SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Program: B Tech (All Program except CSBS, CSDS-311) / MBA Tech (All Program)/ B Tech Integrated (Computer/Mechanical)	**Semester :** II/VI
Course: Linear Algebra and Differential Equations	**Code:** 702BS0C051

Teaching Scheme				Evaluation Scheme	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- 100)**
3	0	1	4	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Knowledge of fundamental concepts in Algebra, Differential and Integral Calculus.

Course Objective

This course aims to instil in prospective engineers knowledge of concepts and techniques in Linear Algebra and Differential Equations. It also prepares the students to deal with advanced level of Mathematics and applications that would be essential for their disciplines.

Course Outcomes

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

1. Demonstrate understanding of the fundamental concepts of Linear Algebra and carry out related computational skills
2. Use effective mathematical methods for solving Differential Equations
3. Analyse functions, matrices and equations
4. Apply Calculus techniques and Algebraic skills to solve real life problems

Detailed Syllabus

Unit	Description	Duration
1.	**Linear Equations and Vector Spaces** Rank of Matrix, System of linear equations, Vector space, Subspace of vector space, Linear span, Linear independence and dependence, Basis, Dimension.	10
2.	**Linear Transformation and Eigenvalues** Linear transformation, Matrix associated with linear transformation, Composition of linear maps, Kernel and Range of a linear map, Rank-Nullity Theorem, Inverse of a linear transformation, Cayley- Hamilton Theorem, Eigenvalues, Eigenvectors, Eigenvalues of symmetric, skew-symmetric, Hermitian and Skew-Hermitian matrices, Diagonalization, Orthogonal Diagonalization of a real symmetric matrix.	12
3.	**First order Ordinary Differential Equations** Exact equations, Equations reducible to exact equations using integrating factors, Linear equations, Bernoulli equation, Orthogonal trajectories.	5

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

4.	**Higher order Ordinary Differential Equations** Higher order linear differential equations with constant coefficients, operator method, undetermined coefficients, Wronskian, variation of parameters method, Euler-Cauchy equation, power series solution: Example - Legendre and Bessel Differential Equations.	12
5.	**Partial Differential Equations** Introduction, Formation of Partial Differential Equations, Classification of second order Partial Differential Equations, Integrals of Partial Differential Equations, Solutions of Partial Differential Equations by the Method of Direct Integration, separation of variables method to simple problems in Cartesian coordinates, Initial & boundary value problems and solutions by separation of variables.	6
	Total	**45**

Text Books

1. B.V. Ramana, *Higher Engineering Mathematics*, 1st Edition , McGraw Hill Education, 2017.
2. B.S. Grewal, *Higher Engineering Mathematics*, 44th Edition, Khanna Publishers, 2017.
3. D. Poole, *Linear Algebra: A Modern Introduction*, 3rd Edition , Brooks/Cole, 2010.

Reference Books

1. G. B. Thomas, *Calculus*, Pearson, 13th Edition 2014.
2. Veerarajan T, *Engineering Mathematics- I*, 1st Edition, McGraw-Hill Education, 2016.
3. Erwin Kreyszig, *Advanced Engineering Mathematics*, 10th Edition ,Wiley India, 2017.
4. G. Strang, *Introduction to linear algebra*, 5th Edition, Wellesley Cambridge Press, 2016.
5. G. F. Simmons, *Differential equations with applications and historical notes*, 2nd Edition McGraw-Hill Education, 2017.
6. W. E. Boyce and R. C. DiPrima, *Elementary Differential Equations and Boundary Value Problems*, 9th Edition, ,Wiley India, 2015.
7. S.L. Ross, *Differential Equations*, 3rd Edition,Wiley India, 2016
8. H. K. Dass, *Advanced Engineering Mathematics*, 22nd Edition ,S. Chand, 2019.

Tutorial Work

8 to 10 Tutorial exercises based on the syllabus.

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Program: B Tech (All Program except CSBS, CSDS, CSDS-311,Mechanical, Civil)/ MBA Tech (IT, Computer, Data Science)				**Semester:** II	
Course: Quantum and Statistical Physics				**Code**: 702BS0C009	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- 100)**
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

Prerequisite:-

Course Objective

This course is aimed to teach the drawbacks of classical physics in explaining several experimental observations and old quantum theory; and to discuss the necessity of new mechanics and the laws related to it.

