

Detailed Curriculum for Undergraduate Degree B.Tech. in Electrical Engineering (w.e.f. AY: 2025-26)

Part III: Detailed Curriculum

Induction Program (Mandatory)

Induction program for students to be offered right at the beginning of the first year.

3 Weeks Duration

- Physical Activity
- Creative Arts
- Universal Human Values
- Literary
- Proficiency Modules
- Lectures by Eminent People
- Visits to Local Areas
- Familiarization to College, Dept./Branch & Innovations
- Extra-Curricular Activities

Course Name:	Mathematics-I		
Course Code:	BS-M101	Category:	Basic Science Courses
Semester:	First	Credit:	4.0
L-T-P:	3-1-0	Pre-Requisites:	High School Mathematics
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:

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|---|---|
| 1 | To utilize the mean value theorems in engineering fields. |
| 2 | To understand limit, continuity and partial derivatives, chain rule, implicit function. |
| 3 | To understand and apply improper integral in engineering fields. |
| 4 | To utilize vector functions in different fields of engineering. |
| 5 | To understand convergence of sequence and series. |

Course Contents:

Module No.	Description of Topic	Contact Hrs.
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1	Differential Calculus (Function of single variable): • Successive differentiation, Leibnitz's theorem; Indeterminate forms and L'Hospital's rule. • Rolle's theorem, Lagrange's mean value theorem, Taylor's and Maclaurin theorems with remainders; Maxima and minima. • Evolutes and Involutives.	9L
2	Differential Calculus (Function of multi-variables): • Limit, continuity and differentiability. • Partial differentiation, chain rule, total differential, Jacobian, Euler's theorem on homogeneous function. • Maxima and minima; Lagrange's multipliers.	10L
3	Integral Calculus: • Line integrals, double integrals, change of order, triple integrals. • Evaluation of surface areas and volumes of revolutions.	8L
4	Improper Integrals: • Improper integrals, their types, convergence criterion of some standard improper integrals. • Gamma and Beta functions, their relation (no proof) and applications.	5L
5	Vector Calculus: • Vector differential operator, scalar and vector point functions, gradient, tangential plane, unit normal vector, directional derivatives, divergence and curl. • Divergence theorem, Green's theorem and Stoke's theorem (statements only) and applications.	9L
6	Sequence and Series: • Sequence, types of a sequences, boundedness, monotonicity & convergence. • Series of positive terms; Geometric and p-series and their convergence criterion; Convergence test of series: Comparison test, D'Alembert's ratio test, Cauchy's root test, Raabe's test. • Alternating series; Absolute convergence, Leibnitz's theorem.	7L
Total		48L

Course Outcomes:

After completion of the course, students will be able to:

1	Utilize mean value theorems for solution of engineering problems.
2	Apply the concept of partial derivatives and maxima minima in real life situations.
3	Solve multiple integrals and utilize them in different practical situations.
4	Evaluate different types of improper integrals and apply into engineering problems.
5	Apply divergence theorem, Green's and Stoke's theorem for solving various

	engineering problems.
6	Apply the concept of series and sequence to analyze real world phenomena.

Learning Resources:	
1	'An Introduction to Differential Calculus' by Maity and Ghosh, NCBA.
2	'A Text Book of Engineering Mathematics' by N. P. Bali, Laxmi Publication.
3	'Advanced Engineering Mathematics' by H. K. Dass, S. Chand Publication.
4	'Mathematical Methods of Science and Engineering' by Kanti B. Dutta, Cengage Learning.
5	'Higher Engineering Mathematics' by B.S. Grewal, Khanna Publishers.
6	'Advanced Engineering Mathematics' by Erwin Kreyszig, John Wiley.
7	'Vector Analysis' by Chakraborty and Ghosh, U. N. Dhur Pvt. Ltd.
8	'An Introduction to Integral Calculus' by Maity and Ghosh, NCBA.
9	'Vector Analysis' by Murray R Spiegel, McGraw Hill.

Alternative NPTEL/SWAYAM Courses:			
Sl. No.	NPTEL Course Name	Instructor	Host Institute
1	Engineering Mathematics - I	Prof. Jitendra Kumar	IIT Madras

Course Name:	Chemistry		
Course Code:	BS-CH101	Category:	Basic Science Courses
Semester:	First	Credit:	3.0
L-T-P:	3-0-0	Pre-Requisites:	High School Chemistry
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To solve various engineering problems applying the basic knowledge of structure, chemical bonding in atomic and molecular levels along with intermolecular forces of interactions.
2	To use relevant water treatment method in solving domestic and industrial problems.
3	To solve the engineering problems using knowledge of engineering materials and properties.
4	To use relevant cells/ batteries from energy-efficient, economic and eco-friendly perspective for domestic and industrial applications.
5	To solve the engineering problems using concept of corrosion and thermodynamics.

