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

Autonomy Syllabus Scheme-I (2021-22)

Bachelor of Technology
in
Computer Engineering
Information Technology
Artificial Intelligence and Data Science
Electronics and Telecommunication Engineering
Electronics Engineering

&

Master of Technology
in
Artificial Intelligence

(with Effect from AY 2021-22)

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From the Principal's Desk:

The academic reforms recently recommended by the AICTE and UGC have effectually strengthened the higher education system in India. 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, being an autonomous institute possesses more flexibility in adapting newer approaches to reach higher levels of excellence in engineering education. This first syllabus scheme under the autonomy comprises state-of-the-art courses and laboratory sessions on emerging areas of technology. The syllabus is designed with an objective to foster the students for developing innovative solutions to real-world issues of the society and/or industry through the acquired knowledge. The induction program for the students is deliberated as per guidelines of AICTE and shall be executed over the entire First Year.

With an ideology that the root of innovation is 'interest', the curriculum offers a wide range of elective courses - grouped into core and inter-disciplinary domains. At par with international engineering education, the students can choose to study courses concerning areas of their interests.

The 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 shall be practiced across the first three years of engineering, focusing on graduate attributes like work ethics, responsibilities towards society, problem-solving ability, communication skills, motivation for life-long learning, leadership and teamwork, etc. that may not be copiously imbibed through regular engineering courses. The proficiencies acquired herein shall open huge employment and entrepreneurial opportunities for the students.

Students of the institute are already provided exposure to the work culture and trends in industries through live / collaborative projects / product developments, etc. Under autonomy too, through the component of Project-Based Learning included in the syllabus, the students shall develop Mini, Minor, and Major projects in Second, Third, and Last Year respectively concerning healthcare, agriculture, societal / industrial need-based problems, etc. as well as pursue internships at the end of each semester / year - making them industry-ready engineers. The blend of all these learning components in the curriculum shall strengthen the research and innovation ecosystem in the institute — for best benefits of the students.

This first syllabus shall be effective from Academic Year 2021-22 to all four years at once. It comprises 165 credits, follows the AICTE model curriculum, focuses on learner-centric approach as well as continuous evaluation, and shall offer the ideal learning experience for the students of the institute.

In the coming years, the institute shall also offer an Honours degree for students who are desirous of pursuing their special interest areas in industry-relevant tracks like Artificial Intelligence, Internet of Things, Cyber Security, etc. Through joint efforts of all stakeholders, strategic planning, and efficient execution of neoteric educational practices with hi-tech wizardry, we shall strive to become a role model for all autonomous institutes across the nation.

Dr. Suresh Ukarande,
Principal and Chairman - Academic Council

Member Secretary, Academic Council's Desk:

We, Board of Studies in Computer Engineering (CE), Information Technology (IT), Artificial Intelligence and Data Science (AI-DS), Electronics and Telecommunication (ET) and Electronics Engineering (EX) are very happy to present 4 years of undergraduate and 2 years of post-graduation in Artificial Intelligence (AI), Engineering technology syllabus effective from the Academic Year 2021-22 under the autonomy status granted to our institute, K J Somaiya Institute of Engineering and Information Technology (KJSIEIT). We are sure you will find this syllabus interesting, challenging and meeting the needs of Industry 4.0.

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'. Thus exercising academic freedom by eligible and capable institutes is the need for developing the intellectual climate of our country and bringing and promoting academic excellence in higher education system. KJSIEIT under its first autonomous syllabus scheme (KJSIEIT-Scheme I) is keen in providing globally required exposure to its learners focusing sound theoretical background supported by practical experiences in the relevant areas of engineering and technology.

Besides engineering and technology foundation, Industry 4.0 demands modern, 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 professional, ability to work in teams on multidisciplinary projects, etc. Thus KJSIEITs autonomy Scheme-I syllabus has been designed for the learners to successfully acquaint with the demands of the industry worldwide, life-long experiential learning, professional ethics with universal human values and training for needed skillsets and 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, innovations, and industry requirements.