Course Outcomes

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

1. Define and illustrate the basic laws related to quantum and statistical mechanics
2. Interpret the concepts related to quantum and statistical mechanics to explain observed phenomena in nature
3. Apply the concepts of quantum and statistical mechanics to solve different engineering problems

Detailed Syllabus

Unit	**Description**	**Duration**
1.	Introduction to Quantum Physics, Black body radiation, Explanation of it using the photon concept, Photoelectric effect, Compton effect, de Broglie hypothesis, Experiments demonstrating wave properties of electron: Electron interference (double slit experiment), Electron Diffraction (Davison - Germer experiment), Uncertainty Principle. Wave-particle duality, Born's interpretation of the wave function, Verification of matter waves, Uncertainty principle.	6
2.	Basic postulates of quantum mechanics, concept of wave function, Superposition principle of eigenstates. Concept of collapse of wave function. Time dependent and time independent Schrodinger Equation, Concept of free particle, particle in an infinite and finite potential well, box problem. Bound vs. unbound states.	8
3.	Concept of Quantum Tunnelling. Reflection and Transmission coefficients. Few realistic examples of tunnelling, e.g., alpha decay, Probe microscopes (Scanning Tunnelling microscope). Simple Harmonic Oscillator, explanation in 1D (no detailed derivation). Hydrogen atom.	6
4.	Introduction to Statistical Physics. Ensembles (Canonical, Micro canonical and Grand canonical) Classical (Maxwell-Boltzmann) and Quantum statistics, [Bose Einstein (BE) and Fermi Dirac (FD)]. Derivation of classical statistics and BE and FD statistics.	6

Signature

(Head of the Department)

5.	Applications: equipartition of energy, Planck's distribution, Bose-Einstein Condensation	4
	Total	**30**

Text Books

1. A. Beiser, S. Mahajan and S. Choudhury, *Concept of Modern Physics*, 7th edition, Tata McGraw Hill, (SIE) 2015.
2. Arthur Beiser, *Perspectives of Modern Physics*, McGraw Hill, 1969

Reference Books

1. Eisberg and Resnik, *Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles*, 2nd edition Wiley, 2006.
2. R. A. Serwey, C. J. Moses, C. A. Moyer, *Modern Physics*, 3rd edition, Thomson, 2005.
3. David J. Griffiths, *Introduction to Quantum Mechanics*, 2nd edition,Pearson, 2015.
4. Frederick Reif, *Fundamentals of Statistical and Thermal Physics*, Waveland press, 2010.

Laboratory Work

8 to 10 experiments based on the syllabus.

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Program: B Tech /MBA Tech all branches (except B Tech CSBS,CSDS, CSDS-311)				**Semester**: I /II	
Course: English Communication				**Code:** 702BSOCO59	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE)**
-	**2**	**-**	**1**	**Marks Scaled to 50**	**-**

Pre-requisite: -

Course Objective

The objective of the course is to develop students' competency in the English language in relation to listening, speaking and reading.

Course Outcomes

After completion of the course, the student will be able to –

1. Use their knowledge of vocabulary and grammar to articulate their ideas effectively
2. Demonstrate effective listening and speaking skills in oral communication situations such as speeches, conversations, power-presentations, etc
3. Apply different reading techniques as needed to read passages effectively

Detailed Syllabus

Unit	**Description**	**Duration**
1.	**Vocabulary Building through Literature** Introduction to root and affixes, Synonyms and antonyms, Idioms and phrasal verbs, Commonly confused words, Words: denotation, connotations and usage	**06**
2.	**Useful Practices of Grammar** Articles and Prepositions, Subject-verb agreement, noun-pronoun agreement, Personal Pronouns (First Person, Second Person, Third Person), Modifiers – Errors in Modifiers (Misplaced, Dangling, Squinting), Redundancies and clichés, Tenses, Parallelism, Punctuation, Sentences, clauses and phrases, Active and passive voice, direct and indirect speech	**06**
3.	**Oral Communication** Listening skills, Public speaking, impromptu speaking, Situational dialogues	**06**
4.	**Comprehension through Short Fiction** Fast Reading, Skimming, Scanning, Active Reading, Cloze Reading, SQ3R Technique	**06**

