MCKV INSTITUTE OF ENGINEERING

NAAC Accredited "A" Grade Autonomous Institute under UGC Act 1956
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Detailed Curriculum for Undergraduate Degree
B.Tech in Computer Science and Engineering
(w.e.f. AY: 2025-26)
Part III: Detailed Curriculum

Course Name:	**Mathematics-II**		
Course Code:	BS-M201	**Category:**	Basic Science Courses
Semester:	Second	**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:	
1	To learn concepts of Matrices & Determinants.
2	To learn how to solve different types of ordinary differential equation.
3	To comprehend Laplace transform & inverse Laplace transform.
4	To understand basic concept of graph theory.

Course Contents:

Module No.	**Description of Topic**	**Contact Hrs.**
1	**Matrices and Determinants** • Matrix & types of matrices. • Introduction to determinant, properties (proofs of identities are excluded). • Rank of a matrix, inverse of a matrix, Linear systems of equations, eigen-values and eigen-vectors, Caley-Hamilton theorem.	**8L**
2	**Ordinary Differential Equations of First order:** • Solution of first order and first degree differential equations: Exact equations and their solution, Non-exact equations, Integrating Factors. Linear and Bernoulli's equations. • Solution of first order and first degree differential equations: Solvable for $\boldsymbol{p}$, solvable for $\boldsymbol{x}$, solvable for $\boldsymbol{y}$; Clairaut's form.	**8L**
3	**Higher Order Ordinary Differential Equations:** • Equations with constant coefficients, D-operator, Complementary Function (CF) and Particular Integral (PI). • Cauchy-Euler's homogeneous equations. • Method of variation of parameters. • Solution of simultaneous first order ordinary differential equations.	**10L**
4	**Laplace Transforms (LT):** • Definition of LT, LT of some standard functions; Properties of LT:	**10L**

	Linearity, Change of scale property, First and Second Shifting property; LT of $t^n F(t)$ and $F(t)/t$; LT of unit step and periodic functions; LT of derivatives. • Inverse LT: Method of partial fractions, Convolution theorem. • Solutions of initial and boundary value problems by LT.	
5	**Graph Theory:** • Introduction: Definitions of graphs, walks, path & circuits. • Connected and disconnected graphs, directed and non-directed graphs, simple graphs, complete and bi-partite graphs; Some related theorems on graph. • Incidence and adjacency matrix; Graph isomorphism. • Shortest path: Dijkstra's algorithm. • Definition of tree, binary tree; Some related theorems on trees. • Spanning tree: BFS and DFS algorithms. • Minimal spanning tree: Kruskal's and Prim's algorithms.	**12L**
Total		**48L**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Apply the concept of matrix and determinants in different fields.
2	Determine eigen values, eigen vectors and utilize them to solve physical and engineering problems.
3	Apply different techniques to solve first and second order ordinary differential equations to address the modelling of systems and problems of Engineering field.
4	Apply Laplace Transform in analyzing physical problems.
5	Utilize graph algorithms for solving different network and other problems.

Learning Resources:	
1	'An Introduction to Differential Equation' by Maity & Ghosh, NCBA.
2	'Introduction to Graph Theory' by Dipak Kumar Ghosh, NCBA.
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	'Advanced Differential Equation' by M.D Raisinghania, S. Chand Publication.

Corresponding NPTEL/SWAYAM Courses:			
Sl. No.	**NPTEL Course Name**	**Instructor**	**Host Institute**
1	Engineering Mathematics - II	Prof. Jitendra Kumar	IIT Kharagpur

Course Name:	**Chemistry**		
Course Code:	BS-CH201	**Category:**	Basic Science Courses
Semester:	Second	**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.

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-EE201	**Category:**	Engineering Science Courses
Semester:	Second	**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.

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, Earthling, 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 Electrica land 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.**
1	**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**
2	**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**
3	**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**
4	**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

LearningResources:	
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-HU201	**Category:**	Humanities and Social Sciences including Management Courses
Semester:	Second	**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-HU202	**Category:**	Humanities and Social Sciences including Management Courses
Semester:	Second	**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.
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	**2L**

	husbandry, trade), Grama (village) as socio-economic unit. • Education systems—Gurukula, inclusiveness, and community learning. • **Scientific methodology**—Pramanas (means of knowledge): Pratyaksha, Anumana, Agama.	
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.
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, Rashtrotthana 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-CH291	**Category:**	Basic Science Courses
Semester:	Second	**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-EE291	**Category:**	Engineering Science Courses
Semester:	Second	**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) Theveni'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

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

Course Name:	Workshop / Manufacturing Practices		
Course Code:	ES-ME292	**Category:**	Engineering Science Courses
Semester:	Second	**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 -	**8P**

	Explanation of various terms (Cope and Drag Box, 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-HU291	**Category:**	Humanities and Social Sciences including Management Courses
Semester:	Second	**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.

