrate the operation of machines and transformer
Lab Outcomes (LOs):	Learner will be able to… 1. analyze the behaviour of DC circuits using network theorems. 2. perform experiment on single phase AC circuits. 3. demonstrate experiment on three phase AC circuits. 4. demonstrate experiments on single phase transformer and machines.

Lab No	Experiment Title	LO mapped	Hrs/Lab
1.	Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.	**LO1**	**2**
2.	To measure output voltage across load resistor/current through load resistor and verify the result using Mesh and Nodal analysis.	**LO1**	**2**
3.	Verification of Superposition Theorem.	**LO1**	**2**
4.	Verification Thevenin's Theorem.	**LO1**	**2**
5.	Verification Norton's Theorem.	**LO1**	**2**
6.	Verification Maximum Power Transfer Theorem.	**LO1**	**2**
7.	To find the resistance and inductance of a coil connected in series with a pure resistance using three voltmeter methods.	**LO2**	**2**
8.	To find the resistance and inductance of a coil connected in parallel with a pure resistance using three ammeter method.	**LO2**	**2**
9.	To find resonance conditions in a R-L-C series resonance circuit	**LO2**	**2**
10.	To find resonance conditions in a R-L-C parallel resonance circuit.	**LO2**	**2**
11.	To measure relationship between phase and line, currents and voltages in three phase system (star & delta)	**LO3**	**2**
12.	To measure Power and phase in three phase system by two wattmeter method.	**LO3**	**2**
13.	To find the equivalent circuit parameters by conducting OC and SC test on single phase transformer	**LO4**	**2**
14.	Study of AC and DC machine.	**LO4**	**2**

15.	Study of single phase transformer.	**LO4**	**2**

Virtual Lab Links:

1. https://ems-iitr.vlabs.ac.in/List%20of%20experiments.html

Term work: 25 Marks

1. Term work should consist of a minimum of 8 experiments
2. Journal must include at least 2 assignments on content of theory and practical of the course.
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks (Experiments: 20-marks, Assignments: 05-marks.)

Lab Code	Lab Name	Credits (P+TUT)
BSXS11	**Vocational Skill- SAT I: Skill-Based Learning (Workshop – I)**	**1 + 0**

Lab Prerequisites:	1. Knowledge of basic measuring tools 2. Ability to identify basic materials used in engineering
Lab Objectives:	1. To impart training to develop engineering skill sets. 2. To inculcate respect for physical work and hard labour 3. To get exposure to interdisciplinary activity based learning.
Lab Outcomes (LOs):	Learner will be able to: 1. develop the technical skills by making a job as per drawing in fitting trade. 2. understand the industrial scenario, different mechanisms and application of mechatronic components. 3. organize the electromechanical components to build a simple model. 4. understand the working principle of modern manufacturing tool (3D printing). 5. develop the technical skills by making a job as per drawing in the carpentry trade.

Lab No	Experiment Title	LO Mapped	Hrs/Lab
i.	**Lab Prerequisites**	**--**	**2**
	Fitting 1.1 Demonstration of use and setting of fitting tools for chipping, cutting, filing, marking, center punching, drilling and tapping.	**LO1**	**8**
	1.2 Develop a simple fitting joint job example: open tenon fitting joint, involving different operations like cutting and filing to size, drilling and tapping.		
2.	**Basic electromechanical workshop** 2.1 Introduction to Indian industrial scenario,Industry4.0	**LO2**	**10**
	2.2 Demonstration of basic mechatronic components like sensors, transducers, actuators, batteries, motors, gear train and belt drive.		
	2.3 Introduction to Mechanisms– linkage system, slider crank mechanism, cam follower mechanism, crank rocker mechanism, simple robotic arm, degree of freedom.		
	2.4 Develop a model using electromechanical components. (As per probable list)	**LO3**	
	2.5 Introduction to 3D printing and demonstration.	**LO4**	
3.	**Carpentry**	**LO5**	**10**

	3.1 Demonstrate use and setting of hand tools like hacksaws, jack planes, chisels and gauges for developing of various joints, wood tuning method. Develop a carpentry joint job.		
Recommended Books	1. Elements of Workshop Technology, Vol. I & II, Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy, 16th Edition, 2015, Media Promoters, India. 2. A Course in Workshop Technology, Vol. I &II, Raghuwanshi B.S., 10th Edition, 2012 Reprint 2017, DhanpatRai and Co. India. 3. Product Design and Development, Karl T Ulrich and Steven D Eppinger, 5th Edition 2012, McGraw Hill. 4. 3D Printing with Autodesk: Create and Print 3 D Objects with 123D, AutoCAD and Inventor, John Biehler, 1st Edition 2014, Que Publishing.		
Useful Links:	1. https://www.youtube.com/watch?v=Kv1zo9CAxt4 2. https://www.youtube.com/watch?v=PtbIy_nW2BQ 3. https://www.youtube.com/watch?v=APTsbOw8Mq4		

Term work marks : 50 marks

The distribution of term work marks is given below:

1. A Fitting job – 15 marks
2. Electromechanical model (group) – 15 marks
3. A carpentry job – 15 marks
4. Journal – 5 marks

Activity Based Learning Code	Value Education – SAT II: Activity Based Learning (Contemporary Concerns)	Credits (TH+P+TUT)
BSXA12	1. Innovation and Creativity/ 2. Study of world's top 2 problems/ 3. Problems in Governance and administration	**0+1+0**
Prerequisite:	Knowledge of Problems and Issues of the National, Global, Societal and Environmental Issues that need attention.	
ABL Objectives:	1. To identify various Social, Environmental, Economic, Hospital Management, Governance etc. related issues and problems via case study approach. 2. To have an in-depth analysis of the issues and problems of the case studies. 3. To propose feasible technological solutions for social, ethical, environmental and legal issues surrounding the subject of study.	
ABL Outcomes:	1. Define the areas of problems and issues by forming specific statements. 2. Analyse the collected data to propose solutions to solve the social concerns. 3. Documentation & presentation/ group discussion within Indian perspectives with ethical parameters	

Guidelines for Activity Based Learning:

1. Students shall form a group of 4-5 and will be allotted a real time case study.
2. Students should investigate, analyse the cases and propose technological solutions.
3. Supervisor may give inputs to students during activity; however, focus shall be on self-learning.
4. The faculty supervisor will monitor the activities and documentation of the students assigned to them.
5. Students in a group shall discuss the problems effectively and propose multiple solutions for selected problem.
6. Professional committee may arrange two to three guest lectures based on the problem/topic in the activity head so that students will get more idea about the topic selected.
7. The marks will be assigned by the faculty supervisor according to the assessment rubrics. The marks are to be submitted to the Exam Cell.

Curriculum for Activity Based Learning:

Module 1- Environmental concerns

(A) Case study based on the environmental degradation, climate change

(B) Green Technological Solutions

Module 2- Social concerns

(A) Problems related to brain drain, downsizing, malnutrition etc

(B) Multidisciplinary approaches

Module 3- Health & Medical concerns

(A) Malnutrition, food wastage

(B) Lack of medical infrastructural & proposed solutions

Module 4- Economic concerns

(A) Recession & unemployment

(B) Solutions in the direction of promotion of start-ups.

Activity No	Activity Title	Activity Outcome Mapped	Hrs
1	1.Generating awareness on contemporary concerns 2. Need and importance to analyse the issue 3. To motivate students for technological or theoretical solutions E.g.: Share specimens of 'Realistic case studies'& Topic Finalization (Group of 5)	1	2
2	Introduction & background of the study	1	2
3	Aims of the Study & definition of key terms	2,6	2
4	Significance of the Problem	2,4,6	2
5	Discussion & Proposed Technological Solutions	2,4,6	2
6	Conclusion	2,4,6	2
7	Recommendations	3,6	2
8	Appendices	3,6	2
9	References	2,4,6	2
10	Presentation of the contemporary concerns	3,4,6	2
11	Presentation of the contemporary concerns	3,4,6	2
12	Presentation of the contemporary concerns	3,4,6	2
13	Presentation of the contemporary concerns	5,6	2
14	Course recap, Outcomes, Summarization	-	2
		Total	**28**

Term Work (25 Marks):
Marks will be awarded based on designed Assessment Rubrics which includes the following; 1 Study of the issue and relevant sustainable solution 2 Submission of report 3 Presentation/group discussion of case study

Activity Based Learning Code	Co-Curricular-SAT III: Activity Based Learning(Induction)	Credits (TH+P+TUT)
BSXA13	1. Adapting to the new environment diverse thoughts, backgrounds 2. Inculcation of ethos of the institution in a larger perspective	**0+2+0**
Prerequisite:	Knowledge of Problems and Issues of the National, Global, Societal and Environmental Issues that need attention.	
ABL Objectives:	1.To make the newly joined students feel comfortable 2.To sensitize the new admits towards exploring their academic interests and activities 3.To make the learners work for excellence, promote bonding within them, 4.To provide a broader view of life, and building of character 5. To impart universal human values	
ABL Outcomes:	1. Adapt to the new environment 2. Emphasize upon setting up a healthy daily routine 3. Create bonding in the batch as well as between faculty and students 4. Enhance awareness, sensitivity and understanding of the self, people around them, society at large, and nature 5. Acquire universal human values	

Guidelines for Activity Based Learning:

At the start of the induction, the incumbents learn about the institutional policies, processes, practices, culture andvalues, and their mentor groups are formed. The different activities are:

1. Orientation: In the first session of Induction program learners and parents to be oriented about institute policies, processes, practices, culture and values. In addition to this, learners will be educated for 1st year academic program information in terms of academic calendar, assessment plan, grading information, university ordinances, rules and regulations related to academics.