6	To solve the respective industry and engineering problems in choosing the proper synthesis method for any specific molecules and relevant application of spectroscopic techniques.
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Course Contents:		
Module No.	Description of Topic	Contact Hrs.
1	Periodic properties: Quantum numbers; Electronic configurations of the atoms; Periodic properties (Atomic radii, Ionic radii, Ionization potential, electron affinity, Electronegativity, metallic and non-metallic character, oxidizing and reducing character); Polarizability (Fajans' rule); Hard soft acids and bases; Effective nuclear charge.	4L
2	Molecular Structure and Bonding: Molecular geometries (VSEPR theory, Hybridization, sigma and pi bond, determination of hybridization state and structure of molecules); Molecular orbital theory: Bonding and anti-bonding orbital's; MO diagram of diatomic molecules (Homonuclear and heteronuclear); Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties (Octahedral and tetrahedral complexes); CFSE and applications of CFT; EAN Rule.	4L
3	Implications of Intermolecular forces: Ionic, dipolar and van Der Waals' interactions; Ideal gas equation, compressibility factor, Real gas equation, Virial equation of state, Boyle's Temperature, Critical state, reduced equation of state.	2L
4	Use of free energy in chemical equilibria: Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Electrochemistry: EMF of cell, Free Energy, Single electrode potential-Derivation of Nernst equation; construction, working and applications of calomel and glass electrode. Batteries: Primary and Secondary batteries, Fuel cells.	7L
5	Stereochemistry, Organic reactions and synthesis of drug molecules: Stereochemistry: Isomerism, Stereoisomerism, Optical activity, Enantiomers and Diastereomers, Fischer and Sawhorse and Newman projection (inter conversion), R-, S and E-, Z-Nomenclature. Organic reactions: Addition, Substitution and Elimination reaction. Synthesis of a commonly used drug molecule: Paracetamol, Aspirin.	8L
6	Spectroscopic techniques and applications: UV/Vis Spectroscopy; IR spectroscopy Identification of organic compounds by IR spectroscopy; NMR spectroscopy.	4L

7	Engineering Materials, Water chemistry and Corrosion: Engineering Materials: Polymers: Basics of terms polymers: Monomer and its functionality, Polymers and degree of polymerization. Classification of polymers - Thermoplastics & Thermosetting resins. Types of Polymerizations (i) Addition (ii) Condensation (iii) Co-Polymerization. Organic Semiconductor and Introduction to Nanomaterials. Water Chemistry: Introduction, H- bond, sources and impurities in water, Hardness of water, types, determination of hardness using EDTA titration, numerical problems on hardness of water. Definition of Biological oxygen demand (BOD) and Chemical Oxygen Demand (COD), determination of COD of waste water sample and Numerical problems on COD. Corrosion: Oxidation corrosion, Pilling Bedworth rule, Electrochemical corrosion, Corrosion of bimetals, Waterline corrosion, Crevice corrosion, Pitting corrosion, Stress corrosion, Factors influencing the corrosion, Prevention of corrosion	7L
Total		36L

Course Outcomes:

After completion of the course, students will be able to:

1	Identify appropriate substances and intermolecular force of interactions for different engineering applications.
2	Understand and assess the suitability of water source for domestic and industrial application, effluents and minimize water pollution.
3	Qualitatively analyze the engineering materials and understand their properties and applications.
4	Choose cells/batteries suitable for eco-friendly and economical industrial processing.
5	Understand corrosion and develop economical prevention techniques.
6	List of major chemical reactions that are used in the synthesis of molecules and select different energy ranges from electromagnetic spectra for specific applications in molecular levels.

Learning Resources:

1	'Chemistry: Principles and Applications' by M. J. Sienko and R. A. Plane.
2	'University chemistry' by B. H. Mahan.
3	'Fundamentals of Environment and Ecology' by D. De & D. De.
4	'Chemistry-I' by Gourkrishna Das Mohapatra.
5	'Fundamentals of Molecular Spectroscopy' by C. N. Banwell.

6	'Engineering Chemistry (NPTEL Web-book)' by B. L. Tembe, Kamaluddin and M. S. Krishnan.
7	'Physical Chemistry' by P. W. Atkins.
8	'Spectroscopy of Organic Compounds' by P. S. Kalsi.
9	'Physical Chemistry' by P. C. Rakshit.
10	'Organic Chemistry (Volume I)' by I. L. Finar.
11	'Engineering Chemistry' by Dr. Rajshree Khare.
12	'Polymer Science and Technology' by Premamoy Ghosh.
13	'Engineering Chemistry' by Jain and Jain.