The salient features of KJSIEITs autonomy Scheme-I syllabus are:

1. Total 165 credits ensuring extra time for students' experiential learning through extracurricular activities, innovations, and research.
2. Introduction of Skill Based, Activity Based, Technology based and Project Based learning to showcase learners' creativity, interest and talent by developing additional skillsets, social involvement and contributions through activities, case studies, field visits, internships, creative learning, innovative mini, minor and major project developments, strengthen their profile and increasing the chances of employability.
3. Value addition learning through MOOCs platforms such as IBM-ICE, Coursera, NPTEL, SWAYAM, Spoken Tutorial etc.
4. Emerging areas of technology learning in Artificial Intelligence, Machine learning, Data Science, Internet of things, Cyber Security, Block chain, augmented and Virtual reality.

We would like to place on record our gratefulness to the faculty, alumni, students, industry experts and stakeholders for having helped us in the formulation of this syllabus.

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 a freshly conferred '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 exposure to SAT courses—SAT I—Team Building & Managerial Skills & SAT II—Decision Making, Problem Solving & Critical Thinking, the syllabus seamlessly incorporates ethical values with an interdisciplinary approach. It endeavors a perfect balance of practical training and a curriculum module 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.
- 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

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
1UBSC201	Engineering Mathematics II	3– 0 – 0	03	3 – 0 – 0	03	BS
1UBSC202	Physics and Nanotechnology	2 – 0 – 0	02	2 – 0 – 0	02	BS
1UBSC203	Materials Chemistry	2– 0 – 0	02	2 – 0 – 0	02	BS
1UBSC204	Engineering Graphics	2 – 0 –0	02	2 – 0 – 0	02	ES
1UBSC205	Computer Programming	3 – 0 – 0	03	3 – 0 – 0	03	ES
1UBSL202	Physics and Nanotechnology Laboratory	0 – 1 – 0	01	0 – 0.5 – 0	0.5	BS
1UBSL203	Material Chemistry Laboratory	0 – 1– 0	01	0 – 0.5– 0	0.5	BS
1UBSL204	Engineering Graphics Laboratory	0 – 4 – 0	04	0 – 2 – 0	02	ES
1UBSL205	Computer Programming Laboratory	0 – 2 – 0	02	0 – 1 – 0	01	ES
1UBSL206	Professional Communication Skills	0 – 4** – 0	04	0 – 2 – 0	02	BS
1UBSW207	Workshop II	0 – 2 – 0	02	0 – 1 – 0	01	ES
1UBSX(S/A/T)22	Exposure-SAT Course II	0 – 2* – 0	02	0 – 1 – 0	01	SAT
		12-16-0	**28**	**12- 08 –0**	20	

***SAT Hours are under Practical head but can be taken as Theory or Practical or both as per the need.**

****2 hours of Practical be conducted as theory for class**

Semester- II-Examination Scheme

Course Code	Course Name	Examination Scheme Marks								
		CA			ESE	TW	O*	P	P&O	Total
		T-1	T-2	IA						
1UBSC201	Engineering Mathematics II	15	15	10	60	--	--	--	--	100
1UBSC202	Physics and Nanotechnology	10	10	10	45	--	--	--	--	75
1UBSC203	Materials Chemistry	10	10	10	45	--	--	--	--	75
1UBSC204	Engineering Graphics	15	15	10	60	--	--	--	--	100
1UBSC205	Computer Programming	15	15	10	60	--	--	--	--	100
1UBSL202	Physics and Nanotechnology Laboratory	--	--	--	--	25	--	--	--	25
1UBSL203	Material Chemistry Laboratory	--	--	--	--	25	--	--	--	25
1UBSL204	Engineering Graphics Laboratory	--	--	--	--	25	--	25	--	50
1UBSL205	Computer Programming Laboratory	--	--	--	--	25	--	25	--	50
1UBSL206	Professional Communication Skills	--	--	--	---	50*	--	--	--	50
1UBSW207	Workshop II					50				50
1UBSX(S/A/T)22	Exposure/SAT Course II					25				25
Total		65	65	50	270	225	25	50		725

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

Course Code	Course Name	Credits (TH+P+TUT)
1UBSC201	Engineering Mathematics-II	3+ 0+ 0

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 integral solver 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	15 marks
2.	Test 2	15 marks
3.	Internal Assessment	10 marks

Tests:

Two tests of 15 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 one hour.

