SOMAIYA
VIDYAVIHAR

K J Somaiya Institute of Engineering and Information Technology
An Autonomous Institute affiliated to University of Mumbai
Accredited by NAACand NBA, Approved by AICTE, New Delhi

Item no. 4.5
A.C Date:9/7/2022

Autonomy Syllabus Scheme-II (2022-23)

Bachelor of Technology

in

First Year Engineering

(Basic Sciences and Humanities department)

(with Effect from AY 2022-23)

Somaiya Ayurvihar Complex, Eastern Express Highway, Sion (East), Mumbai. 400 022, India
Telephone: (91-22)24061404, 24061403 email: principal.tech@somaiya.edu,
Web:www.somaiya.edu/kjsieit

From the Principal's Desk:

The challenges and demands of the dynamic industry increasingly require technocrats to be skilled, adaptive, and innovative. The National Educational Policy 2020 (NEP 2020) framed by the Government of India intends to induce a paradigm shift by re-conceptualising the higher education. Recent academic reforms recommended by the AICTE and UGC have also effectually upscaled the higher education system in India. It is further the role of HEIs to offer high-quality educational opportunities and enable the next generation to succeed globally. Hence, to adhere to the status quo, and enhance the academic standards and quality of engineering education further, it is essential to assimilate innovation and recurrent revision in curriculum, teaching-learning methodology, examination, and assessment system.

In congruence with it, the University of Mumbai has adapted Outcome-Based Education (OBE) system and has revised the engineering curriculum thrice in the last decade — as Rev 2012, Rev 2016, and the recent Rev 2019, 'C' scheme focusing on cutting-edge technology courses.

K. J. Somaiya Institute of Engineering and Information Technology (KJSIEIT), being an autonomous institute possesses more flexibility in adapting newer approaches to reach higher levels of excellence in engineering education. The Syllabus Scheme – I implemented under the academic autonomy conferred to KJSIEIT w.e.f. A.Y. 2021-22 already comprises of state-of-the-art courses and laboratory sessions on emerging areas of technology. With an ideology that the root of innovation is 'interest', the curriculum offered a wide range of elective courses — grouped into core and inter-disciplinary domains. At par with international engineering education, it followed a learner-centric approach, where the students could choose to study courses concerning areas of their interests.

This curriculum introduces 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 were practiced across the first three years of engineering, focusing on graduate attributes like work responsibilities towards society, problem-solving ability, communication skills, motivation for life-long learning, leadership and teamwork, etc. that could not be copiously imbibed through regular engineering courses. The inclusion of induction program for the First Year students is deliberated as per the guidelines of AICTE and helps students belonging to diverse backgrounds to adjust in the new academic environment.

However, sustained initiatives are required to assure efficiency, academic excellence, and growth. Hence, KJSIEIT Syllabus Scheme – II introduces 03 newer dimensions to Scheme – I: Internship, SBL of Foreign and Indian Languages, and Honours Degree — that shall be implemented w.e.f. from A.Y. 2022-23 across all the branches and all 04 years of engineering.

1. **Internship:** Firstly, the redesigned Scheme – II incorporates 14 Credits for Internship (cumulative 600-700 Hours), which shall be mandatory for all the students and is to be pursued during all 04 years of graduation. Based on the AICTE Internship Policy, this initiative shall enable graduates to respond to the current needs of the industry and equip them with skills required at national and global level. The students shall gain practical understanding and training on cutting-edge technologies and industry practices in a suitable industry or organization. While innovation and entrepreneurship are emerging as fulcrums of higher education, the internship will also provide an exposure to innovation, entrepreneurial,

and incubation opportunities through various related activities, and instil a start-up spirit in the students.

Further, the students of KJSIEIT already have an exposure to the work culture and trends in industries through live / collaborative projects / product developments, etc. and they often contribute significantly to the society through various projects. Under autonomy too, through the component of Project-Based Learning included in the syllabus, the students develop Mini, Minor, and Major projects in Second, Third, and Last Year respectively concerning healthcare, agriculture, societal / industrial need-based problems, etc. Through duality of Major Project development and newly introduced activities / components as a part of Internship, the students shall learn about research methodology, IP and IPR — resulting into generation of quality research articles, copyrights, and patents.