Corresponding NPTEL/SWAYAM Courses:

Sl. No.	Course Name	Instructor Name	Host Institute
1	Concepts of Chemistry for Engineering	Prof. Anindya Datta Prof. Debabrata Maiti Prof. Chidambar Kulkarni Prof. Arnab Dutta	IIT Bombay
2	Engineering Chemistry III	Prof. K. M. Muraleedharan	IIT Madras
3	Fundamentals of Spectroscopy	Prof. Sayan Bagchi Prof. Anirban Hazra	IIT Madras
4	Characterization of Polymers, Elastomers and Composites	Prof. Santanu Chattopadhyay	IIT Kharagpur

Course Name:	Basic Electrical and Electronics Engineering		
Course Code:	ES-EE101	Category:	Engineering Science Courses
Semester:	First	Credit:	3.0
L-T-P:	2-1-0	Pre-Requisites:	Knowledge of Class XII level Physics & Mathematics
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Group A: Basic Electrical Engineering

Course Objectives:

1	To provide comprehensive idea about AC and DC circuit analysis
2	To make the students understand about working principals and applications of electric machines
3	To make the students understand the components of low voltage electrical installations

4	To provide basic idea about general structure of electrical power system.
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Course Contents:		
Module No.	Description of Topic	Contact Hrs.
01	DC Circuits Kirchhoff's Laws; Analysis of series, parallel and series-parallel Networks by Thevenin's, Norton's and Superposition theorem, Star-delta transformation	3L
02	AC Circuits Single Phase A.C. Circuits, Generation of sinusoidal voltage, definition of average value, root mean square value, form factor and peak factor, phasor representation of alternating quantities; Analysis with phasor diagrams of R, L, C, RL, RC and RLC circuits; Real power, reactive power, apparent power and power factor, Resonance, Significance of half power frequency.	3L
03	Three phase system Three Phase A.C. Circuits covering, Generation of three phase power, definition of Phase sequence, balanced supply and balanced load; Relationship between line and phase values of balanced star and delta connections	3L
04	Electromagnetism Faradays Laws, Lenz's Law, Fleming's Rules, Statically and dynamically induced EMF; Concepts of self-inductance, mutual inductance and coefficient of coupling, B-H curve	2L
05	DC Machines Working principle of DC machine as a generator and a motor, Types and construction of DC machine, EMF equation of DC machine, Voltage build-up of DC generator, Back EMF of DC motor, Torque speed characteristics, Starting for DC motor.	3L
06	Transformers Construction of single phase transformers (core and shell types), EMF equation, operation in no load and with load, equivalent circuit, losses, efficiency Three-phase Induction motor Concept of rotating magnetic field; Principle of operation, types and constructional features, Applications.	3L

07	Electrical Installations Single line diagram of electric power system, MCB, ELCB, MCCB, Earthing, types of Batteries.	1L
Total		18L

Course Outcomes:

After completion of the course, students will be able to:

1	Apply DC circuits using Kirchhoff's laws (KVL and KCL) and network Theorems.
2	Analyze the behavior of single-phase, and three-phase AC circuits
3	Explain the operation of rotating electrical machines and transformers based on the principles of electromagnetism.
4	Describe low-voltage electrical installation components and general structure of an electrical power system.

Learning Resources:

1	D.P. Kothari and I.J. Nagrath, Basic Electrical Engineering, TataMcGrawHill, 2010.
2	C.L. Wadhwa, Basic Electrical Engineering, New Age, 2007.
3	SK Bhattacharya, Basic Electrical and Electronics Engineering, Pearson, 2011
4	Ashfaq Husain and Haroon Ashfaq, Fundamentals of Electrical Engineering, Dhanpat Rai & Co., Delhi, 2007.
5	J.B. Gupta, Basic Electrical Engineering, Kataria & Sons, 2015.
6	L.S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
7	E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

Alternative NPTEL/SWAYAM Courses:

Sl. No.	NPTEL Course Name	Instructor	Host Institute
1	Fundamentals of Electrical Engineering	Prof. Debapriya Das	IIT Kharagpur

Group B: Basic Electronics Engineering

Course Objectives:

1	To make the students understand about semiconductor.
2	To make the students understand about Diode and its circuits.
3	To make the students understand about different Transistors.
4	To make the students understand about the basics of OPAMP and Digital Electronics.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
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01	Introduction to Semiconductors: Energy band theory, Fermi levels: Conductors, Semiconductors and Insulators: electrical properties, band diagrams, intrinsic and extrinsic, energy band diagram, electrical conduction phenomenon, P-type and N-type semiconductors, drift and diffusion carriers, mass action law.	4L
02	Diode and Diode Circuits: Formation of P-N junction, depletion region, built-in-potential, forward and reverse biased P-N junction, energy band diagrams, V-I characteristics, Zener diode forward and reverse characteristics, Avalanche breakdown and zener breakdown. Simple diode circuits, load line, linear piecewise model; rectifiers: half wave, full wave, PIV, ripple factor, efficiency.	3L 2L
03	Bipolar Junction Transistor (BJT) and Field Effect Transistor (FET): Formation of PNP / NPN junctions, schematic symbols, current components in BJT, energy band diagram, transistor mechanism and principle of operation, CE, CB, CC configuration and characteristics, cut-off, active and saturation mode. Early effect. Qualitative discussion on BJT as an amplifier. Introduction to JFET and MOSFET (N channel only)	3L 1L
04	Introduction to OPAMP and Digital Electronics: Introduction to Operational Amplifiers: Characteristics, Inverting and Non-Inverting mode of operation, summing amplifier, difference amplifier, integrator and differentiator. Introduction to Digital Electronics.	3L 2L
Total		18L

Course Outcomes:

After completion of the course, students will be able to:

1	Explain the basics of semiconductors and carrier transport phenomena.
2	Discuss the principle of operation of diodes, rectifiers and characteristics of BJT.
3	Explain the structure and principle of operation of JFET and MOSFET.
4	Discuss the characteristics and applications of OPAMP
5	Apply theoretical concepts to solve basic engineering problems on diodes, BJT, OPAMP and digital electronics

Learning Resources:

1	Rakshit and Chattopadhyay: Introduction to Electronics Principle
2	Malvino: Electronic Principle.
3	Millman & Halkias: Integrated Electronics.
4	Boyelstad & Nashelsky: Electronic Devices & Circuit Theory.

Alternative NPTEL/SWAYAM Courses:

Sl. No.	NPTEL Course Name / Link	Instructor	Host Institute
1	Basic Electronics, IIT Roorkee	Dr. Pramod Agarwal	IIT Roorkee

Course Name:	Communication Skill (Jeevan Kaushal-I)		
Course Code:	HM-HU101	Category:	Humanities and Social Sciences including Management Courses
Semester:	First	Credit:	2.0
L-T-P:	2-0-0	Pre-Requisites:	Basic Spoken and Written Skills
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:

1	Identify common communication problems that may be holding learners back.
2	Perceive what the non-verbal messages are communicating to others.
3	Understand the role of communication in the teaching-learning process.
4	Understand the importance of empathetic listening.
5	Explore communication beyond language.

Course Contents:

Module No.	Description of Topic	Conduct Hrs.
1	Listening: Techniques of Effective Listening, Listening and Comprehension, Probing Questions, Barriers to Listening.	3L
2	Speaking: Pronunciation, Enunciation, Vocabulary, Fluency, Common Errors.	4L
3	Reading: Techniques of Effective Reading, Gathering Ideas and Information from a Given Text, Evaluating Those Ideas and Information, Interpreting Texts.	4L
4	Writing and Different Modes of Writing: The Writing Process, Effective Writing Strategies, Different Modes of Writing.	7L

5	Non-verbal Communication: Meaning of Non-verbal Communication, Advantages of Using Non-verbal Communication, Different Modes of Non-verbal Communication, Dos and Don'ts of Non-verbal Communication, Learning From Experts, Activity-based Learning.	6L
Total		24L

Course Outcomes:

After completion of the course, students will be able to:

1	Get a clear understanding of good communication skills.
2	Know what they can do to improve their communication skills.

Learning Resources:

1	'Five essential listening skills for English learners' by R Ahmed, British Council.
2	'Oops, Did I Say That? 15 Common English Mistakes You Never Noticed Before' by M Snyder, FluentU.
3	'Communication for Business' by Shirley Taylor, Pearson Education.
4	'The Importance of Body Language' by J Tabares, Art of Eloquence.

Alternative NPTEL/SWAYAM Courses:

Sl. No.	NPTEL Course Name and Link	Instructor	Host Institute
1	Technical English for Engineers	Prof. Aysha Iqbal	IIT Madras

Course Name:	Introduction to Indian Knowledge System (Indian Knowledge System-I)		
Course Code:	HM-HU102	Category:	Humanities and Social Sciences including Management Courses
Semester:	First	Credit:	2.0
L-T-P:	2-0-0	Pre-Requisites:	Nil
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:

1	To introduce students to the holistic and scientific traditions of Indian knowledge.
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2	To understand how India's civilizational legacy can inform modern scientific and technological inquiry.
3	To explore the interdisciplinary nature and contemporary relevance of traditional Indian sciences, arts, and governance.
4	To provide awareness of the protection and ownership of traditional knowledge through IPR.
5	To introduce students to the holistic and scientific traditions of Indian knowledge.