Internal Assessment (IA):

Internal Assessment consists of two assignments each of 10 marks. First assignment is to be conducted when approx. 40% syllabus is completed and second assignment is to be conducted when additional 40% syllabus (excluding the contents covered in assignment 1) is completed. Average of the two assignment should be consider.

End Semester Theory Examination:

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

Course Code	Course Name	Credits (TH+P+TUT)
1UBSC202	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. apply the foundation of laser and fibre optics in development of modern communication technology. 3. describe significance of Maxwell's equations. 4. assimilate the wide scope of nanotechnology in modern developments and its role in emerging innovating applications. 5. 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.	**LASER AND FIBRE OPTICS** 2.1 Laser: spontaneous emission and stimulated emission, metastable state, population inversion, types of pumping, resonant cavity,	**CO2**	**1**	**7**
	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**	

	2.4 Fibre optics: Total Internal Reflection, critical angle, types of optical fibres, angle of acceptance, Numerical Aperture for step index fibre		**1**	
	2.5 V number; number of modes of propagation, Fibre optic communication system		**1**	
	2.6 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**	
3.	**ELECTRODYNAMICS** 3.1Scalar and Vector field, Vector Algebra, Position vector, Displacement Vector	**CO3**	**1**	**6**
	3.2 Physical significance of gradient, divergence and curl in Cartesian co-ordinate system		**2**	
	3.3 Divergence theorem, Stokes theorem, Gauss's law for electrostatics, Gauss's law for magnetostatics, Faraday's Law and Ampere's circuital law		**1**	
	3.4 Maxwell's equations (Free space and time varying fields), significance of Maxwell's equations		**2**	
4.	**NANOTECHNOLOGY I: Basics and Types of Nanomaterials** 4.1 Introduction to Nanosystem, Size Dependent Phenomenon: Surface to volume ratio.	**CO4**	**1**	**4**
	4.2 Properties of Nanomaterials: Optical, electrical, magnetic, and mechanical		**1**	
	4.3 Types of Nanomaterials: Classification based on dimension, Morphology, Physical and Chemical properties		**1**	
	4.4 Applications of Nanomaterials		**1**	
5.	**NANOTECHNOLOGY II: Synthesis, Fabrication and Characterization Techniques** 5.1 Two main approaches in nanotechnology -Bottom up technique and Top down technique	**CO5**	**1**	**5**
	5.2 Chemical Synthesis, Physical Synthesis		**1**	
	5.3 Nanofabrication by Lithography		**1**	
	5.4 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) : 30 Marks

Continuous Assessment will be done on the following basis-

Weightage	Assessment Method	Time of Conduction	Process
10 Marks	Test 1 (T1)	Will be conducted after completing approx. 40% syllabus	Test will be conducted for 20 marks and the marks obtained by the student will be converted into 10
10 Marks	Test 2 (T2)	Will be conducted when additional 35% syllabus is completed	Test will be conducted for 20 marks and the marks obtained by the student will be converted into 10
10 Marks	Internal Assessment	Throughout the semester as and when a module is completed	Minimum 2 Assignments to solve numerical problems and minimum 3 MCQ Quizzes

End Semester Examination:

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

Course Code	Course Name	Credits (TH+P+TUT)
1UBSC203	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, Ceramics & powder metallurgy-** **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, CO3**	**3**	**8**
	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**	
	3.3 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.		**3**	
4	**Phase Rule Gibbs** 4.1 **-** Phase Rule Statement of Gibbs' Phase Rule, Terms involved with examples, Application of Phase rule to One	**CO2**	**2**	**4**
	4.2 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**	

5	**Material characterization techniques** **5.1 -**IR spectroscopy: Principle, instrumentation, fingerprint region and Application with simple Numerical problems	**CO4**	**2**	**5**
	5.2 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**	10 marks
2	**Test 1**	10 marks
3	**Internal Assessment**	10 marks

Tests:

Two tests of 10 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 one hour.