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

5.	**Presentations** Planning – occasion, audience, purpose, Outlining – introduction, main body, conclusion, Visual slide design, Verbal, non-verbal communication	**06**
	Total	**30**

Text Books

1. Meenakshi Raman and Sangeeta Sharma, *Technical Communication: Principles and Practice*, 3rd ed. Oxford University Press, 2015
2. Mark Lester and Larry Beason, *The McGraw-Hill Education Handbook of English Grammar and Usage*, 3rd ed. McGraw Hill, 2019

Reference Books

1. Bovee Courtland and John Thill, *Business Communication Today*, Pearson Education, 14th Ed. 2017
2. John Seely, *Oxford Guide to Effective Writing and Speaking*, Oxford University Press, 3rd Ed. 2013
3. Michael Swan, *Practical English Usage*, Oxford University Press, 4th Ed. 1995
4. F.T Wood, *Remedial English Grammar*. Macmillan. 2007

Laboratory Work

8 to 10 experiments based on the syllabus.

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Program: B Tech (All Program except CSBS, CSDS,CSDS-311) /MBA Tech (All Program)				**Semester:** I / II	
Course: Basic Electrical and Electronics Engineering				**Code :** 702EX0C001	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks-50)**	**Term End Examinations (TEE) (Marks -100)**
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite:-

Course Objective

The main objective of this course is to equip the students with the ability to solve, assemble and test simple AC and DC electrical circuits. Further, the course also enables the student to obtain a basic understanding of the working principle and applications of electronics devices.

Course Outcomes

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

1. Interpret DC circuits, theorems and time domain analysis of first order RL circuit
2. Solve series and parallel AC circuits and compare star/delta configurations
3. Explain the principles of transformer and electrical machines
4. Understand the construction, working principle and applications of electronics devices and logic circuits

Detailed Syllabus

Unit	**Description**	**Duration**
1.	**DC Circuits** Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's current law, Kirchhoff's voltage laws, Analysis of simple circuits with dc excitation, Superposition Theorem, Thevenin's Theorems, Norton's Theorems. Time-domain analysis of first-order RL circuits.	6
2.	**AC Circuits** Generation of alternating emf, instantaneous, rms, peak, average values and related other terms, vector representation of AC quantities, Steady state analysis of R, L, C series and parallel circuits, resonance. Generation of three-phase emf, star connection, delta connection, relationship between line and phase quantities.	8
3.	**Transformers and Electrical Machines**	6

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

	Construction and working of single-phase transformer Ideal and practical transformer, equivalent circuit, Losses in transformers, Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Single-phase induction motor, construction and working, DC motor construction, working and types.	
4.	**Analog Electronics (**no mathematical treatment and design) Half and full wave rectifiers, special purpose diodes -zener regulator, BJT and its applications, amplifier, oscillator, overview of opto-electronics devices, opto-couplers, concepts of transducer, Operational amplifier (IC-741), Inverting and Non-Inverting, Comparator, Timer (IC-555) and multivibrators.	5
5.	**Digital Electronics** Logic gates, concept of universal logic; implementation of Boolean expressions using logic gates, application of digital circuits: e.g., adder, subtractor, multiplexer, de-multiplexer, Analog to Digital Converter, Digital to Analog Converter.	5
	Total	**30**

Text Books

1. D. C. Kulshreshtha, *Basic Electrical Engineering*, 1st Edition, McGraw Hill Education,2017.
2. E. Hughes, *Electrical and Electronics Technology*, 10th Edition, Pearson Education,2013.
3. Boylstad R.L., Nashelsky L., *Electronic Devices and Circuit Theory*, 12th Edition, Pearson, 2012.
4. M. Morris Mano, *Digital Logic and Computer Design*, 10th Edition, Prentice Hall India, 2008.

Reference Books

1. V. D. Toro, *Electrical Engineering Fundamentals*, 2nd Edition, Pearson Education India, 2015.
2. Jacob Millman & Halkias, *Electronic Devices & Circuits*, 2nd edition, Tata McGraw Hill, 2013.

Laboratory Work

8 to 10 experiments based on the syllabus.