2. **Honours Program**: Another major initiative through the Scheme – II is the introduction of B.Tech. with Honours program 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. This Honours program is of high-end industry standards and shall offer multi-fold opportunities for the learners such as additional credits, specialization in the chosen domain, job-ready skills, multidisciplinary knowledge, etc.
3. **Foreign and Indian Languages**: As another initiative, the Skill-Based Learning (SBL) in Scheme – II shall also comprise of developing verbal and written communication skills in Foreign and Indian Languages, which is a blooming trend and future necessity for various career prospects. The students shall acquire these skills through MOOC courses, giving them opportunities to learn the target language from beginners to advanced level. These SBL and the TBL courses shall acquaint students with skills of digital age learning from online platforms, along with time management ability, ethics, and professionalism.

Through joint efforts of all stakeholders, newer initiatives, strategic planning, and efficient execution of neoteric educational practices with hi-tech wizardry, KJSIEIT is endeavouring to become a role model for all autonomous institutes across the nation.

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

Preamble by Member Secretary, Academic Council :

K J Somaiya Institute of Engineering and Information Technology (KJSIEIT) 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 education institutes as 'the freedom to modernize curricula, making it globally competent, locally relevant and skill oriented to promote employability'.

We, autonomous KJSIEITs Board of Studies in Computer Engineering (CE), , Artificial Intelligence and Data Science (AI-DS), Electronics and Telecommunication (ET) and Information Technology (IT) had prepared Autonomy Scheme-I curricula from Academic Year 2021-22 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 our UG and PG learners, focusing sound theoretical background supported by practical experiences in the relevant areas of engineering and technology.

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. KJSIEITs autonomy Scheme-I syllabus was framed looking at the overall demands of Industry 4.0 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.

It provides unique learning experiences to learners through extracurricular activities, innovations, and research with the introduction of Skill Based, Activity Based, Technology based and Project Based learning, showcasing learners' creativity, interest and talent by developing additional skill sets, social involvement and contributions through activities, case studies, field visits, internships, creative learning, innovative mini, minor and major project developments. This helped in strengthening learners' profile with increased chances of employability and avenues for start-ups. 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-II, implemented w.e.f academic year 2022-23 for developing the intellectual climate of our country, bringing academic excellence in higher education system with the introduction of additional credit and audit courses for

1. Internships,
2. Skill Based Learning and
3. Honours Degree Programs in 6 emerging areas of technologies.

These additions are targeted for promoting academic, professional and personal development of learners through hands-on working experience under internships, exposure to foreign and Indian Regional Languages through MOOCs and award of specialisation through Honours Degree Program. Internships will channelize learners' working experience with Industries, Government Sectors, NGO, MSMEs, Long term Rural Developments, and Research, Innovation, IPRs and Entrepreneurial setup. Two innovative courses on skill based implementing NEP 2020 guidelines and Honours Degree Program along with 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 are sure that with Scheme-I in academic year 2021-22 and Scheme-II from Academic Year 2022-23, the blend of innovative learning components in the curriculum shall strengthen the research and entrepreneurial culture of the institute benefitting the graduating engineers immensely.

We would like to place on record our gratitude to the faculty, alumni, students, industry experts, academicians and stakeholders, helping continuously strengthen the academics, making KJSIEIT as one of best engineering colleges across nation and top most choice of engineering aspirants.

Dr. Sunita R Patil

Member Secretary, Academic Council and Vice Principal, KJSIEIT, Sion

From BS BoS Chairman's Desk: -

Dear Students, Teachers & Stakeholders,

The Department of Basic Sciences & Humanities (BS) of KJ Somaiya Institute of Engineering and Information 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:

- The design of SAT courses – Activity based learning SAT I & Activity based learning SAT II, is to seamlessly incorporate ethical values along with an interdisciplinary approaches. It endeavors a perfect balance of practical training and a curriculum module being logically outlined to meet the entrepreneurial skills with dynamic trends of job market.
- 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.
- 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.

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
KJSIEIT, Sion

Structure for Student Induction Program

New students enter an institution with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose.

The Induction Program is designed to make the newly joined students feel comfortable, sensitize them towards exploring their academic interests and activities, reducing competition and making them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and building of character.

Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

Transition from school to university/college life is one of the most challenging events in student's life. Therefore, it should be taken seriously, and as something more than the mere orientation program.