End Semester Theory Examination:

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

Course Code	Course Name	Credits (TH+P+TUT)
1UBSC204	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**
1.	**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**	
2.	**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**
3.	**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**	
4.	**Orthographic Projections:** **4.1** Fundamentals of orthographic projections. Different views of a simple machine part as per the first angle projection method recommended by I.S.	**CO4**	**3**	**3**
5.	**Sectional Orthographic Projections:** **5.1** Basic concept and significance of sectional orthographic projections. Full sectional view of simple machine parts. (Excluding half section)	**CO5**	**3**	**3**
6.	**Isometric Views:** **6.1** 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): (40 Marks)

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 approximately 35% to 40% syllabus.	Test 1 will be conducted for 30 marks and the marks obtained by the student will be converted to 15. **(Conventional/Manual Drafting)**
15 Marks	Test 2 (T2)	Will be conducted when additional 40% syllabus is completed	Test 2 will be conducted for 30 marks and the marks obtained by the student will be converted to 15. **(Drafting on AutoCAD software)**
10 Marks	Internal Assessment (IA)	Throughout the semester as and when a module is completed	On completion of each module, knowledge of students will be evaluated through MCQ/Conventional Drafting/AutoCAD.

End Semester Theory Examination:

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

Course Code	Course Name	Credits (TH+P+TUT)
1UBSC205	Computer Programming	3+0+0

Prerequisite:	Competency in 'Computer Programming' terminologies.
Course 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
Couse Outcomes:	Learner will be able to… 1. implement, test and execute programs comprising of control structures. 2. formulate simple algorithms for arithmetic, logical problems and translate them to programs in C language. 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,	CO3	6	6

	Accessing a function and parameter passing: Call by Value and Call by reference • Recursive functions • 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**	15 marks
2	**Test 1**	15 marks
3	**Internal Assessment**	10 marks

Test:
Assessment consists of two tests of 15 marks each. The first test is to be conducted when approx. 40% syllabus is completed and second test when additional 35% syllabus is completed.

Internal Assessment (IA):

Students will have to solve MCQ quiz throughout the Semester as and when a module is completed.

End Semester Theory Examination:

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

Lab Code	Lab Name	Credits (P+TUT)
1UBSL202	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 I V 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 Nanomaterial's (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:

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: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks

Lab Code	Lab Name	Credits (P+TUT)
1UBSL203	**Material Chemistry**	**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/	**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	**LO2**	**1**
6	Molecular weight determination of polymers by Oswald	**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:

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: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks)

Lab Code	Lab Name	Credits (P+TUT)
1UBSL204	**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**
1	Term Sheet 01: Orthographic Projections without section	**LO1**	**4**
2	AutoCAD sheet 01: Redraw sheet for acquainting the AutoCAD software	**LO2**	**6**
3	Term Sheet 02: Projection of Solids	**LO1**	**6**
4	AutoCAD sheet 02: Orthographic Projections without Section	**LO2, LO3**	**6**
5	Term Sheet 03: Sectional Orthographic Projections	**LO1**	**6**
6	AutoCAD sheet 03:	**LO2, LO3**	**8**

	Sectional Orthographic Projections		
7	Term sheet 04: Isometric Views	**LO1**	**6**
8	AutoCAD sheet 05: Isometric Views	**LO2, LO4**	**6**
9	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:

Component-1 : 07Marks

Component-2 : 06 Marks

Component-3 : 07 Marks

Attendance : 05 Marks (Theory & Practicals)

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)
1UBSL205	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	**LO2,LO3**	

	number using as while loop.		
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:

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

1. Experiments: 15 Marks
2. Assignment: 05 Marks

3. Attendance: 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:

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 Marks: 25 Marks

Lab Code	Lab Name	Credits (TH+P+TUT)
1UBSL206	**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. 6. successfully interact in all kinds of settings, displaying refined grooming and social skills.