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Program: B Tech (All Program except CSBS, CSDS,CSDS-311) /MBA Tech (All Program)/B Tech Integrated (Mechanical/Computer)				**Semester:** I / II/V/VI	
Course: Design Thinking				**Code:** 702BS0C011	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks -50)**	**Term End Examinations (TEE) (Marks -100)**
2	0	0	0	Marks Scaled to 50	---

Pre-requisite: -

Course Objective

The objective of this course is to understand the concept of Design thinking through engaging the students in projects/ assignments that illustrate the various pillars of Design thinking. Imbibe the higher order skill of Design thinking which they will be able to apply in various projects during their course, to create new products & services.

Course Outcomes

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

1. Develop a human-centric approach towards problem solving
2. Apply design thinking principles to come up with innovative solutions to problems and challenges

Detailed Syllabus

Unit	Descriptions	Duration
1.	Introduction to Design Thinking -Design Thinking as 'Experience Innovation' - Concepts of Customer Desirability, Technological Feasibility, Business Viability and their significance	2
2.	Case Study: Discussion on HBR article Design Thinking by Tim Brown (Pre-Read based analysis of all four case studies covered in article)	2
3.	Mindset Creation - Growth Mindset vs. Fixed Mindset - Essential elements of Design Thinking Mindset - Case Study: Jeff Bezos-Amazon's approach of being Customer Obsessed	2
4.	- Pillars of Design Thinking - Introduction to Stages of Design Thinking based on Stanford d. School	2
5.	Case Study for Application of Design Thinking IDEO Shopping Cart (Case Video followed by debrief/class discussion)	2
6.	Empathy [A] -Introduction to empathy -Decoding Customer Behaviour using DT (using case study method)	2
7.	Empathy [B]	4

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

	-Tools:Understanding Consumer's Unmet Needs & Pain Points: (Observation, Focused Interviews, Shadowing, Journey Mapping) - Rules and tips for each specific tool (Class activity based learning for each tool)	
8.	Empathy [C] Debrief of Class Activity for Journey Mapping Empathy Case Study: 'Embrace- Infant Incubator'	2
9.	Define -Analysis of data gathered from Empathy stage through tools like Clustering & Affinity Diagrams -Building Problem Statements & understanding POV -Tools: Framing problems as 'How Might We?' questions	2
10.	Ideate -Concept of Semi-structured approach to Ideation in DT -Rules of Ideation -Tools: Brainstorming, Brainwriting, Dot Voting	2
11.	Ideate -Class Activity to demonstrate Brainstorming & Dot Voting - Case Study for Out of the Box Idea Generation: Steelcase	2
12.	Prototype -Introduction to concept of prototyping & basic techniques of rapid prototyping -Introduction to Low fidelity vs. High fidelity prototypes and their significance in the Design Thinking process -General information on user testing & MVPs - Case Study for Prototyping & User Testing: Nordstorm Innovation Lab	2
13.	Term End Group Project Analysis of Design Thinking success stories from across various domains – Students are expected to build a presentation based on the design thinking led success story of their chosen company/organization	4
	Total	**30**

Textbook and Reference Books

1. Idris Mootee , *Design Thinking for Strategic Innovation*, Wily, 2014.

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Program B Tech (All Program except CSBS, CSDS-311 and Civil) and MBA Tech All Program				**Semester:** I / II	
Course: Electrical and Electronics Workshop				**Code:**702EX0C021	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks ---)**
0	2	0	1	Marks Scaled to 50	--

Pre-requisite – Nil

Course Objective

This course gives the basic working knowledge required for the production of various engineering products. It is the backbone of the real industrial environment which helps to develop and enhance relevant technical hand skills required by the engineer working in the various engineering industries and workshops.

Course Outcomes

After completion of the course, the student will be able to -

1. Identify correct testing instruments and tools for various tasks
2. Build PCB circuits using through hole and SMD components for small applications
3. Make use of required electrical components for building domestic wiring circuits
4. Assemble PC hardware and configure network topology

Detailed Syllabus

Unit	Description	Duration
1.	**Familiarization and application of testing instruments and commonly used measuring instruments and tools** Multimeter, Function generator, Power supply, Digital Storage Oscilloscope (DSO) etc. Soldering iron, De-soldering pump, Pliers, Cutters, Wire strippers, Tweezers, Crimping tool, Hot air soldering and de-soldering.	4
2.	**Printed circuit boards (PCB)** Types, Single sided, Double sided, PTH, Processing methods, schematics design using open source software and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride) and drilling. **Soldering and Joining Processes –** Introduction, Techniques and circuit assembly. Assembling of electronic circuits using SMT (Surface Mount Technology) components/stations.	8
3.	**Study, demonstration and identification of common electrical materials such as wires, cables, switches, fuses and connectors**	