2. Mentoring: Mentoring and connecting the students with faculty members is the most important part of student induction. Mentoring process shall be carried out in small groups, group of 10 students to be formed and allocate one senior student from 3rd year of same program in which new students have taken admission, students mentor will continue for two years, till student mentors graduate from the institute. For two (2) such groups one faculty mentor to be allocated from the same department/program, who will remain the mentor till those students graduates from the institute. In the second session of Induction program, groups for mentoring to be formed and student mentors and faculty mentors to be introduced to newly inducted students. Introduction of mentoring system to be given to new students. Minimum one meeting to be conducted every month during semesters with students group by faculty mentors. For record keeping appropriate formats to be developed and information to be updated regularly by faculty mentors.

3.Universal Human Values: Universal Human Values gets the student to explore oneself and experience the joy of learning, prepares one to stand up to peer pressure and take decisions with

courage, be aware of relationships and be sensitive to others, understand the role of money in life and experience the feeling of prosperity. Need for character building has been underlined by many thinkers, universal human values provide the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but by getting the students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values.

4. Proficiency Modules: The induction program period can be used to overcome some critical lacunas that students might have, for example, English, Mathematics, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially.

A diagnostic test should be conducted on Day 2 itself. Before the test, the students should be informed that the test would not affect their grades, branch change, or any aspect of their admission, placement, study, etc. Purpose of the test is to provide help to those students who need help in English, Mathematics, Computer proficiency etc. Students having more than 80% marks in their qualifying examination in respective subjects need not take the diagnostic test. For those below this cut-off, writing the test is mandatory. Students with weak performance in the test, must attend a non-credit course in Basic English, Basic Mathematics, and Basic Computer Operation etc. Their attending the course is mandatory. There would be no separate fee payable for the course. The classes of Basic courses must start from Day 4 at the latest. Students those who are excluded from basic courses, for them some activity in the domain of creative arts, cultural and literature to be organised.

5.Physical Activity: Fitness session, yoga classes, lecture(s) on facing world with sportsman spirit, making young students aware that there is nothing like being failure in the world. The world gives opportunities to all.

The incoming students must be divided into batches of 50 students maximum, and a qualified coach in physical education/ faculty member should be attached to each batch. The list of available games, sport, or physical activities should be announced in orientation program on Day 1. They should be asked to fill their choice with three preferences, and the game or sport be allotted to them as per their preference. The physical activity should start from Day 3 onwards, wherein the student learns and plays his assigned game during the induction program. It is also important that along with his assigned game the student also practises yoga.

6. Creative Arts, Cultural and Literary Activity: Qualified instructors for arts may be hired on contract basis and be paid honorarium as per norms of the institute. Daily 90 to 120 minute sessions may be arranged. The list of available art forms, such as vocal music, instrumental music, folk music, painting, sketching, dance, group dance, clay modelling, pottery, dramatics, etc. should be announced. They should be asked to fill their choice with three preferences, and the art form be allotted to them as per their preference. There should be sufficient number of teachers for each art form. The ratio may be kept as 1 teacher for every 25 students.

A faculty member interested in literary activity should be assigned for organizing the activity. A list of books which are interesting and educational should be prepared beforehand. Books in Indian languages must be included and even given priority. Students are losing connection with languages in general and their own language, in particular. Students should be assigned a book or other smaller reading material. They should be asked to read and write a critical summary. They should present their summary in front of their group. A literary group may consist of around 30-40 students.

Similarly, debating and public speaking activity could also be undertaken. If the college can arrange for a drama workshop where a group of students learn and enact a play it would be very good. Not all the incoming students would do this, but those who wish may be provided the opportunity. Help may be taken from senior students engaged in such extra- curricular activities in the college.

7. Familiarisation with Institute and Department: The students admitted in a branch would visit their allotted department or branch. The Head of the department and other associated faculty should address the new student's right on Day 2 or so. Arrangements should be made about the meeting/gathering. The parents of the students should also be welcomed if they accompany their ward. It would be helpful if an alumnus of the Dept. relates his professional experience related to the field of the study to the incoming students.

8.Lectures /Workshops by Eminent People: Eminent people from all walks of life may be invited to deliver lectures, namely, from industry, academia, social science (authors, historians), social work, civil society, alumni etc. be identified and invited to come and address the new students. Motivational lectures about life, meditation, etc. by Ramakrishna Mission, Art of Living, S-VYASA university, Vivekanand Kendras, etc. may be organized. Workshops which rejuvenate or bring relief to students would also be welcome, such as, Art of Living workshops.

9. Extra-Curricular Activity: Every college has extra-curricular activities. Most of them are student driven. They are organized by student councils and clubs. The extra-curricular activities going on in the college should be presented to the new students under the guidance of faculty advisors for such activity. The new students should be informed about how they can join the activities. Related facilities should be described to them. Presentation on the activities by the student council should be made.

10. Feedback and Report on the Program: A formal feedback at the end of the program should be collected from students by their filling a form in writing or online. Besides the above, each group (of 20 students) should write a report on the Induction Program towards the end of the semester. They would also have to make a presentation of their report. They should be encouraged to use slides while making a presentation. Presentation of the report should be made in the language they are comfortable with, without any insistence that it should be in English. It is more important that they feel comfortable and confident. Each group may make the presentation through 4-5 of its group members or more. In case, the number of new students in a college is large, the presentation should be made by each group in front of 4 other groups besides their own, thus there would be about 100 students (in 5 groups) in the audience in a session. Several such sessions could run in parallel or serially. In each session, their faculty mentors and student guides, if any, should also be in the audience. These sessions would tell you how well the program ran, and what the students are feeling at the end of the program. This would also serve as a grand closure to the program.

Submission guidelines:

1. The evaluation criteria of induction program are based on active participation in all the activities carried out under the induction program. However, 15-20 page report of participation in any 02 activities should be submitted to gain the credits.
2. The evaluation shall be against Term Work for 50 marks.
3. The marks will be assigned by the faculty supervisor according to the Assessment Rubrics.
4. The marks are to be submitted to the respective Departments and the Departments will submit them to the Exam Section.

Structure for Student Induction Program

Minimum 12 sessions will be conducted from the following 30 sessions, from 1st week to last week of academics,throughout the semester.

Session 1	Orientation program
Session 2	Mentoring (group formation and introduction)
Session 3	Diagnostic test (basic English, maths and computer operation)
Session 4	Familiarisation of Department and Institute (Visits to department, laboratory, Library, Examination cell, office etc)
Session 5	Physical Activity (Yoga, sports etc)
Session 6	Universal human values session
Session 7	Proficiency Modules (Short courses on basic maths, English and computer operation etc. for identified students)
Session 8	Physical Activity (Yoga, sports etc)
Session 9	Proficiency Modules (Short courses on basic maths, English and computer operation etc. for identified students)
Session 10	Creative Arts, Cultural and Literary Activity
Session 11	Physical Activity (Yoga, sports etc)- 1
Session 12	Extra-Curricular Activity- 1
Session 13	Physical Activity (Yoga, sports etc)-2
Session 14	Extra-Curricular Activity- 2
Session 15	Physical Activity (Yoga, sports etc)- 3
Session 16	Lectures /Workshops by Eminent People- 1
Session 17	Physical Activity (Yoga, sports etc)- 4
Session 18	Lectures /Workshops by Eminent People- 2
Session 19	Creative Arts, Cultural and Literary Activity- 1
Session 20	Lectures /Workshops by Eminent People- 3
Session 21	Creative Arts, Cultural and Literary Activity- 2
Session 22	Universal Human Values- 1(Group Discussion among students as per mentoring group on various aspects of life, values, ethics etc.)
Session 23	Creative Arts, Cultural and Literary Activity- 3
Session 24	Universal Human Values- 2 (Group Discussion among students as per mentoring group on various aspects of life, values, ethics etc.)
Session 25	Creative Arts, Cultural and Literary Activity- 4
Session 26	Universal Human Values- 3 (Group Discussion among students as per mentoring group on various aspects of life, values, ethics etc.)