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		**2**	

	• 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	**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: : 10 Marks
Writing Ability Evaluation : 15 Marks
Attendance : 05 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)

Lab Code	Lab Name	Credits (P+TUT)
1UBSW207	Workshop - II	1 + 0

Lab Prerequisites:	1. Knowledge of basic measuring tools 2. Ability to identify basic materials used in engineering 3. Awareness of Electrical terminology, Circuit diagram 4. Knowledge of Ohm's law and Kirchhoff's law
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 engineering domain
Lab Outcomes (LOs):	Learner will be able to: 1. develop the technical skills by making a job as per drawing in the carpentry trade. 2. develop the technical skills by making a job as per drawing using sheet metal. 3. understand the safe practices to be adopted in the electrical environment. 4. demonstrate the wiring practices for the connection of simple electrical load/ equipment. 5. prepare an object/product using PCB trade as per given specifications.

Lab No	Experiment Title	LO Mapped	Hrs/Lab
i	**Lab Prerequisites**	--	2
1.	**Carpentry** 1.1 Demonstrate use and setting of hand tools like hacksaws, jack planes, chisels and gauges for developing of various joints, wood tuning method.	CO1	8
	1.2 Develop a carpentry joint job.		
	1.3 Report on demonstration of a job involving wood turning.		
2.	**Sheet metal working and Joining** 2.1 Demonstrate, use and setting of hand tools like scissor, mallet, plier, snipper.	CO2	8
	2.2 Develop a sheet metal job using tools for cutting etc, and equipments for bending, spot welding.		
3.	**Basic Electrical work shop** 3.1 Wiring standards, Electrical safety in the work place, safe work practices. Protective equipment, measures and tools	CO3	10
	3.2 Single phase and three phase wiring. Familiarization. of protection switchgears and their ratings (fuse, MCB, ELCB).	CO3	

	3.3 Different wiring methods: Godown wiring, Staircase wiring, House wiring, switch and plug connection, ceiling fan connection, tube light connection	**CO4**	
	3.4 Layout drawing, layout transfer to PCB, etching and drilling and soldering technique.	**CO5**	

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, Dhanpat Rai 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=Kv1zo9CAxt4 3. https://www.youtube.com/watch?v=PtbIy_nW2BQ

Term work

Term work marks: 50

The distribution of term work marks is given below:

1. A Carpentry job – 14 marks
2. A Sheet metal job (group) – 14 marks
3. Basic Electrical work shop (wiring and PCB in group) – 14 marks
4. Attendance – 4 marks
5. Journal – 4 marks

Lab Code	Lab Name	Credits (P+TUT)
1UBSX (S/A/T)22	**Exposure –SAT Course II (Decision Making, Problem Solving and Critical Thinking)**	**0 -1- 0**

Lab Prerequisite:	Awareness on the importance of making good decisions, problem solving & critical thinking as management skills.
Course Rationale	This curriculum intends to incorporate the application of logical methods and critical reasoning to solve problems for effective decision making. The exposure to analysis, synthesis and positive enquiry will be pivotal to address individual and organizational problems and develop the critical thinking skills needed in today's dynamic job-market. The case studies and managerial situations will be vital to explore successful models and proven methods that are readily transferable on-the-job.
Lab Objectives:	1. To develop competencies and skills required for effective 'Decision Making' 2. To articulate the skills & dispositions needed for 'Problem-Solving' 3. To avoid common obstacles, test one's beliefs and assumptions, and correct distortions in one's thought processes via 'Critical Thinking'
Lab Outcomes: (LOs):	At the end of the course, the student will be able to 1. choose and apply appropriate problem solving and decision-making processes and methods. 2. demonstrate the key elements of problem solving—the ethical issues and integrity with alternative solutions. 3. gain confidence in assessing problems accurately, evaluating alternative solutions, and anticipating likely risks through critical thinking.

Lab No	Activity Title	LO Mapped	Hrs/Lab
i	**Prerequisite Concepts and Course outline**	**----**	**1**
1.	**Video Snippets:** Various types of 'Leadership' for 'Decision Making'	**LO1**	**2**
2.	**Group Activity:** Brain- storming techniques on 'Problem Solving' –4 types (a) Reverse Brainstorming (b) Stop-and-go Brainstorming (c) Phillips 66 Brainstorming & (d) Brain writing. (Administering one problem & evoking different techniques)	**LO2**	**2**
3.	**Case Study**: 'Critical Thinking' –that involves steps—observation, analysis, interpretation, reflection, evaluation, inference,	**LO3**	**2**