Course Contents:

Module No.	Description of Topic	Conduct Hrs.
1	India – The Cradle of Civilization - Geographical uniqueness of Bharatavarsha. - Natural resources, climate, rivers, and biodiversity of the subcontinent. - Role of geography in shaping Indian civilization and self-sustained development. - Historical perception of India as a prosperous and culturally rich land.	2L
2	Foundations of Indian Knowledge: - Overview of Vedic corpus, Itihasas (Ramayana, Mahabharata), and Puranas. - Significance of these texts in shaping philosophy, ethics, governance, and daily life. - Vedangas and their role in scientific disciplines: - Siksha (phonetics), Vyakarana (grammar), Chandas (prosody) - Nirukta (etymology), Jyotisha (astronomy), Kalpa (rituals)	3L
3	Sciences in Ancient India Mathematics: Development of number systems, zero, place-value, algebra, trigonometry, calculus (Kerala School). Astronomy: Celestial observations, motion of planets, eclipses, Indian calendars (Aryabhata, Nilakantha). Health Sciences: Ayurveda principles - Basic concepts of Ayurveda. The three Gunas and Three Doshas, Pancha-mahabhuta and Sapta-dhatu. The importance of Agni (digestion). Six Rasas and their relation to Doshas. Ayurvedic view of the causes of the diseases.	4L
4	Indian Language and Aesthetic Traditions - Structure and logic of Indian linguistic sciences. - Contributions of Panini, Bhartrihari; phonetic precision in preserving texts. - Literature: Nature of Kavya (poetic works), Rasa theory, aesthetics in Natyasastra. - Role of literature and arts in moral and cultural education.	2L

5	Indian Contributions to Engineering and Technology • Architecture: Principles of Vastu and town planning; Indus Valley civilization; temple architecture across India. • Metallurgy: Zinc distillation, rust-free iron (Delhi Iron Pillar), steel making. • Textiles: Cotton and silk weaving, dyeing techniques; India's global textile trade legacy.	4L
6	Society, Polity, and Sustainability • Indian concepts of Dharma, Rta, and Yajna—ethics, duty, and sustainability. • Economy and Governance: Varta (agriculture, animal husbandry, trade), Grama (village) as socio-economic unit. • Education systems—Gurukula, inclusiveness, and community learning. • Scientific methodology—Pramanas (means of knowledge): Pratyaksha, Anumana, Agama.	2L
7	Global Outreach and Contemporary Relevance • Spread of Indian knowledge (language, astronomy, medicine, architecture) to Asia and Europe. • Contributions to global sciences and arts—decimal system, yoga, Ayurveda, Sanskrit grammar. • Modern-day revival and adoption—Ayurveda, Yoga, classical arts.	3L
8	Intellectual Property Rights (IPR) and Protection of Traditional Knowledge • Introduction to IPR: Patents, copyrights, trademarks, and geographical indications. • Relevance to Traditional Knowledge (TK): Challenges in protecting indigenous practices, medicine, and crafts. • Indian frameworks for TK protection: Traditional Knowledge Digital Library (TKDL), GI Registry of India. • Global frameworks: WIPO, Nagoya Protocol. • Case studies: Neem, Turmeric, Basmati rice—biopiracy and legal battles. • Importance of awareness and sensitization regarding IPR among engineering graduates.	4L
Total		24L

Course Outcomes:

After completion of the course, students will be able to:

1	Understand the foundations of Indian civilization and its geographical, cultural, and philosophical uniqueness that contributed to self-sustained development.
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2	Interpret the core texts of Indian knowledge systems such as the Vedas, Puranas, and Vedangas, and explain their relevance to science, ethics, and governance.
3	Analyze contributions of ancient Indian scholars in science, health, language, and arts, and evaluate their influence on modern disciplines.
4	Demonstrate awareness of traditional knowledge protection through intellectual property rights and assess the relevance of Indian Knowledge Systems in global and modern contexts.

Learning Resources:

1	'Samskrta Śāstrom ka Itihās' by Baladev Upadhyaya, Chowkhambha, Varanasi, 2010.
2	'Introduction to Indian Knowledge System, Concept and Applications' by B.Mahadevan, Vinayak Rajat Bhat and Pavana R.N. Nagendra, PHI Learning Pvt. Ltd.
3	'Indian Knowledge System and its Applications' by Dr. Buddhadeb Chandra & Dr. Sourav Ghosh, Global Net Publication.
4	'The Beautiful Tree: Indian Indigenous Education in the Eighteenth Century', Dharampal Classics Series, Rashtrottana Sahitya, Bengaluru, 2021.
5	'A Concise History of Science in India' by D. M. Bose, S. N. Sen and B. V. Subbarayappa, Eds., 2nd Ed., Universities Press, Hyderabad, 2010.
6	'Timeless India Resurgent India' by J. K. Bajaj and M. D. Srinivas, Centre for Policy Studies, Chennai, 2001.
7	'Traditional Knowledge and Intellectual Property Rights: Indian Perspective' by N.S. Gopalakrishnan.
8	'Yoga Sutra of Patanjali', Ramakrishna Mission, Kolkata.
9	'Indian Science and Technology in the Eighteenth Century' by Dharampal.