Session 27	Creative Arts, Cultural and Literary Activity- 5
Session 28	Physical Activity (Yoga, sports etc)- 5
Session 29	Feedback and Report on the Program- 1
Session 30	Feedback and Report on the Program- 2

Course Code	Course Name	Credits (TH+P+TUT)
BSC201	**Engineering Mathematics-II**	**3+ 0+ 1**

Prerequisites:	1.Basics of trigonometry 2.Basics of Integral calculus 3.Basics of curve tracing
Course Objectives:	1. To classify and study first order and first degree differential equations 2. To explain the fundamental concepts of linear differential equations of higher order with constant coefficients 3. To analyse Beta and Gamma functions and rectification of curves 4. To introduce the theory of double integrals and its evaluation techniques 5. To apply double integrals for finding area and enumeration of triple integrals 6. To use numerical methods for solving differential equations and integrals
Couse Outcomes:	After taking this course learner will be able to.. 1. solve problems in the field of engineering using concepts of first order and first degree differential equations. 2. find the solution of engineering problems using the theory of higher order linear differential equations with constant coefficients. 3. determine the value of definite integrals using special functions called Beta and Gamma functions and DUIS techniques. 4. evaluate the double integrals in different coordinate systems. 5. apply double integration to find area and calculate triple integrals. 6. make use of numerical techniques to find the solution of first order differential equations and integrals.

Module No.	Sub Topics	CO mapped	Hrs/ Subtopic	Total Hrs/Module
i	**Prerequisite Concepts and Course outline**	**--**	**2**	**2**
1.	**Differential Equations of First Order and First Degree** 1.1 Exact differential Equations, Equations reducible to exact form by using integrating factors.	**CO1**	**4**	**6**
	1.2 Linear differential equations (Review), equation reducible to linear form, Bernoulli's equation # **Self-learning topics:** Simple application of differential equation of first order and first degree to electrical and Mechanical Engineering problem		**2**	

2.	**Linear Differential Equations with Constant Coefficients and Variable Coefficients of Higher Order** 2.1 Linear Differential Equation with constant coefficient, complementary function, particular integrals of differential equation of the type f(D)y=X where X is e^{ax},sin(ax+b), cos(ax+b), x^n, $e^{ax}V$,xV.	**CO2**	**4**	**6**
	2.2 Method of variation of parameters. **# Self-learning topics**: Cauchy's homogeneous linear differential equation and Legendre's differential equation, Applications of Higher order differential equation.		**2**	
3.	**Beta and Gamma Function, Differentiation under Integral sign and Rectification Pre-requisite: Tracing of curves** 3.1Beta and Gamma functions and its properties.	**CO3**	**4**	**8**
	3.2 Differentiation under integral sign with constant limits of integration.		**2**	
	3.3 Rectification of plane curves.(Cartesian and polar) **#Self-learning topics**: Rectification of curve in parametric co-ordinates.		**2**	
4.	**Multiple Integration-1** 4.1 Double integration -definition, Evaluation of Double Integrals.(Cartesian & Polar)	**CO4**	**2**	**7**
	4.2 Evaluation of double integrals by changing the order of integration.		**3**	
	4.3 Evaluation of integrals over the given region. (Cartesian & Polar) **#Self-learning topics:** Application of double integrals to compute Area, Mass.		**2**	
5.	**Multiple Integration-2** 5.1 Evaluation of double integrals by changing to polar coordinates.	**CO5**	**2**	**6**
	5.2 Application of double integrals to compute Area		**2**	
	5.3 Triple integration definition and evaluation (Cartesian, cylindrical and spherical polar coordinates). **#Self-learning topics:** Application of triple integral to compute volume.		**2**	

6.	**Numerical solution of ordinary differential equations of first order and first degree, and, Numerical Integration** 6.1 Numerical solution of ordinary differential equation using (a) Euler'smethod (b) Modified Euler method, (c) Runge-Kutta fourth order method	**CO6**	**3**	**6**
	6.2 Numerical integration- by (a) Trapezoidal (b) Simpson's 1/3rd (c) Simpson's 3/8th rule (all with proof). **#Self-learning topics:** Numerical solution of ordinary differential equation using Taylor Series method.		**3**	
ii	**Course conclusion:** Recap of Modules, Outcomes, Applications, and Summarization.	**-**	**1**	**1**

Books:

Text Books	1. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication 2. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven Chapra, McGraw Hill 3. Elementary Linear Algebra with Application by Howard Anton and Christ Rorres. 6th edition. 4. John Wiley & Sons, INC.
Reference Books	1. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited, 9thEd. 2. Engineering Mathematics by Srimanta Pal and SubodhBhunia, Oxford University Press
Useful Links:	1.e-PGPathshala (inflibnet.ac.in) 2.https://nptel.ac.in/noc/courses/111/ 3.https://www.coursera.org/courses?query=mathematics 4. https://ndl.iitkgp.ac.in/

Continuous Assessment (CA):

The distribution of Continuous Assessment marks will be as follows –

1.	Test 1	20 marks
2.	Test 2	20 marks

Tests:

Two tests of 20 marks each should be conducted in a semester. The first test is to be conducted when approx. 40% syllabus is completed and second test when additional 40% syllabus (but excluding contents covered in Test I) is completed. Duration of each test shall be 1 hour and addition of both tests will be considered as a head of passing.

Term Work (TW):25 marks

1. Term work should consist of a minimum of 6 class tutorials

2. Journal must include at least 2 assignments on content of theory of the course.

The distribution of term work marks will be as follows –

1.	Tutorials	20 marks
2.	Assignment	05 marks

End Semester Theory Examination:

End Semester Theory Examination will of 60-Marks and duration 2 hours 30 minutes.

Course Code	Course Name	Credits (TH+P+TUT)
BSC202	Physics and Nano Technology	2 + 0 + 0

Prerequisites:	1.Wave front and Huygens's principle, reflection and refraction, diffraction, Fresnel diffraction and Fraunhofer diffraction 2.Absorption, recombination, energy bands of p-n junction, refractive index of a material, Snell's law 3.Electric Charges, Coulomb's law-force between two point charges, Electric field, electric field due to a point charge, electric field lines, electric dipole, electric field due to a dipole, Gauss's law, Faraday's law 4.Scattering of electrons, Tunneling effect, Electrostatic focusing, magneto static focusing
Course Objectives:	1. To give exposure to the basic concepts of optics and electrodynamics. 2. To provide fundamentals of nanotechnology encouraging engineering students to venture in research field
Couse Outcomes:	Learners will be able to... 1. identify the applications of diffraction grating in spectroscopy and monochromators. 2. describe the working of lasers and applications of lasers. 3. apply the foundation of fibre optics in development of modern communication technology 4. describe significance of Maxwell's equations. 5. assimilate the wide scope of nanotechnology in modern developments and its role in emerging innovating applications. 6. describe different techniques of Synthesis and Characterization.

Module No.	Sub Topics	CO mapped	Hrs/ Subtopic	Total Hrs/Module
i	**Prerequisite Concepts and Course outline**	--	1	1
1.	**DIFFRACTION** 1.1 Fraunhofer diffraction at single slit	CO1	1	4
	1.2 Diffraction Grating		1	
	1.3 Resolving power of a grating		1	
	1.4 Applications of diffraction grating in spectroscopy, monochromators, Determination of wavelength of light using plane transmission grating		1	
2.	**LASERS** 2.1 Laser: spontaneous emission and stimulated emission, metastable state, population inversion, types of pumping, resonant cavity,	CO2	1	4
	2.2 Three level lasers, Four level lasers, Helium Neon laser (gas laser), Nd:YAG laser (solid state laser), Semiconductor laser		2	
	2.3 Einstein's equations, Holography and other applications of laser		1	

3.	**FIBRE OPTICS** 3.1 Fibre optics: Total Internal Reflection, critical angle, types of optical fibres, angle of acceptance, Numerical Aperture for step index fibre	**CO3**	**1**	**3**
	3.2 V number; number of modes of propagation, Fibre optic communication system		**1**	
	3.3 Optical sensor: Photodiode, construction and use of photodiode as ambient light measurement and flux measurement, use of optical fibre in pressure sensing, temperature sensing, smoke sensing, water level sensing applications		**1**	
4.	**ELECTRODYNAMICS** 4.1Scalar and Vector field, Vector Algebra, Position vector, Displacement Vector	**CO4**	**1**	**6**
	4.2 Physical significance of gradient, divergence and curl in Cartesian co-ordinate system		**2**	
	4.3 Divergence theorem, Stokes theorem, Gauss's law for electrostatics, Gauss's law for magnetostatics, Faraday's Law and Ampere's circuital law		**1**	
	4.4 Maxwell's equations (Free space and time varying fields), significance of Maxwell's equations		**2**	
5.	**NANOTECHNOLOGY I: Basics and Types of Nanomaterials** 5.1 Introduction to Nanosystem, Size Dependent Phenomenon: Surface to volume ratio.	**CO5**	**1**	**4**
	5.2 Properties of Nanomaterials: Optical, electrical, magnetic, and mechanical		**1**	
	5.3 Types of Nanomaterials: Classification based on dimension, Morphology, Physical and Chemical properties		**1**	
	5.4 Applications of Nanomaterials		**1**	
6.	**NANOTECHNOLOGY II: Synthesis, Fabrication and Characterization Techniques** 6.1 Two main approaches in nanotechnology -Bottom up technique and Top down technique	**CO6**	**1**	**5**
	6.2 Chemical Synthesis, Physical Synthesis		**1**	
	6.3 Nanofabrication by Lithography		**1**	
	6.4 Characterization Techniques: XRD, SEM, AFM, TEM, XPS, SERS, RBS, UV-V Spectrometer		**2**	
ii	**Course conclusion: Recap of Modules, Outcomes, Applications, and Summarization.**	**-**	**1**	**1**
Books:				
Text Books	1.A Text book of Engineering Physics -Dr. M. N. Avadhanulu,Dr. P. G. Kshirsagar, S. Chand, Revised Edition 2014			