Course Name:	**Ideation Laboratory**		
Course Code:	PW-BS281	**Category:**	Project Work
Semester:	Second	**Credit:**	1.0
L-T-P:	0-0-2	**Pre-Requisites:**	High School Subjects
Full Marks:	100		
Examination Scheme:	Presentation: 40	Continuous Assessment: 55	Attendance: 05

Course Objectives:	
1	To introduce students to the fundamentals of research, invention, innovation, and design thinking for addressing real-world societal and technological challenges.
2	To develop the ability to identify problems, conduct literature reviews using scientific databases, and analyze existing solutions to identify research gaps and opportunities for innovation.
3	To familiarize students with the process of transforming innovative ideas into feasible solution concepts through systematic planning, documentation, and effective presentation.

Course Contents:		
Module No.	**Description of Topic/ Experiment**	**Contact Hrs.**
1	**Introduction to Ideation, Research, Invention and Innovation** Understanding creativity, invention, innovation, and entrepreneurship. Difference between research, invention, and innovation. Importance of innovation in solving societal and industrial problems. Discussion on successful innovations and their impact on society.	**2P**
2	**Research Methodology and Problem Identification** Introduction to research methodology. Types of research. Characteristics of a good research problem. Identification of societal, environmental, healthcare, agricultural, educational, and industrial problems. Techniques for problem observation and problem statement formulation. • Exercise: Identification of a real-life societal problem and preparation of a preliminary problem statement.	**2P**
3	**Literature Review: Fundamentals and Importance** Purpose and significance of literature review. Identifying research gaps and opportunities for innovation. Techniques for systematic literature survey. • Exercise: Literature search on a selected problem.	**2P**
4	**Literature Review Tools and Databases** Hands-on training on Google Scholar, Google Patents, ScienceDirect, IEEE Xplore, SPIE Digital Library, Optica Publishing, SpringerLink, Wiley, Scopus, Web of Science, and other relevant databases. Citation tracking and reference management tools. • Exercise: Collection and organization of relevant literature.	**2P**
5	**Research Ethics, Plagiarism and AI-Assisted Writing** Research ethics and responsible conduct of research. Understanding plagiarism and its consequences. Plagiarism detection tools. Appropriate use of AI tools in academic writing and innovation. AI-generated content checking and validation. • Exercise: Plagiarism and AI-content analysis of sample documents.	**2P**
6	**Design Thinking and Innovation Framework** Introduction to Design Thinking. Empathize, Define, Ideate, Prototype, and Test stages. User-centric innovation approach. Problem reframing and need assessment. • Activity: Design Thinking exercise based on selected societal problems.	**2P**
7	**Idea Generation and Concept Development** Brainstorming techniques, mind mapping, SCAMPER, reverse thinking, and lateral thinking. Evaluation of innovative ideas based on feasibility, novelty, impact, scalability, and sustainability. • Exercise: Generation and screening of multiple solution concepts.	**2P**

8	**Selection of Problem and Proposed Solution** Finalization of societal problem and innovative solution. Defining project objectives, expected outcomes, scope, and constraints. Feasibility analysis and risk assessment. • Activity: Submission and presentation of project proposal.	**2P**
9	**From Problem Identification to Solution Conceptualization** Development and refinement of innovative ideas to address identified societal or technological challenges. Conceptual design of proposed solutions using block diagrams, flowcharts, sketches, circuits, algorithms, and process workflows, as applicable. Evaluation of novelty, feasibility, societal impact, and scalability of the proposed idea. Discussion on possible pathways for future implementation and development. • Activity: Preparation and presentation of an innovative idea addressing a selected societal or technological problem.	**2P**
10	**Technology Readiness Levels (TRLs)** Introduction to Technology Readiness Levels. Understanding TRL-1 – TRL-9. Assessment and positioning of projects within appropriate TRL levels. Pathways for technology maturation and commercialization. • Exercise: TRL assessment of selected projects.	**2P**
11	**Project Documentation and Report Writing** Preparation of project report containing: • Abstract • Problem Statement • Literature Review • Proposed/Implemented Solution • Novelty of the Solution • Methodology • Budget Estimation Guidelines for technical writing, figures, tables, references, and citations. • Activity: Report preparation.	**2P**
12	**Concept Validation, Presentation and Evaluation** Refinement of the proposed solution based on mentor feedback. Preparation of conceptual design, workflow, block diagrams, flowcharts, sketches, circuit diagrams (where applicable), and feasibility analysis. Development of a roadmap for future prototype implementation and testing. Preparation of presentation slides and project pitch. Effective communication of innovative ideas to evaluators and stakeholders. • Final Presentation and Evaluation of the proposed innovative solution.	**2P**
Total		**24P**

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

1	Differentiate between research, invention, and innovation, and apply design thinking principles to identify and define real-world problems.
2	Conduct literature surveys using scholarly databases and repositories, evaluate existing solutions, and identify research gaps for innovation.
3	Develop and evaluate innovative solution concepts for real-world problems through problem identification, research, feasibility assessment, and effective technical communication.
4	Present and defend innovative ideas effectively using appropriate technical documentation, visual aids, and professional communication skills.