Corresponding NPTEL/SWAYAM Courses:

Sl. No.	NPTEL Course Name	Instructor	Host Institute
1	Introduction to Indian Knowledge System	Prof. Nandini Sinha Kapur	Indira Gandhi National Open University
2	Indian Knowledge System: Concepts and Applications in Science	Prof. B. Mahadevan, Dr. Vinayak Rajat Bhat, Dr. R Venkata Raghavan	IIM Bangalore, Chanakya University, Bengaluru,

Course Name:	Chemistry Laboratory		
Course Code:	BS-CH191	Category:	Basic Science Courses
Semester:	First	Credit:	1.5
L-T-P:	0-0-3	Pre-Requisites:	High School Chemistry

Full Marks:	100		
Examination Scheme:	Semester Examination: 60	Continuous Assessment: 35	Attendance: 05

Course Objectives:	
1	To introduce practical applications of chemistry concepts in solving related engineering problems.
2	To estimate hardness, alkalinity of water in checking its suitability for drinking and other relevant purposes.
3	To estimate the strengths of acids and bases using conductometric and pH-metric methods.
4	To synthesize a drug molecule and a polymer in learning how organic compounds are prepared in industry.
5	To learn estimation skills related to the lubricant properties such as saponification value, surface tension and viscosity of oils.
6	To determine the rate constant of a reaction from the change in concentrations as a function of time.

Course Contents: (Choose 10 experiments from the following)		
Module No.	Description of Topic	Contact Hrs.
1	Determination of chloride ion in a given water sample by Argentometric method (using chromate indicator solution).	3P/week
2	Determination of Alkalinity of a Given Water Sample.	
3	Determination of temporary and permanent hardness in water sample using EDTA.	
4	Determination of dissolved oxygen present in a given water sample.	
5	Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.	
6	pH-metric titration for determination of strength of a given HCl solution against a standard NaOH solution.	
7	Estimation of iron using permanganometry method (Redox titration).	
8	Synthesis of drugs (Paracetamol/Aspirin)	
9	Synthesis of Polymers (Phenol-formaldehyde and Urea-formaldehyde resin)	
10	Heterogeneous equilibrium (determination of partition coefficient of acetic acid between n-butanol and water).	
11	Determination of viscosity/surface tension of the given liquid.	
12	Determination of rate constant of acid catalysed hydrolysis of methyl acetate.	

13	Determination of acid value (Acidity) of oil.	
14	The adsorption of acetic acid on active charcoal.	
Total		30P

Experiments that may be performed through Virtual Labs:

Sl. No.	Experiment Name	Experiment Link(s)
1	Determination of chloride content of water.	http://vlabs.iitb.ac.in/vlabsdev/labs/nitk_labs/Environmental_Engineering_1/experiments/determination-of-chloride-nitk/simulation.html
2	Determination of surface tension and viscosity.	http://pcv-au.vlabs.ac.in/physical-chemistry/Determination_of_Viscosity_of_Organic_Solvents/
3	Determination of the rate constant of a reaction.	http://pcv-au.vlabs.ac.in/physical-chemistry/EMF_Measurement/
4	Acid value of an oil.	http://biotech01.vlabs.ac.in/bio-chemistry/Estimation_of_Saponification_Value_of_Fats_or_Oils/

Course Outcomes:

After completion of the course, students will be able to:

1	Carry out different types of titrations for estimation of concerned in substances and solutions.
2	Estimate the physical & chemical parameters for assessing the quality of water and explain the process of water treatment.
3	Execute various experimental procedures such as conductometry and pH- metry in order to find out the concentrations of acids or bases from the equivalence points.
4	Determine the saponification value and measurements of adsorption, surface tension and viscosity.
5	Synthesize a drug molecule and/or a polymer as an example of organic synthesis methods widely used in industry.
6	Understand the kinetics of a reaction from the change in concentration of reactants or products as a function of time.

Learning Resources:

1	'Experiments in Applied Chemistry' by Dr. Sunita Rattan.
2	'Laboratory Manual on Engineering Chemistry' by Dr. Sudha Rani.
3	'A Text book on Experiments and calculations in Engineering Chemistry' by S. S. Dara.
4	'Laboratory Manual of Organic Chemistry' by Raj K Bansal.
5	'Advanced Practical Chemistry' by S.C. Das.
6	'An Advanced Course in Practical Chemistry' by A. K. Nad, B. Mahapatra, A. Ghoshal.