	2.Modern Engineering Physics - A. S. Vasudeva, S. Chand, Revised Edition 2013 3.Engineering Physics D. K Bhattacharya,PoonamTandon, Oxford Higher Education, 1st Edition 2015 4.Engineering Physics -R. K. Gaur,S. L. Gupta, Dhanpat Rai Publications, 2012 5.Engineering Physics -V. Rajendran, McGraw Hill Educations, 2017 6.A Textbook of Nanoscience and Nanotechnology, T. Pradeep Tata McGraw Hill Education Pvt. Ltd., 2012
Reference Books	1.Concepts of Modern Physics - ArtherBeiser, ShobhitMahajan, S. Choudhury, McGraw Hill, 7th Edition 2017 2. Fundamentals of optics - Francis A. Jenkins, Harvey E. White, McGraw Hill Publication, India, 4th Edition 3.Fundamentals of Physics, Halliday and Resnick, Wiley publication 4.Introduction to Electrodynamics, D. J. Griffiths, Pearson Publication 5.Nano: The essentials, understanding Nanoscience and Nanotechnology, T. Pradeep, Tata McGraw Hill` 6.Nanomaterials: Synthesis, Properties and Applications, A. S. Edelstein and R. C. Cammarata, Institute of Physics Pub., 2001

Useful Links:

1. NPTEL :: Physics - NOC: Introduction to LASER
2. NPTEL :: Nanotechnology - Nanostructures and Nanomaterials: Characterization and Properties
3. NPTEL :: Physics - Electrodynamics
4. https://nptel.ac.in/courses/115/107/115107095/

Assessment

Continuous Assessment (CA) :

Continuous Assessment will be done on the following basis-

Weightage	Assessment Method	Time of Conduction	Process
15 Marks	Test 1 (T1)	Will be conducted after completing approx. 40% syllabus	Duration of each test shall be 45 minutes and addition of both tests will be considered as a head of passing.
15 Marks	Test 2 (T2)	Will be conducted when additional 35% syllabus is completed	

End Semester Examination:

End Semester Theory Examination will of 45-Marks and duration 2 hours.

Course Code	Course Name	Credits (TH+P+TUT)
BSC203	**Material Chemistry**	**2+ 0 + 0**

Prerequisites:	1. Classification and crystallinity of polymers 2. Metals and metallurgical operations 3. Principles of spectroscopy 4. Fundamentals of thermodynamics
Course Objectives:	1.To recognize the types, properties and applications of polymers, composite materials, alloys and ceramics 2. To apply phase rule on one and two component systems 3.To describe fabrication of polymers, composite materials, alloys & ceramics 4.To interpret the techniques of spectroscopic analysis
Course Outcomes	Learners will be able to… 1. identify different types of chemical materials and use the right material for specific engineering applications . 2. interpret various phase transformations using thermodynamics. 3. be familiar with various manufacturing techniques to obtain simple/complex shapes of materials. 4. apply basic concepts of spectroscopy in characterizing chemical materials using FTIR and NMR

Module	Detailed Contents	CO Mapped	Hr/ Subtopic	Total Hrs
i	Prerequisite Concepts and Course outline	**--**	**1**	**1**
1.	**Polymers-** **1.1** Introduction, Thermoplastic and Thermosetting polymers. Molecular weight (Number average and Weight average), Numerical problems on molecular weight, Effect of heat on polymers (glass transition temperature), Viscoelasticity.	**CO1, CO3**	**2**	**5**
	1.2 Polymer Blends, Polymer Alloys, Engineering & Specialty Polymers, Biomedical Polymers, Liquid crystal polymers, Conducting Polymers, Biopolymers, Intelligent (Smart) Polymers .Compounding of plastics, Fabrication of plastics- Compression, Transfer, Injection and Extrusion moulding, Blown Film Extrusion Moulding.		**3**	

2	**Composite materials-** 2.1 Introduction, Constitution- i) Matrix phase ii) Dispersed phase. Characteristic properties of composite materials. Classification- (A) Particle - reinforced composites- i) Large – particle reinforced composites ii) Dispersion – strengthened composites. (B) Fiber – reinforced composites- i) Continuous – aligned ii) Discontinuous – aligned (short)- (a) aligned (b) randomly oriented (C) Structural Composites- i) Laminates (ii) Sandwich Panels, Fibre reinforced composites	**CO1, CO3**	**2**	**4**
	2.2 Important Fibre Reinforced Composites, Processing of Fibre reinforced composites, Applications of composite materials.		**2**	
3	**Alloys and Ceramics** **3.1 Alloy**-Introduction to alloy, purpose of making alloys, Ferrous Alloys, plain carbon steel, heat resisting steels, stainless steels (corrosion resistant steels), effect of the alloying element, Ni, Cr, Co, Mg, Mo, W, and V. Non-Ferrous Alloys- Alloys of Al – i) Duralumin ii) Magnalumin. Alloys of Cu-Brasses – i) Commercial brass ii) German Silver. Bronzes – i) Gun metal ii) High – phosphorus bronze. Alloys of Pb– i) Wood's metal. ii) Tinman's solders. Their composition, properties & uses. Shape memory alloy.	**CO1**	**3**	**5**
	3.2 Ceramics -Introduction to ceramic powde**r,** Classification of ceramics, Application of ceramics. General methods to produce ceramic powder, Manufacture of some important oxide and non oxide ceramic powders.		**2**	
4	**Powder Metallurgy and its industrial applications** **4.1 Powder Metallurgy and its industrial applications**-Introduction, methods of metal powder formation (1) (a) Mechanical pulverization (b) Atomization (c) Chemical reduction (d) Electrolytic process (e) Decomposition. (2) Mixing & blending (3) Sintering. (4) Compacting, Various methods of compacting and shaping such as i) cold pressing. ii) Powder injection moulding. iii) Hot compaction. Applications of powder metallurgy.	**CO3**	**3**	**3**
5	**Phase Rule** **5.1 – Gibb's Phase Rule**-Statement of Gibb's Phase Rule, Terms involved with examples, Application of Phase rule to	**CO2**	**2**	**4**
	5.2 Reduced Phase Rule, Application of Phase rule to Two Component System (Pb- Ag), Advantages and Limitations of Phase Rule. Numerical problems on Phase Rule		**2**	

6	**Material characterization techniques** **6.1 -**IR spectroscopy: Principle, instrumentation, fingerprint region and Application with simple Numerical problems	**CO4**	**2**	**5**
	6.2 NMR Spectroscopy: Principle, instrumentation, Chemical Shift and Application with simple Numerical problems		**3**	
ii	**Course conclusion:** Recap of Modules, Outcomes, Applications, and Summarization.	**-**	**1**	**1**

Books:

Text Books	1.Engineering Chemistry - Jain & Jain (DhanpatRai) 2. Engineering Chemistry – Dara&Dara (S Chand) 3. Engineering Chemistry - Wiley India (ISBN – 9788126519880) 4. A Text Book of Engineering Chemistry – ShashiChawla (DhanpatRai) 5. Engineering Chemistry – Payal Joshi &Shashank Deep (Oxford University Press) 6. Engineering Chemistry-OG Palanna (McGraw Hill Education)
Reference Books	1.W.D. Kingery, Introduction to Ceramics, 2nd ed., John Wiley & Sons, 1999. 2.W.D. Callister, D.G. Rethwisch, Materials science and Engineering: An Introduction, 8th ed., Wiley, 2010. 3.Principles of Instrumental Analysis,7th Edition, Douglas A.Skoog/F.James Holler/Stanley R.Crouch. 4.Fundamentals of Analytical Chemistry ,8th Edition.

Useful Links:

https://onlinecourses.nptel.ac.in /noc20_cy08/preview

https://www.chemguide.co.uk/

https://nptel.ac.in/courses/112/104/112104221/

https://onlinecourses.nptel.ac.in/noc21_me59/preview

Continuous Assessment (CA):

The distribution of Continuous Assessment marks will be as follows –

1	**Test 1**	15 marks
2	**Test 2**	15 marks

Tests: Two tests of 15 marks each should be conducted in a semester. The first test is to be conducted when approx. 35-40% syllabus is completed and second test when additional 35-40% syllabus (but excluding contents covered in Test I) is completed. Duration of each test shall be 45 minutes and addition of both tests will be considered as a head of passing

End Semester Theory Examination:

End Semester Theory Examination will of 45-Marks and duration 2 hours.