Signature
(Head of the Department)

	Wiring of fan, tube light, two-way control (staircase wiring), Earthing- Need, objectives and types – Plate, Pipe, Rod and maintenance free earthing. Understanding of electric shock, understand rating and working of Miniature Circuit Breakers (MCB), Electric Leakage Circuit Breaker (ELCB), Residual Current Circuit Breaker (RCCB) and Fuse.	8
4.	**Introduction to PC Hardware –** Assembly of I/O peripherals, memories and storage devices, Central Processing Unit (CPU), Graphic Processing Unit (GPU), and SMPS. LAN configuration using device (MAC) address, Switch/Hub configuration (4/8 port), router configuration using GSM. Study of ARDUINO boards (uno/mega), sensors – Temperature, Humidity, LDR, Smoke, Ultrasonic etc., Shields – Motor driver, wi-fi, IO, DC gear motors, Stepper motor.	10
	Total	**30**

Text Books

1. R.S. Khandpur, *Printed Circuit Boards: Design, Fabrication, assembly and testing*, 3rd ed. Tata McGraw Hill, , 2017.
2. Dan Gookin, *Troubleshooting and maintaining your PC*, 3rd ed., Wiley, 2017.
3. R.P. Singh, *Electrical Workshop: Safety, Commissioning, maintenance and testing of electrical equipment*, 3rd ed., IK International Publishing, 2012.

Reference Books

1. John H. Watt, Terrell Croft, *American Electricians' Handbook: A Reference Book for the Practical Electrical Man*, 9th ed., McGraw-Hill, 2018.

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

Signature
(Head of the Department)

Laboratory Work

6 to 8 laboratory exercises (and a practicum) based on the syllabus.

List of experiments:

1. To identify electronic components with specification (Functionality, type, size, color coding, package, symbol, cost etc). (wires, Cables, Connectors, Fuses, Switches, Relays, Heat sink etc.)
2. To understand and use measuring and testing instruments (Mutimeter, Function generator, Power supply, Digital Storage Oscilloscope)
3. To design PCB schematics using suitable software.
4. To fabricate single sided PCB for a simple electronic circuit.
5. To assemble and test an electronic circuit.
6. To study functioning of circuit breakers.
7. Experiment based on house hold wiring of appliances such as fan, tube light etc.
8. Dis-assemble and assemble of PC.
9. To configure LAN, switch and router for network topology.
10. To simulate and implement simple applications using ARDUINO.
11. Practicum

Signature
(Head of the Department)

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Program: B Tech Mechanical ,Civil/ Mechatronics				**Semester: II/**IV	
Course: Chemistry				**Code:**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- 100)**
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

Prerequisite: HSC level Chemistry

Course Objective

The aim is to acquaint students with engineering materials like lubricants, polymers, nanomaterials and composites. Also to familiarize them with the industrial importance of water chemistry, application of fuels and concept of metal corrosion.

Course Outcomes

After completion of the course, the student will be able to -

1. Rationalize fundamentals of corrosion and materials
2. Understand basic concepts in water, combustion of fuels and polymer chemistry
3. Solve numerical problems based on water, fuels and combustion, lubricants

Detailed Syllabus: (per session plan)

Unit	Description	Duration
1.	**Polymers** Introduction, basic concepts of degree of polymerization, tacticity, melting and glass transition temperature and its importance. Types of polymerization (Addition, condensation and co-polymerization). Smart polymer materials, conducting polymers, liquid crystals, applications of polymers.	**05**
2.	**Lubricants** Definition, Mechanism of lubrication, Properties- viscosity, viscosity index, flash & fire, cloud & pour points, oiliness, saponification & acid value (numericals based on saponification and acid value)	**04**
3.	**Fuels & Combustion** Discuss the definition, classification and characteristics. Calculation of Calorific value-Theoretical & Experimental method (Bomb calorimeter). Solid Fuels: Coal, proximate and ultimate analysis, Numerical based on analysis of coal. (Dulong's formula) and bomb calorimetry. Combustion: calculation on air and oxygen requirement.	**06**