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4.	**Group Presentation:** 'Types of Decision Makers': • The Charismatic. • The Deep Thinker. • The Skeptic. • The Follower. • The Controller.	**LO1**	**2**
5	**Debate**: Trending topics on business meetings to emerge as a 'Problem Solver Team'	**LO2**	**2**
6	**Quiz**: Decision making skills	**LO1**	**2**
7	**Group Discussion**: A burning issue linking Decision making to Problem Solving with application of effective Critical Thinking	**LO1, LO2, LO3**	**2**
8	**Role Play**: To understand workplace problems, the causes & role of an "intermediary" or "moderator" for problem solving skills	**LO1**	**2**
9	**Case Studies:** Corporate Ethics for 'Problem Solving'	**LO2**	**2**
10	**A Short Skit**: Various types of 'Personality' The most widely accepted traits are the 'Big Five': • Openness. • Conscientiousness. • Extraversion. • Agreeableness. • Neuroticism.	**LO1, LO2, LO3**	**2**
11	**Book Review:** Group of 4 students to prepare a book review based on inspirational leaders, situations and present the same.	**LO3**	**2**
12	**Quiz :** On various managerial parameters	**LO1**	**2**
13	**Panel Discussion:** With moderators view, topics related to decision making, problem solving skills.	**LO1, LO2**	**2**
ii	**Course conclusion:** Recap of Modules, Outcomes, Applications, and Summarization.	**-**	**1**

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List of assignments:
(In the form of Short Notes, Questionnaire/ MCQ Test, Role Play, Case Study, Quiz, etc.)

Sr. No.	Title of Experiment
1	Documentation of global leaders (any 3 leaders) with leadership qualities

2	Worksheet on Brain-Storming techniques for 'Problem Solving'.
3	Video recording of group activity (any of the activity covered in syllabus)
4	Classification of business icons & enlisting their personality style
5	Surveying any 2 case-studies on 'Critical Thinking' with reference source

Useful links:

Sr. No	Topic	Links
1	Introduction to Problem-Solving Skills for University Success, 'Coursera'	https://www.coursera.org/learn/problem-solving-skills
2	Effective Decision Making, By Dr.	https://onlinecourses.swayam2.ac.in/cec19_hs02/preview
3	The 4 types of team members you can	https://www.youtube.com/watch?v=5bYYFfpbSqc
4	Leadership Styles Autocratic	https://www.youtube.com/watch?v=1AZMiq6Mg-
5	What do all great leaders have in	https://www.youtube.com/watch?v=KgmKNKM0i1g
6	Brainstorming Techniques: How to	https://www.youtube.com/watch?v=YXZamW4-Ysk

Books and References:

1.Edwards, W., & von Winterfeldt, D. (1986). Decision analysis and behavioral research. Cambridge University Press, 604, 6-8.
2.Wasserman, D., Lempert, R. O., & Hastie, R. (1991). Hindsight and causality. Personality and Social Psychology Bulletin, 17(1), 30-35.
3.Adair, J (2007). Decision making and problem-solving strategies. Kogan Page Limited
4.Kalantari, B. (2010). Herbert A. Simon on making decisions: enduring insights and bounded rationality. Journal of Management History, 16(4), 509-520.
5.Buchanan, L. &O'Connell, A. (2006). A Brief History of Decision Making. Harvard Business review.
6.Akrani,G. (2011).Importance of Decision Making in Management. Kalyan City Life: Sharing Wisdom and Vivid Memories of Life.
7.Newell, A., & Simon, H. A. (1972). Human problem solving (Vol. 104, No. 9). Englewood Cliffs, NJ: Prentice-Hall.
8.Braisby, N., & Gellatly, A. (2005). Foundations of cognitive psychology. Cognitive Psychology, 1-32
9. Davidson, J. E., & Sternberg, R. J. (Eds.). (2003). The psychology of problem solving. Cambridge university press.
10. Goldstein, E. B. (2014). Cognitive psychology: Connecting mind, research and everyday experience. Nelson Education.

Term Work (TW) : 25 Marks

(a) Individual/ Group Activity : 10 Marks
(b) Assignments : 10 Marks
(c) Attendance : 05 Marks