Course Code	Course Name	Credits (TH+P+TUT)
BSC204	**Engineering Graphics**	**2+0+0**

Prerequisites:	1. Prior knowledge of geometrical concepts—basic shapes, types of symmetry (reflectional, rotational, translational), scaling, unit measurement system etc 2. Computer competency 3. Visualization details of spatial awareness, objects in three dimensions before actualization of the task
Course Objectives:	1. To develop manual and computerized graphical skills 2. To impart skills in reading and interpretation of engineering drawing 3. To enhance visualization skills 4. To articulate graphical skills, concepts, ideas and design of engineering products through technical drawings 5. To model basic forms of projections as a prerequisite for future engineering tasks 6. To comprehend the diverse visualization dimensions
Course Outcomes	Learners will be able to: - 1. draw basic views of diverse projections of engineering drawing—lines and planes. 2. discern the concepts of projection of solids with acquisition of graphical skills. 3. apply the visualisation skills viz. concepts of sections and development of lateral surface in practical application. 4. sketch technical drawings—two-dimensional orthographic drawing without section from the three-dimensional pictorial view. 5. demonstrate the basic principles of projections in converting 3D view to 2D drawing with section. 6. imagine the three-dimensional solid from two-dimensional pictures.

Module	Detailed Contents	CO Mapped	Hr/ Subtopic	Total Hrs
i	**Prerequisite Concepts and Course outline**	**--**	**1**	**1**
01.	**1.1 Introduction to Engineering Graphics:** Principles of Engineering Graphics and their significance, usage of Drawing instruments, Types of Lines, Dimensioning Systems as per IS conventions.	**CO1**	**1**	**5**
	1.2 Projection of Points and Lines: Projection of points in multiple quadrants. Lines inclined to both the reference planes in multiple quadrants. (Excluding Traces of lines).		**3**	

	@1.3 Projection of Planes: Triangular, Square, Rectangular, Pentagonal, Hexagonal and Circular planes inclined to either HP or VP only. (Exclude composite planes).		**1**	
02	**Projection of Solids:** (Prism, Pyramid, Cylinder, Cone only) Solid projection with the axis inclined to both HP and VP. (Exclude Spheres, Composite, Hollow solids and frustum of solids). Use change of position or Auxiliary plane method	**CO2**	**6**	**6**
03	**3.1 Section of Solids:** Section of Prism, Pyramid, Cylinder, & Cone cut by plane perpendicular to at least one reference plane. (Exclude Curved Section Plane). Use change of position or Auxiliary plane method	**CO3**	**4**	**6**
	3.2 Development of the lateral surface: Developing only the lateral surface (not the base) of the solid which is left out after a solid is being cut by a plane. (Exclude development of a solid with a hole in it and reverse development)		**2**	
04	**Orthographic Projections:** Fundamentals of orthographic projections. Different views of a simple machine part as per the first angle projection method recommended bv I.S.	**CO4**	**3**	**3**
05	**Sectional Orthographic Projections:** Basic concept and significance of sectional orthographic projections. Full sectional view of simple machine parts. (Excluding half section)	**CO5**	**3**	**3**
06	**Isometric Views:** Isometric Views, Conversion of Orthographic Views to Isometric Views (Excluding Sphere).	**CO6**	**3**	**3**
ii	**Course conclusion: Recap of Modules, Outcomes, Applications, and Summarization.**	**-**	**1**	**1**

- **@ only in Term Work (i.e; Questions will not be asked for any examination.)**
- **Maximum coverage of module 04, 05 and 06 should be during the Practical sessions**

Books:

Text Books	1.N.D. Bhatt, "Engineering Drawing (Plane and solid geometry)", Charotar Publishing House Pvt. Ltd. 2.N.D. Bhatt & V.M. Panchal, "Machine Drawing", 3.Charotar Publishing House Pvt. Ltd.

Reference Books	1.Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publisher. 2.Prof. Sham Tickoo (Purdue University) & GauravVerma, "(CAD Soft Technologies): Auto CAD 2012 (For engineers and Designers)", Dreamtech Press NewDelhi. 3.Dhananjay A Jolhe, "Engineering Drawing" Tata McGraw Hill. 4.K. Venugopal, “Engineering Drawing and Graphics”, New Age International.

Useful Links:

https://youtu.be/cQHDAfrptUc

https://nptel.ac.in/courses/112/103/112103019/#

https://nptel.ac.in/courses/112/104/112104172/

Assessment

Continuous Assessment (CA):

Continuous Assessment will be done on the following basis-

Weightage	Assessment Method	Time of Conduction	Process
20 Marks	Test 1 (T1)	Will be conducted after completing approximately 35% to 40% syllabus.	Test 1 will be conducted for 20 marks. **(Conventional/Manual Drafting)**
20 Marks	Test 2 (T2)	Will be conducted when additional 40% syllabus is completed	Test 2 will be conducted for 20 marks. **(Drafting on AutoCAD software)**

Duration of each test shall be 1 hour 30 minutes and addition of both tests will be considered as a head of passing.

End Semester Theory Examination:

End Semester Theory Examination will of 60-Marks and duration 3 hours.

Course Code	Course Name	Credits (TH+P+TUT)
BSC205	**Computer Programming**	**3+0+0**

Prerequisite:	Competency in 'Computer Programming' terminologies.
Course Objectives:	1. To provide exposure in developing algorithm, flowchart and thereby writing efficient codes for user defined problem. 2. To familiarize the logic of structured programming approach. 3. To emphasize on the development of applications of a program using function. 4. To introduce the types and structure of computer language 5. To create awareness on the role of pointers 6. To discern the types and concept of files
Couse Outcomes:	Learner will be able to… 1. formulate simple algorithms for arithmetic, logical problems and translate them to programs in C language. 2. implement, test and execute programs comprising of control structures. 3. decompose a problem into functions and synthesize a complete program. 4. demonstrate the use of arrays, strings and structures in C language. 5. apply the acquired conceptual knowledge of pointers. 6. identify the task of types of files to solve the task effectively.

Module No	Sub Topics	CO mapped	Hrs/ Subtopic	Total Hrs/Module
i.	**Prerequisite Concepts and Course outline**	**--**	**2**	**2**
1.	**Introduction, Fundamentals of C Programming** Introduction to components of a Computer System. Introduction to structure programming approach, Introduction to Algorithm and Flowchart	**CO1**	**2**	**7**
	• Keywords, Identifiers, Constants and Variables • Data types in C, Operators in C • Basic Input and Output Operations • Expressions and Precedence of Operators • In-built Functions, Pre-processor Directives, library, Header Files	**CO1**	**5**	
2.	**Control Structures, Branching and looping structures** Introduction to Control Structures	**CO2**	**1**	**8**
	• If statement, If-else statement, Nested if-else, else-if Ladder • Switch statement • For loop, While loop, Do while loop • Break, continue and go to statements	**CO2**	**6**	
3.	**Functions** • Introduction to functions • Function prototype, Function definition, Accessing a function and parameter passing: Call by Value and Call by reference • Recursive functions	**CO3**	**6**	**6**

	• Storages Classes: Auto, extern, Static and Register			
4	**Arrays and Strings** • Introduction to Arrays • Declaration and initialization of one dimensional and two-dimensional arrays. • Definition and initialization of String • String functions	**CO4**	**6**	**6**
5	**Structure and Union** • Concept of Structure and Union • Declaration and Initialization of structure and union • Nested structures • Array of Structures • Passing structure to functions	**CO5**	**5**	**5**
6	**Pointers and Files** • Fundamentals of pointers • Declaration, initialization and dereferencing of pointers • Operations on Pointers • Concept of dynamic memory allocation • Types of File, File operation- Opening, Closing, Creating, Reading, Processing File	**CO6**	**7**	**7**
ii	**Course conclusion:** Recap of Modules, Outcomes, Applications, and Summarization.	**-**	**1**	**1**

Books:

Text Books	**1.** E. Balaguruswamy, Programming in ANSI C, McGraw-Hill **2.** Kernighan, Ritchie, "The C Programming Language", Prentice Hall of India **3.** Sumitabha Das, Computer Fundamentals and C Programming, McGraw-Hill **4.** Pradeep Day and ManasGosh ,"Programming in C", Oxford University Press.
Reference Books	**1.** Byron Gottfried, "Programing with C", McGraw Hill (Schaum"s outline series) **2.** Venugopal K.R, Prasad Sudeep, "Mastering C", McGraw-Hill **3.** KanetkarYashwant," "Let Us C", BPB Publication.