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

	Liquid fuels: Mining of Petroleum, Cracking, Reforming, Knocking in IC engines, Octane number, Cetane number & anti-knocking agents (TEL and MTBE) Gaseous fuel: (LPG, CNG) Composition, properties and application.	
4.	**Water Chemistry** Concept of hardness of water, types of hardness and its determination by EDTA methods, numerical based on water hardness. Water softening processes by: Lime-soda method, ion-exchange process and reverse osmosis process. Role of water as a universal solvent.	**05**
5.	**Chemistry of Corrosion and protection** Introduction, types of corrosion, chemical and electrochemical theories of Corrosion and their sub-types (corrosion by oxygen and other gases and liquids), factors affecting corrosion, preventive measures for corrosion-Cathodic and anodic protection methods, use of protective coatings (galvanization, tinning, metal cladding, electroplating, organic coatings like paints and varnishes).	**05**
6.	**Chemistry of Important Engineering Materials and Nanomaterials** Introduction to alloys (steels, special steels, Carbon steel, brass, bronze and applications). Introduction to composites; Classification (Polymer, Metal & Ceramic composites, Cement), applications of composites. Introduction to nanomaterials, Structural features and properties of Nanomaterials, recent advances in nanomaterials, application of nano materials in catalysis, medicine, construction chemicals, paints and pigments and heat transfer fluids.	**05**
	Total	**30**

Text Books

1. Palanna. O.G., Engineering Chemistry, Tata McGraw Hill Education. Pvt. Ltd, 1st Edition 2009.

Reference Books

1. *Advance Organic Chemistry*, Jerry March,7th edition ,2013
2. *P. W. Atkins, Physical Chemistry*, ELBS/Oxford, 9th Edition, 2010.
3. *Textbook of Nanoscience and Nanotechnology*, B.S. Murty, P. Shankar, Baldev Raj, B B Rath, James Murday, Springer Science, 2013

Laboratory Work

8 to 10 experiments based on the syllabus.

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Program: B Tech (All Program except CSBS, CSDS-311) / MBA Tech (All Program)/ B Tech(Civil, Mechanical, CSEDS)					**Semester:** I/II
Course : Physics					**Code:** 702BS0C002
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- 100)**
3	2	0	4	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite Nil

Course Objective

The knowledge of Physics relevant to engineering is critical for converting ideas into technology. An understanding of Physics also helps engineers understand the working and the limitations of existing devices and techniques, which eventually leads to new innovations and improvements. This course aims to make students understand the basic concepts of Physics thoroughly with a view to lay foundations for the various engineering courses.

Course Outcomes

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

1. Relate and interpret the relationship and interaction between the nature and the matter with a scientific outlook
2. Identify and apply different processes of physics that have wide applications in industrial and technological sectors
3. Develop creative thinking, problem solving abilities and considerable scientific skills, viz. experimental, observational, manipulative, investigatory and decision making etc.

Detailed Syllabus

Unit	Description	Duration
1.	**Semiconductors Physics** Formation of energy bands and classification of solids into conductors, semiconductors and insulators, direct and indirect band gap semiconductors, fermi levels in semiconductor, energy gap and its temperature dependence, physics of semiconductor junction, hall effect and application.	8
2.	**Optics** Interference: Thin film interference, wedge shaped film and Newton's rings and their applications. Diffraction: Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits, Characteristics of diffraction grating and its applications.	9
3.	**LASER and Fiber optics** Introduction to interaction of radiation with matter, Population inversion,	9

Signature
(Head of the Department)

	pumping, various modes, threshold, population inversion, Solid state LASER, Semiconductor LASER, Gas LASER, applications of lasers. Introduction, optical fiber as a dielectric wave guide, total internal reflection, numerical aperture and various fiber parameters, losses associated with optical fibers, step and graded index fibers, application of optical fibers.	
4.	**Electricity and Magnetism** Laws and applications of electrostatics and magnetostatics, Maxwell's equations and applications, introduction to waveguides.	6
5.	**Nuclear and Plasma Physics** Introduction to nuclear physics, types of nuclear reactions, nuclear fission as a source of energy, Particle accelerators: Cyclotron, Synchrotron, Nuclear radiation counters: Geiger Muller Counter, scintillation counter. Basic concepts of Plasma physics: Plasma as a state of matter, Debye length, plasma frequency, collisions, dc conductivity, ac conductivity Applications of plasma physics.	8
6.	**Modern Engineering materials** (Introduction and basic properties of each material) Nanomaterials, Superconductors, Dielectrics, metallic glasses, biomaterials.	5
	Total	**45**