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it.

New students be informed that the Induction is mandatory non-credit course for which a certificate will be issued by the institution.

At the start of the induction, the incumbents learn about the institutional policies, processes, practices, culture and values, 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 ofrelationships 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'sand dont's, but by getting the students to explore and think by engaging them in a dialogue. It is best taughtthrough 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 thelacunas substantially.

   A diagnostic test should be conducted on Day 2 itself. Before the test, the students should be informed thatthe 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 toall.

   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 speakingactivity could also be undertaken. If the college can arrange for a drama workshop where a group of studentslearn 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.

A certificate shall be awarded to all the students, upon successful completion of the induction program based on their report and presentation.

Tentative schedule of 1st Week Induction Program:

Day 1	Session 1	Orientation program
	Session 2	Mentoring (group formation and introduction)
Day 2	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)
Day 3	Session 5	Physical Activity (Yoga, sports etc)
	Session 6	Universal human values session
Day 4	Session 7	Proficiency Modules (Short courses on basic maths, English and computer operation etc. for identified students)
	Session 8	Physical Activity (Yoga, sports etc)
Day 5	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

A session may be conducted for around 2-3 hours each. Minimum 12 sessions to be conducted from the following 20 sessions, from 2nd week to last week of academics,throughout the semester.

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

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 (Hrs.) TH – P – TUT	Total (Hrs.)	Credits Assigned TH – P – TUT	Total Credits	Course Category
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 Mechanics Laboratory	0 – 2 – 0	02	0 – 1 – 0	01	ES
BSL105	Basics of Electrical Engineering Laboratory	0 – 2 – 0	02	0 – 1 – 0	01	ES
BSW106	Workshop I	0 – 2 – 0	02	0 – 1 – 0	01	ES
BSX(S/A/T)11	Activity Based Learning SAT - I	0 – 2* – 0	02	0 – 1 – 0	01	SAT
Total		**13– 10– 01**	**24**	**13 - 05– 01**	**19**	--

***S/A/T Hours are under Practical head but can be taken as Theory or Practical or both as per the need.**

Semester- I-Examination Scheme

Course Code	Course Name	Examination Scheme						
		Marks						
		CA				ESE	TW	Total
		T-1	T-2	Average (T-1 &T-2)	IA			
BSC101	Engineering Mathematics I	30	30	30	10	60	25	125
BSC102	Engineering Physics	20	20	20	10	45	--	75
BSC103	Engineering Chemistry	20	20	20	10	45	--	75
BSC104	Engineering Mechanics	30	30	30	10	60	--	100
BSC105	Basics of Electrical Engineering	30	30	30	10	60	--	100
BSL102	Engineering Physics Laboratory	-	--	--	--	--	25	25
BSL103	Engineering Chemistry Laboratory	-	--	--	--	--	25	25
BSL104	Engineering Mechanics Laboratory	-	--	-	--	--	25	25
BSL105	Basics of Electrical Engineering Laboratory	-	--	--	--	--	25	25
BSW106	Workshop I	-	-	--	-	-	50	50
BSX(S/A/T)11	Activity Based Learning SAT - I	-	-	--	-	-	25	25
Total		**130**	**130**	**130**	**50**	**270**	**200**	**650**

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		**3**	

	a matrix to coding theory.			
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, 9thEd. 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	30 marks
2.	Test 2	30 marks
3.	Internal Assessment	10 marks

Tests:

Two tests of 30 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 15 minutes and average of both tests will be considered as a head of passing.

Internal Assessment (IA):

Marks will be allotted as per designed rubrics.

Term Work (TW):

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. Ultracapacitors: 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) : 30 Marks

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 average of both tests will be considered as a head of passing
20 Marks	Test 2 (T2)	Will be conducted when additional 35% syllabus is completed	
10 Marks	Internal Assessment	Throughout the semester as and when a module is completed	Marks will be allotted as per designed rubrics.

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 phenomenon.	**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		**4**	

	fuels.			
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	20 marks
2	Test 2	20 marks
3	Internal Assessment	10 marks

Tests: Two tests of 20 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 1 hour and average of both tests will be considered as a head of passing.

Internal Assessment (IA): Marks will be allotted as per designed rubrics.