Useful Links:

1. https://onlinecourses.nptel.ac.in/noc19_cs42/preview
2. https://onlinecourses.swayam2.ac.in/aic20_sp06/preview
3. https://onlinecourses.swayam2.ac.in/cec20_cs02/preview
4. https://www.coursera.org/specializations/c-programming
5. https://www.udemy.com/course/c-programming-for-beginners-/

Continuous Assessment (CA):

1	**Test 1**	20 marks
2	**Test 2**	20 marks

Test:
Assessment consists of two tests of 20 marks each. The first test is to be conducted when approx. 40% syllabus is completed and second test when additional 35% syllabus is completed. Duration of each test shall be 1 hour and addition of both tests will be considered as a head of passing.

End Semester Theory Examination:

End Semester Theory Examination will of 60-Marks and duration 2 hours 30 minutes.

Lab Code	Lab Name	Credits (P+TUT)
BSL202	**Physics and Nano Technology Laboratory**	**0.5 +0**

Lab Prerequisites:	1. Interference in thin films 2. Crystallography basics 3. Semiconductor Physics
Lab Objectives:	1. To improve the knowledge about the theory concepts of Physics learned in the class 2. To improve ability to analyse experimental result and write laboratory report
Lab Outcomes (LOs):	Learners will be able to... 1. perform experiment on diffraction and determine width of the slit / wavelength of light / grating element. 2. determine parameters like numerical aperture of an optical fibre / divergence of laser beam. 3. plot IV characteristics of a photo diode. 4. synthesize Nanomaterials and perform experiments of Nanotechnology experiment using virtual lab / Simulation. 5. determine properties of nanoparticles.

Lab No.	Experiment Title	LO mapped	Hrs/Lab
i	**Lab Prerequisites**	**--**	**2**
1.	Determination of width of a slit using single slit diffraction experiment (laser source)	**1**	**1**
2.	Determination of wavelength of light (laser source) using Diffraction grating.	**1**	**1**
3.	Determination of wavelength of light (ordinary source) using Diffraction grating.	**1**	**1**
4.	Determination of grating element of grating using LASER Source.	**1**	**1**
5.	Study of divergence of laser beam	**2**	**1**
6.	Determination of Numerical Aperture of an optical fibre.	**2**	**1**
7.	Study of I-V characteristics of Photo diode.	**3**	**1**
8.	Synthesis of Nanomaterials (demonstration)	**4**	**1**
9.	Synthesis carbon nanotubes. (demonstration)	**4**	**1**
10.	Determination of Crystallite Size and Micro strain of Nanomaterial Using XRD data.	**5**	**1**
11.	Determination of particle size and optical band gap of nanomaterial using UV-V Spectrometer	**5**	**1**

12.	Any other experiment based on syllabus may be included, which would help the learner to understand concept. Virtual lab may be developed and used for performing the experiments.	--	**1**

Virtual Lab Links:

1.https://vlab.amrita.edu/?sub=1

Term work: 25 Marks

1. Term work should consist of a minimum of 8 experiments

2. Journal must include at least 2 assignments on content of theory and practical of the course.

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

4.Total 25 Marks (Experiments: 20-marks, Assignments: 05-marks)

Lab Code	Lab Name	Credits (P+TUT)
BSL203	**Material Chemistry Laboratory**	**0.5+0**

Lab Prerequisites:	1. Knowledge of volumetric analysis 2. Knowhow of gravimetric analysis 3. Principles of Spectroscopy
Lab Objectives:	1. To enhance knowledge about the theory learned in the class 2. To analyse experimental results and write laboratory report
Lab Outcomes (LOs):	After experimentation, the learners will be able to: 1. determine metal ion concentration using colorimeter, spectrophotometer and flame photometer. 2. synthesize a polymer and discern its physical properties like molecular weight, melting point. 3. make use of analytical techniques (complexometric, redox and iodometric titrations) to find the composition of alloys. 4. analyse chemical materials by different characterization techniques like FTIR and NMR.

Lab No	Experiment Title	LO mapped	Hrs/Lab
i	**Lab Prerequisites**	**--**	**2**
1.	Determination of Na/K by Flame photometry.	**LO1**	**1**
2.	To determine metal ion concentration using colorimeter/ spectrophotometer	**LO1**	**1**
3.	Instrumentation and Working Principles of Infra-Red(IR) Spectroscopy Using Salt Plates.	**LO4**	**1**
4	Nuclear magnetic resonance spectroscopy and evaluation of simple 1HNMR spectra of select organic compounds using virtual lab.	**LO4**	**1**
5	Synthesis of biodegradable polymer using corn starch or potato starch	**LO2**	**1**
6	Molecular weight determination of polymers by Oswald Viscometer.	**LO2**	**1**
7	To determine melting point and /or glass transition temperature of a polymer	**LO2**	**1**

8	Estimation of Zn in brass by Complexometric titration	**LO3**	**1**
9	Estimation of Ni in an alloy by Complexometric titration.	**LO3**	**1**
10	Estimation of Sn in Solder by iodometrically	**LO3**	**1**
11	Estimation of Fe from plain carbon steel by redox titration.	**LO3**	**1**
12	Estimation of Cu in brass by Iodometric titration	**LO3**	**1**

Virtual Lab Links:

1 https://vlab.amrita.edu/

2 http://vlabs.iitb.ac.in/vlab/labscs.html

Term work : **25 Marks**

1.Term work should consist of a minimum of 8 experiments

2. Journal must include at least 2 assignments on content of theory and practical of the course.

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

4.Total 25 Marks (Experiments: 20-marks, Assignments: 05-marks)

Lab Code	Lab Name	Credits (P+TUT)
BSL204	**Engineering Graphics Laboratory**	**2+0**

Lab Prerequisites:	1. Knowledge of geometry such as basic shapes, different types of symmetry (reflectional, rotational, translational), scaling, unit measurement system etc 2. Computer know – how, navigating menus and dialogs, operating mouse and keyboard, managing files and directories 3. A keen eye for detail and good spatial awareness
Lab Objectives:	1. To inculcate the skill of drawing with the basic concepts 2. To Use AutoCAD for engineering drafting 3. To teach basic utility of Computer Aided drafting (CAD) tool
Lab Outcomes (LOs):	Learners will be able to… 1. visualize, draw and learn basic drafting skills by using standard drawing instruments in a conventional way. 2. create, Annotate, Edit and Plot drawings using basic AutoCAD commands and features. 3. apply basic AutoCAD skills to draw different views of a 3D object. 4. apply basic AutoCAD skills to draw the isometric view from the given two views.

Lab No	Experiment Title	LO mapped	Hrs. Lab
i	**Lab Prerequisites**	**--**	**4**
01	Term Sheet 01: Orthographic Projections without section	**LO1**	**4**
02	AutoCAD sheet 01: Redraw sheet for acquainting the AutoCAD software	**LO2**	**6**
03	Term Sheet 02: Projection of Solids	**LO1**	**6**
04	AutoCAD sheet 02: Orthographic Projections without Section	**LO2 and LO3**	**6**
05	Term Sheet 03: Sectional Orthographic Projections	**LO1**	**6**
06	AutoCAD sheet 03:	**LO2 and LO3**	**8**

	Sectional Orthographic Projections		
07	Term sheet 04: Isometric Views	**LO1**	**6**
08	AutoCAD sheet 05: Isometric Views	**LO2 and LO4**	**6**
09	Term sheet 05: Section of Solids with DLS	**LO1**	**4**

Term work:

Term work comprises of three components:

<u>Component-01: Term Sheet (Use half Imperial Drawing Sheet)</u>

Term Sheet 01: Orthographic Projections without section (2 Problems)

Term Sheet 02: Projection of Solids (3 Problems)

Term Sheet 03: Sectional Orthographic Projections (2 Problems)

Term Sheet 04: Isometric Views (2 Problems)

Term Sheet 05: Section of Solids with DLS (2 Problems)

<u>Component-2: Assignments (Use A3 size Drawing sketch book)</u>

Assignment 01: Orthographic Projections without section (2 Problems)

Assignment 02: Projection of Lines and Projection of Planes (2 Problems each)

Assignment 03: Projection of Solids (2 Problems)

Assignment 04: Sectional Orthographic Projections (2 Problems)

Assignment 05: Isometric Views (2 Problems)

Assignment 06: Section of solids with DLS (2 problems)

<u>Component-3: CAD Assignments (Submit Print outs on A4 size paper)</u>

CAD Assignment 01: Redraw sheet for acquainting the AutoCAD software (1 Problem)

CAD Assignment 02: Orthographic Projections without Section (2 Problems)

CAD Assignment 03: Sectional Orthographic Projections (1 Problem)

CAD Assignment 04: Isometric Views (2 Problems)

Term Work Marks: 25 Marks

Component-1 : 09Marks

Component-2 : 07 Marks

Component-3 : 09 Marks

Total Marks : 25 Marks

Note: Satisfactory submission of all 3 components is mandatory to fulfil the Term.

Topic for the End Semester Practical Examination (Auto CAD) (2 hours/25 Marks):

1. Isometric drawing. (1 problem) (10 Marks)
2. Orthographic Projection. (3 views with at least one view sectional) (1 problem) (15 Marks)

Note: Knowledge of AutoCAD software, concepts of Engineering Graphics related to specified problem and accuracy of drawing should be considered during evaluation.