Course Name:	Basic Electrical and Electronics Engineering Laboratory		
Course Code:	ES-EE191	Category:	Engineering Science Courses
Semester:	First	Credit:	2.0
L-T-P:	0-0-4	Pre-Requisites:	Knowledge of Class XII level Physics & Mathematics
Full Marks:	100		
Examination Scheme:	Semester Examination: 60	Continuous Assessment: 35	Attendance: 05

Group A: Basic Electrical Engineering Laboratory

Course Objectives:

1	Provide working knowledge for the analysis of basic DC and AC circuits
2	Measurement of power in three phase system
3	Provide working knowledge on Electric machines.

Course Contents:

Module No.	Description of Topic/ Experiment	Contact Hrs.
1	Verification of Circuit Theorem, (a) Thevenin's Theorem (with DC sources only) (b) Norton's Theorem (with DC sources only)	3P
2	Calibration of ammeter and Wattmeter.	3P
3	Measurement of current, voltage and power in RLC series circuit excited by (single-phase) AC supply.	3P
4	Measurement of power in a three phase unbalanced circuit by Two Wattmeter Method	3P
5	Open circuit and short circuit test of a single-phase transformer	3P
6	Starting and reversing of DC shunt motor.	3P
Total		18P

Course Outcomes:

After completion of the course, students will be able to:

1	Illustrate Thevenin's and Norton's theorems
2	Explain the concept of single phase and three phase AC supply.
3	Identify the parameters of a single phase transformer by open circuit and short circuit test.
4	Demonstrate the starting reversing DC motor.

Learning Resources:

1	Laboratory Manual
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Group B: Basic Electronics Engineering Laboratory

Course Objectives:

1	To make the students familiar with the electronic tools and components.
2	To make the students understand about p-n junction diode and zener diode characteristics and half wave and full wave rectifier performances.
3	To make the students understand about the characteristics of BJT and JFET and identify different modes of its operation.
4	To make the students understand about the basics of OPAMP and logic gates.

Course Contents:

Exp. No.	Description of Topic	Contact Hrs.
1	Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multimeters etc. Familiarization with measuring and testing equipment like CRO, Signal generators etc.	3P
2	a) Study of I-V characteristics of p-n Junction diode. b) Study of I-V characteristics of Zener diode.	3P
3	Study of Half and Full wave rectifiers with Regulation and Ripple factors.	3P
4	a) Study of I-V characteristics of BJTs. for CB configurations b) Study of I-V characteristics of BJTs. for CE configurations	3P
5	a) Study of drain characteristics of n-channel Junction Field Effect Transistors. b) Study of OPAMP as inverting and non-inverting amplifiers and determination of gain.	3P
6	Study of Logic Gates and realization of Boolean functions using Logic Gates.	3P
Total		18P

Course Outcomes:

After completion of the course, students will be able to:

1	Identify different electronic components and select appropriate tools and/or equipments for performing specific operation.
2	Determine the I-V characteristics of a p-n junction diode and zener diode and relate them to their applicability.

3	Implement half wave and full wave rectifier circuits and analyse their performance.
4	Determine the I-V characteristics of BJT in CB and CE configurations and identify its different operating regions.
5	Determine the I-V characteristics of JFET.
6	Use OPAMP as amplifier and verify the truth tables of different logic gates.

Learning Resources:

1	Laboratory Manual
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Course Name:	Workshop / Manufacturing Practices		
Course Code:	ES-ME192	Category:	Engineering Science Courses
Semester:	First	Credit:	2.0
L-T-P:	0-0-4	Pre-Requisites:	Nil
Full Marks:	100		
Examination Scheme:	Semester Examination: 60	Continuous Assessment: 35	Attendance: 05

Course Objectives:

1	To impart basic knowledge of various hand tools and their applications in different sections of manufacturing
2	To develop basic manufacturing skills, precision, safety at work place, team working and development of right attitude.

Course Contents:

Module No.	Description of Topic/ Experiment	Contact Hrs.
1	Introduction: Introduction to workshop - Safety precautions to be followed in a workshop. Description of different types of tools used in various shop.	4P
2	Carpentry Shop: Carpentry Tools - Marking Tools - Cutting Tools - Planning Tools - Boring Tools - Striking Tools - Holding Tools - Carpentry Processes • To make wooden joints and/or a pattern or like.	4P
3	Moulding & Casting Shop: Introduction to moulding - Pattern -General procedure for making a good sand mould - Different tools used for preparation of a mould - Explanation of various terms (Cope and Drag Box,	8P