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	**CO1**	**7**	**7**

	reactions at supports for various types of loads on beams. (Excluding problems on internal hinges).			
4.	**Friction**: Revision of Static Friction, Dynamic/ Kinetic 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.	**CO3**	**5**	**5**
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): 40 Marks

Continuous Assessment will be done on the following basis-

Weightage	Assessment Method	Time of Conduction	Process
30 Marks	Test 1 (T1)	Will be conducted after completing approx. 35%-40% syllabus	Duration of each test shall be 1 hour 15 minutes and average of both tests will be considered as a head of passing.
30 Marks	Test 2 (T2)	Will be conducted when additional 40% syllabus is completed	
10 Marks	Internal Assessment (IA)	Throughout the semester as and when a module is completed	Marks will be allotted as per designed rubrics.

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:** 4.1 Working 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) : 30 Marks

Continuous Assessment will be done on the following basis-

Weightage	Assessment Method	Time of Conduction	Process
30 Marks	Test 1 (T1)	Will be conducted after completing approx. 40% syllabus	Duration of each test shall be 1 hour 15 minutes and average of both tests will be considered as a head of passing.
30 Marks	Test 2 (T2)	Will be conducted when additional 40% syllabus is completed	
10 Marks	Internal Assessment	Throughout the semester as and when a module is completed	Marks will be allotted as per designed rubrics.

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:

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:

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:

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:

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

Lab Code	Lab Name	Credits (P+TUT)
BSW106	**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** 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.	**LO5**	**10**
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			
Term work marks: 50 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	Activity Based Learning SAT - I	Credits (TH+P+TUT)
BSX(S/A/T)11	1. Innovation and Creativity/ 2. Study of World's top 2 problems/ 3. How Does the Government Work? [Study of one department of the Central/ State Government]	**0+1+0**
Prerequisite:	Knowledge of Problems and Issues of the National, Global, Societal and Environmental Issus that need attention.	
ABL Objectives:	1. To identify and describe various social, Environmental, Economic, Political, educational, Agricultural, Governance related issues and problems. 2. To plan and prepare a structured or unstructured survey or study methodology to have an in-depth analysis of the issues and problems to carry out the activity. 3. To compare and contrast social, ethical, environmental and legal issues surrounding the subject of study. 4. To analyse and suggest solutions to the existing issues, modify and improve the existing problems.	
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 issues. 3. Demonstrate critical and innovative thinking. 4. Display competence in oral and visual communication. 5. Write accurate documentation for experiments performed. 6. Apply ethical principles like timeliness and adhere to the rules of the laboratory.	

Guidelines for Activity Based Learning:

1. Students shall form a group of 2 to 3 students, while forming a group shall not be allowed less than 2 or more than 3 students, as it is a group activity.
2. Students can select any One activity/Topic from the given activity list.
3. Students should do surveys and collect information on the given problems/topics in the activity head.
4. Faculty supervisor is allotted to a group of 20 to 25 students (based on number of students enrolled for one activity) and supervisor may give inputs to students during activity; however, focus shall be on self-learning.
5. The faculty supervisor will monitor the activities and documentation of the students assigned to them.
6. Students in a group shall discuss the problems effectively and propose multiple solution for selected problem.
7. Professional Committee will arrange Two to Three Guest lecture based on the problem/Topic in the activity head so that student will get more idea about the Topic selected.
8. The marks will be assigned by the faculty supervisor according to the Assessment Rubrics. The marks are to be submitted to the respective Departments and the Departments will submit them to the Exam Section.

Activity No	Activity Title	Activity Outcome Mapped	Hrs
1	Guest lecture to introduce Topic selected in Activity-Based learning	1	2
2	Guest Lecture	1	2
3	Selection of any Two Problems	2,6	2
4	Group Discussion with other students	2,4,6	2
5	Presentation	2,4,6	2
6	Presentation	2,4,6	2
7	Presentation	3,6	2
8	Find out solution for selected problem	3,6	2
9	Group Discussion with other students	2,4,6	2
10	Presentation	3,4,6	2
11	Presentation	3,4,6	2
12	Presentation	3,4,6	2
13	Report submission	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 Identification of problem and solution 2 Submission of Report/demo/act etc. 3 Presentation of Surveys/Case study