Lab Code	Lab Name	Credits Assigned(TH – P – TUT)
BSL205	**Computer Programming Laboratory**	**0 – 1 – 0**

Lab Prerequisite:	Basic understanding of Computer Programming terminologies.
Lab Objectives:	1. To familiarize the logic of structured programming approach 2. To provide exposure in developing algorithm, flowchart and thereby writing efficient codes for user defined problem 3. To emphasize on the development of applications of a program 4. To introduce the types and structure of computer language 5. To create awareness on the role of pointers 6. To discern the types and concept of files
Lab Outcomes (LOs):	Learner will be able to… 1. translate given algorithms to a program. 2. correct syntax and logical errors. 3. write iterative as well as recursive programs. 4. represent data in arrays, strings and structures and manipulate them through a program. 5. declare pointers and demonstrate call by reference concept. 6. create File and demonstrate File concept.

Lab No	Experiment Title	LO mapped	Hrs. Lab
1.	Write Simple Program on C.	**LO1**	**2**
2.	Write a program to accept the temperature in Celsius and to convert and display it in Fahrenheit.	**LO1,LO2**	**2**
3.	Write a program to accept three numbers and display largest of three using a nested if else statement	**LO1,LO2**	
4.	Write a program to find all the roots of a quadratic equation using if-else ladder.	**LO1,LO2**	**2**
5.	Write a program to implement an arithmetic calculator for addition, subtraction, multiplication, division and modulo operation using switch case.	**LO1,LO2**	
6.	Write a program to check whether an entered number is prime number or not using for-loop.	**LO2,LO3**	**2**
7.	Write a program to generate the following pattern using nested for loop.	**LO2,LO3**	
8.	Write a program to check whether the given number is Armstrong number or not using while loop.	**LO2,LO3**	**2**
9.	Write a program to find binary equivalent of a given decimal number using as while loop.	**LO2,LO3**	
10	Write a program to find largest and second largest element of array.	**LO2,LO4**	**2**
11.	Write a program for multiplication of two (M*N) matrices.	**LO2,LO4**	
12.	Study for passing simple parameters to function.	**LO2,LO3**	**2**

13.	Write a program to find out GCD and LCM of two given numbers, using recursive function.	**LO2,LO3**	
14.	Write a program to check whether entered string is palindrome or not.	**LO2,LO4**	**2**
15.	1. Write a program to accept N elements of an array and to sort and display them in ascending order using function. 2. Write a program to calculate and display sum of all the elements except diagonal elements of the matrix using function.	**LO2,LO4**	**2**
16.	Write a program to concatenate first, middle and last name using function.	**LO2,LO4**	**2**
17.	Write a program to swap two numbers using call by address.	**LO2,LO4**	
18.	Write a program using pointers to display the contents of an array in reverse order.	**LO2,LO5**	**2**
19	Define a structure called Player with data members: Player name, team name, batting average. Create array of objects, store information about players, sort and display information of players in descending order of batting average.	**LO2,LO5**	**2**
20.	Write a program to copy the contents of one file to another file.	**LO2,LO6**	**2**
21	Write a program to create and count the number of characters present in the file.	**LO2,LO6**	**2**

Virtual Lab Links:

1. http://cse02-iiith.vlabs.ac.in/
2. https://onlinecourses.nptel.ac.in/noc19_cs42/preview
3. https://onlinecourses.swayam2.ac.in/aic20_sp06/preview
4. https://onlinecourses.swayam2.ac.in/cec20_cs02/preview
5. https://www.coursera.org/specializations/c-programming
6. https://www.udemy.com/course/c-programming-for-beginners-/
7. https://onlinecourses.nptel.ac.in/noc19_cs42/preview

Term work: 25 Marks

Term Work: Experiments (20 Programs) and Assignments (2 Assignments) should be completed by students on the given time duration

1. Experiments: 20 Marks
2. Assignment: 05 Marks

Total: 25 Marks

The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

Practical: 25 Marks

Practical Exam should be conducted for the Lab, on Computer Programming in C subject for given list of experiments.

1.Implementation: :15 Marks

2.Oral based on practical:10 Marks

Total: 25 Marks

Lab Code	Lab Name	Credits (TH+P+TUT)
BSXS24	**Ability Enhancement – SAT IV: Skill-Based Learning (Professional Communication Skills)**	**0 – 2 – 0**

Prerequisites:	1. Fundamental linguistic skills (LSRW) 2. Grammatical proficiency 3. Technical competency for presentation skills
Lab Objectives:	1. To demonstrate the fundamental concepts of interpersonal and professional communication. 2. To encourage active listening with focus on content, purpose, ideas and tone. 3. To facilitate fluent speaking skills in social, academic and professional situations. 4. To train in reading strategies for comprehending academic and business correspondence. 5. To promote effective writing skills in business, technology and academic arenas. 6. To inculcate confident personality traits along with grooming and social etiquettes.
Lab Outcomes:	At the end of the course, the students will be able to…. 1. eliminate barriers and use verbal/non-verbal cues at social and workplace situations. 2. employ listening strategies to comprehend wide-ranging vocabulary, grammatical structures, tone and pronunciation. 3. prepare effectively for speaking at social, academic and business situations. 4. use reading strategies for faster comprehension, summarization and evaluation of texts. 5. acquire effective writing skills for drafting academic, business and technical documents.

Module	Detailed Contents	LO Mapped	Hr/ Subtopic	Total Hrs
i.	**Prerequisite Concepts and Lab outline**	**--**	**1**	**1**
1	**FUNDAMENTALS OF COMMUNICATION** **1.1 Introduction to Theory of Communication:** Definition**,** Objectives**,** Process of Communication, Organizational Communication-Formal (Upward, Downward and Horizontal) Informal (Grapevine)	**LO 1,2,3**	**4**	**12**
	1.2 Methods of Communication: Verbal (Oral & Written)**,** Non-verbal-Non-verbal cues perceived through the five senses: (Visual, Auditory, Tactile, Olfactory and Gustatory cues) **&**Non-verbal cues transmitted through the use of: (The Body, Voice, Space, Time and Silence)		**4**	
	1.3 Barriers to Communication: Mechanical/External**,** Physical/Internal**,** Semantic & Linguistic**,** Socio-Psychological**,** Cultural		**2**	

	1.4 Communication at the Workplace ● Listening Tasks with Recordings and Activity Sheets ● Short Speeches as Monologues • Informative Speeches that Center on People, Events, Processes, Places, or Things • Persuasive Speeches to Persuade, Motivate or Take Action • Special Occasion Speeches for Ceremonial, Commemorative, or Epideictic purposes		**2**	
2	**VERBAL APTITUDE FOR EMPLOYMENT** **2.1. Vocabulary Building:** Word Formation: Prefixes, Bases and Suffixes (Derivational & Inflectional),Synonyms & Antonyms**,** One Word Substitutes, Words Often Confused-Pairs of words, Standard Abbreviations	**LO 3,4**	**1**	**2**
	2.2. Grammar: Error Analysis, Subject - Verb Agreement**,** Misplace Modifiers Articles**,** Prepositions**,** Tautologies**,** Idioms, Cliches		**1**	
3	**DEVELOPING READING AND WRITING SKILLS**. **3.1. Reading Comprehension:** Long Passages**,** Short Passages**,** MCQs on Inferential Questions	**LO 4,5**	**1**	**2**
	3.2. Summarization of reading passages, reports, chapters, books • Graphic Organizers for Summaries (Radial Diagrams like Mind Maps, Flow Charts, Tree Diagrams, Cyclic Diagrams, Linear Diagrams like Timelines, Pyramids, Venn Diagrams) • Point-form Summaries • One-sentence Summaries of Central Idea		**1**	
	3.3. Paraphrasing • Understanding Copyrights • Generating Plagiarism Reports			
4	**BUSINESS CORRESPONDENCE** **4.1. Seven Cs of Business Correspondence:** Clarity**,** Completeness**,** Conciseness**,** Consideration**,** Concreteness**,** Courtesy **&** Correctness	**LO4**	**1**	**6**
	4.2. Parts of a Formal Letter and Formats • Parts/Elements of a Formal Letter (Letterheads and/or Sender's Address, Dateline, Inside Address, Reference Line (Optional), Attention Line (Optional), Salutation, Subject Line, Body, Complimentary Close, Signature Block, Enclosures/Attachments), Identification Marks • Complete Block/Modified/Semi Block Format		**1**	
	4.3. Emails • Format of Emails • Features of Effective Emails • Language and style of Emails		**2**	