	Runner, Riser, Gating and its utility, Parting sand, Vent holes). • One / two green sand moulds to prepare, and a casting be demonstrated.	
4	Fitting Shop: Introduction to Fittings, Fitting Operations, Thread Cutting, Holding Tools - Marking and Measuring tools - Cutting Tools - Finishing Tools. • To make a Gauge from MS plate.	8P
5	Smithy Shop: Introduction – Smithy and Forging, Key Tools (Anvil, Hammer, Smithy hammer, Sledge hammer, Swage, Swage block, Tongs, Chisels, Punches, Flatters, Set hammer etc). • A simple job of making a square rod from a round bar or like.	4P
6	Machine Shop: Demonstration of all the components of lathe – Different operations in lathe. Description of a Milling machine-components of machine. Description of a Shaping machine - Feed Mechanism. • To make a pin from a mild steel rod in a lathe. • To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.	8P
7	Sheet Metal Work: Micrometer-Chisels-Punches-Hammers - Mallets -Various sheet metal forming operations – Shearing – Marking – Punching-Bending. • To make a Tray by surface development method.	4P
8	Welding Shop: Introduction to Arc & Gas welding, MMAW-Gas Welding-Electrode -Equipments for MMAW- Different types of welding joints -AC & DC Welding. Different types of Flames in Gas Welding, Neutral Flame – Oxidizing Flame –Carburizing Flame – Brazing. Safety precautions in Welding Shop. • To join two thick MS plates by manual metal arc welding. • To join two thin MS plates or sheets by gas welding.	8P
Total		48P

Course Outcomes:

After completion of the course, students will be able to:

1	Demonstrate fundamental concept of pattern making, moulding and casting processes for engineering applications.
2	Practice fitting, carpentry, and smithy operations for manufacturing of components.

3	Identify and utilize machine tools for producing components through machining.
4	Explain concepts and applications of various types of fabrication processes.

Learning Resources:

1	'Elements of Workshop Technology' by S. K. Hajra Choudhury, A. K. Hajra Choudhury and Nirjhar Roy, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2	'Manufacturing Engineering and Technology' by S. Kalpakjian and Steven R. Schmid, 4th edition, Pearson Education India Edition, 2002.
3	'Manufacturing Technology - I' by S. Gowri, P. Hariharan and A. Suresh Babu, Pearson Education, 2008.
4	'Processes and Materials of Manufacture' by Roy A. Lindberg, 4th edition, Prentice Hall India, 1998
5	'Manufacturing Technology' by P. N. Rao, Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Course Name:		Communication Skill Laboratory	
Course Code:	HM-HU191	Category:	Humanities and Social Sciences including Management Courses
Semester:	First	Credit:	1.0
L-T-P:	0-0-2	Pre-Requisites:	Students must have basic functional knowledge of English Language and communication
Full Marks:	100		
Examination Scheme:	Semester Examination: 60	Continuous Assessment: 35	Attendance: 05

Course Objectives:

1	To develop basic communicative competence for expressing oneself intellectually and professionally in life.
2	To inculcate linguistic competence required in various life situations.
3	To develop technical communication skills (Listening, Speaking) for employability.

Course Contents:

Module No.	Description of Topic	Conduct Hrs.
1	Honing "Listening Skill" and its sub skills through Language Lab Audio device Scanning- Listening for specific purpose, Skimming- listening for overall understanding, predicting, persuading etc.	4P

2	Predicting content, Listening for gist, Detecting signposts, Listening for details, Inferring meaning, Probing Questions, Barriers to Listening, How to overcome barriers to listening.	4P
3	Honing "Speaking Skill" and its sub skills: Extempore- practicing speech without preparation, Public speaking- Picture presentation for developing fluency, Helping those master Linguistic/Paralinguistic features (Pronunciation / Voice modulation / Stress / Intonation / Pitch & Accent).	8P
4	Developing Enunciation, Active Vocabulary for daily conversation, Fluency activity, Common Errors while speaking.	4P
5	Introduction to nonverbal communication, Advantages of using nonverbal communication, Different modes of nonverbal communication, Open and Closed body language, Eye contact and Facial expression, Hand gestures, Do's and Don'ts in Non-Verbal Communication.	4P
Total		24P

Course Outcomes:

After completion of the course, students will be able to:

1	Demonstrate ability to interpret and express opinions on various topics related to current affairs.
2	Hone linguistic competence necessarily required in various life situations.
3	Develop their intellectual, personal and professional acumen.

Learning Resources:

1	'Communication Skills' by Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
2	'Exercises in Spoken English (Parts. I-III)' by CIEFL, Hyderabad, Oxford University Press.
3	'On Writing Well' by William Zinsser, Harper Resource Book, 2001.
4	'Effective Communication Skills' by Kulbushan Kumar, R S Salaria, Khanna Publishing House, Delhi.
5	'Functional English' by Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha, Cengage Learning India Pvt. Ltd.