	4.4. Types of Letters in Both Formal Letter Format and Emails • Claim & Adjustment Letters • Request/Permission Letters • Sales Letters		**2**	
5	**BASIC TECHNICAL WRITING** **5.1. Introduction** • Definition, Importance and Principles of Technical Writing • Difference between Technical Writing & Literary Writing • Difference between Technical Description & Instructions	**LO5**	**1**	**2**
	5.2. Description of a Technical Object Definition, Diagram, Discussion of Parts/Characteristics & Working			
	5.3. Writing User Instructions User Instructions with Special Notices (Note, Warning, Caution and Danger)		**1**	
	5.4. Description of a Technical / Scientific Process Definition, Diagram, Tools/ Apparatus/Software/ Hardware Used, Working			
6	**PERSONALITY DEVELOPMENT AND SOCIAL ETIQUETTES** **6.1. Personality Development** Introducing Self and/or a Classmate, Formal Dress Code	**LO6**	**1**	**2**
	6.2. Social Étiquettes • Formal Dining Etiquettes • Cubicle Etiquettes • Mobiquette (Mobile Phone Etiquette)		**1**	
ii	**Lab conclusion:** Recap of Modules, Outcomes, Applications, and Summarization.	**-**	**1**	**1**
Books				
Text Books	1. Raman, M., & Sharma, S. (2016). Technical Communication: Principles and practice. New Delhi: Oxford University Press. 2. Rizvi, A. M. (2010). Effective Technical Communication: A guide for Scientists and Engineers. New Delhi: Tata McGraw Hill. 3. Sanjay Kumar & PushpLata (2018). Communication Skills with CD. New Delhi: Oxford University Press.			
Reference Books	1. Hemphill, P.D., McCormick, D. W., & Hemphill, R. D. (2001). Business Communication with writing improvement exercises. Upper Saddle River, NJ: Prentice Hall. 2. Locker, Kitty O. Kaczmarek, Stephen Kyo. (2019). Business Communication: Building Critical Skills. Place of publication not identified: Mcgraw-hill. 3. Murphy, H. (1999). Effective Business Communication. Place of publication not identified: Mcgraw-Hill.			

	4. Kaul, A. (2015). Effective Business Communication. Place of publication not identified: Prentice-Hall of India. 5. Lewis, N. (2014). Word power made easy. Random House USA.

Useful Links:

https://www.mindtools.com/pages/article/newCS_99.htm

https://corporatefinanceinstitute.com/resources/careers/soft-skills/communication/

List of Activities/ Assignments:

Activity No.	Activities /Assignments	Hrs/Lab
1.	Prerequisites Discussion/ Quiz	02
2.	Written record of listening activities	02
3.	Transcription of the practice public speech along with a plagiarism	02
4.	Transcription of the final public speech along with a plagiarism report	02
5.	Written assignment on fundamentals of communication	02
6.	Summarization through graphic organizers (1. Text to graphic	02
7.	Written record of reading activities/Comprehension	02
8.	Aptitude test on vocabulary and grammar	02
9.	2 types of letters in complete/modified/semi block format	02
10.	Written assignment on technical writing	02
11.	Documentation on case studies based on Module 6	02
12.	Documentation on role plays based on Module 6	02
13	Introducing Self and/or a Classmate	02
14.	Lab Conclusion Recap of Modules Applications	02

Term Work : 50 Marks
Assignments : 20 Marks
Speech Test: : 15 Marks
Writing Ability Evaluation : 15 Marks
*Public speech on general topics (Maximum 3 mins. per student)
*****Writing Ability Evaluation will be based on theory and application exercises as mentioned in the syllabus (Descriptive/MCQ)

Note:
The final certification and acceptance of term work will be subject to satisfactory performance/ submission of activities/ assignments and upon fulfilling minimum passing criteria in the term work.

Lab Code	Lab Name	Credits (P+TUT)
BSXS25	**Vocational Skill – SAT V: Skill-Based Learning (Workshop – II)**	**1 + 0**

Lab Prerequisites:	1. Knowledge of basic measuring tools 2. Awareness of Electrical terminology, Circuit diagram 3. Knowledge of Ohm's law and Kirchhoff's law 4. Knowledge of computer fundamentals
Lab Objectives:	1. To impart training to develop engineering skill sets 2. To get exposure of assembling of PC and networking. 3. To get exposure to interdisciplinary engineering domain
Lab Outcomes (LOs):	Learner will be able to: 1. install an operating system and configuration of hardware. 2. identify the network components and perform basic networking and crimping. 3. develop the technical skills by making a job as per drawing using sheet metal. 4. understand the safe practices to be adopted in the electrical environment. 5. demonstrate the wiring practices for the connection of simple electrical load/ equipment. 6. understand the process of PCB making.

Lab No	Experiment Title	LO Mapped	Hrs/Lab
i	**Lab Prerequisites**	**--**	**2**
1.	**Hardware and Networking** 1.1 Assembling of personal computer (PC), installation of operating system and device drivers, boot-up sequence. Installation of software.	**LO1**	**8**
	1.2 Dismantling of a PC, identification of components of a PC such as power supply, motherboard (chipset, on board devices), processor, hard disk, memory (RAM, ROM), CMOS battery, CD drive, monitor, keyboard, mouse, printer, scanner, pen drives, disk drives etc.	**LO1**	
	1.3 Identification of network components: LAN card, wireless card and wifi module, switch, hub, router, different types of network cables (straight cables, crossover cables, rollover cables). Basic networking and crimping.	**LO2**	
2.	**Sheet metal working and Joining** 2.1 Demonstrate, use and setting of hand tools like scissor, mallet, plier, snipper.	**LO3**	**10**
	2.2 Develop a sheet metal job using tools for cutting etc, and equipment's for bending, spot welding.		

3.	**Basic Electrical work shop** 3.1 Electrical safety in the work place. Protective equipment's and tools	**LO4**	**10**
	3.2 Familiarization of single phase and three phase wiring, protection switchgears and their ratings (fuse, MCB, ELCB).	**LO4**	
	3.3 Different wiring methods: Godown wiring, Staircase wiring, House wiring, switch and plug connection, ceiling fan connection, tube light connection	**LO5**	
	3.4 PCB – Introduction: material, classification, layers etc., schematic design of PCB using software, demonstration of PCB making on related machines.	**LO6**	

Recommended Books

Text Books:	1. Elements of Workshop Technology, Vol. I & II, Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy, 16th Edition, 2015, Media Promoters, India 2. A Course in Workshop Technology, Vol. I &II, Raghuwanshi B.S., 10th Edition, 2012 Reprint 2017, DhanpatRai and Co. India 3. Printed Circuit Boards: Design, Fabrication, assembly and testing, R.S. Khandpur, 1st Edition, 2005, Tata McGraw Hill
Reference Book:	1. Electrical Workshop: Safety, Commissioning, maintenance and testing of electrical equipment, R.P. Singh, 3rd Edition 2012, IK International Publishing House Pvt. Ltd.
Useful Links:	1. https://www.youtube.com/watch?v=nRxdBfR2quk 2. https://www.youtube.com/watch?v=PtbIy_nW2BQ 3. https://www.youtube.com/watch?v=m2B8t8vzeUE 4. https://www.youtube.com/watch?v=m2B8t8vzeUE 5. https://www.youtube.com/watch?v=ZOgRyhKsgYk

Term work: 50 marks

The distribution of term work marks is given below:

1. Hardware and networking (group) – 15 marks
2. A sheet metal job (group) – 15 marks
3. Electrical wiring (group) – 15 marks
4. Journal – 5 marks

Exposure Course Code	Exposure Course Name	Credits (TH+P+TUT)
BSXA26	**INDIAN KNOWLEDGE SYSTEM -SAT-VI Activity Based Learning**	**0-1-0**
Prerequisites	Ethos of Ancient Indian Knowledge	
ABL Objectives (AOBs):	1.To expose learners to glorious Indian past knowledge in varied domains 2.To adopt diversified approaches to gain enhanced knowledge of the traditional Indian system 3.To enhance critical thinking by applying tools & resources for respective domains	
ABL Outcomes:	1. Acquire knowledge of fundamental concepts in the ambit of IKS 2. Analyse, document and present the assimilated facts and findings 3. Demonstrate & appreciate the acquired knowledge in an effective manner	
Guidelines for Activity-Based Learning (ABL)	**Guidelines for Activity Based Learning:** 1.Students shall form a group of 4-5 for selection of the topic from list, while forming a group shall not be allowed less than 2 or more than 3 students, as it is a group activity. Students can select any One activity/Topic from the given activity list. Domains: (A)Health & Wellbeing (B) Indian Mythology (C) Indian Architecture (D)Indian Arts (E) Leadership in Indian Perspective (F) Indian Sciences & Mathematics 1.Students should do research/surveys and collect information under the chosen activity head. 2.During the contact hours, each student team is required to provide a progress report to their supervisors 3.The faculty supervisor will monitor the activities and documentation of the students assigned to them. 4. Students in a group shall present the IKS perspectives effectively and demonstrate in-depth understanding of rich Indian heritage. 5. The marks will be assigned by the faculty supervisor according to the Assssment Rubrics. The marks are to be submitted to the Exam Cell.	
Term Work(TW): 25 Marks Term work evaluation shall be of total 25 marks		