Text Books

1. H.K Malik and A.K. Singh, *Engineering Physics*, 2nd Edition, Tata McGraw Hill, 2017.

Reference Books

1. Jearl Walker, David Halliday and Robert Resnick, *Fundamentals of Physics*, 10th edition, Wiley India, 2013.
2. James F.Shackelford and Madanapalli K. Muralidhara, *Materials Science for Engineers,* 7th edition, Pearson Education, 2006.
3. Francis F. Chen, *Introduction to Plasma Physics*, Springer, 2012.

Laboratory Work

8 to 10 experiments based on the syllabus.

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

Signature

(Head of the Department)

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Program: B Tech (Civil Engineering)				**Semester:** II	
Course: Construction Technology				**Code:** 702CI0C003	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- 100)**
2	0	0	2	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Engineering Workshop

Course Objective

This course imparts basic knowledge of construction activities and their sequence, the process of concreting from manufacturing to finishing. It aims to compare various types of flooring and their applications in different scenarios

Course Outcomes

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

1. Describe various construction activities and their sequence
2. Explain the process of concreting from manufacturing to finishing
3. Discuss various types of flooring and their applications

Detailed Syllabus

Unit	Description	Duration
1.	**Excavation** Manual and mechanical method of Excavation, disposal of excavated material, dewatering of trenches, shoring and strutting of Trenches, precaution while excavation, fencing – caution signs.	**04**
2.	**Foundation** Necessity and Purpose of Foundation, Shallow Foundation, Spread foundation, raft foundation, deep foundation and its types, Precast concrete piles. Modern methods of pile installation.	**04**
3.	**Masonry** Terminology, Preparation, construction procedure, post construction precautions, brick masonry stretcher bond and half brick thick masonry, hollow and solid concrete block masonry, fixing of door and window frame in masonry, block masonry. Procedure of constructing un-coursed Rubble and coursed masonry. **Pointing & Plastering**	**06**

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

	Necessity and types, methods of providing pointing and plastering.	
4.	**Formwork and Scaffolding** Types, basic factors governing selection. Erecting and removal of formwork. Scaffolding types, precautions.	**04**
5.	**Concrete** Procedure of mixing concrete, manual and machine mixing, types of mixers, transporting, laying, compacting and curing of concrete, different types of vibrators, underwater concreting.	**06**
6.	**Floors** Solid ground floor, plinth fillings, floor finish with murum, brick-bat concrete, Indian patent stone, cement tiles, China mosaic, floorings for special purposes such as factories, warehouses, stables, garages, railway platforms, upper floors: jack arch construction, mezzanine floors and lofts, false flooring for control rooms.	**06**
	Total	**30**

Text Books

1. Rangwala S C, Building Construction, 33rd edition, Charotar Publications, 2016.

Reference Books

1. Mathur S., Building Construction Handbook, SBS Publishers, 2012.
2. McKay, Building Construction, Pearson India, 2013.
3. Mantri Sandeep, The A to Z of Practical Building Construction and its Management, Mantri Publications, 2017.

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Program: B Tech (All Program except CSBS, CSDS) / MBA Tech (All Program)/ B Tech Integrated All Program					**Semester:** I / II/III/IV
Course: Constitution of India					**Code :** 702BS0C006
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- 100)**
1	0	0	0	Marks Scaled to 50	__

Pre-requisite:-

Course Objective

The course would enable students to get a brief introduction of the Indian Constitution and its principles. The students would have knowledge of concept of 'State' and interdependencies of its institutions vis a vis their relation with fundamental rights.

Course Outcomes

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

1. Understand the historic evolution of the Indian Constitution, its drafting, nature and to understand the principles mentioned in its Preamble
2. Inculcate fundamental rights in its true sense and also the permissible restrictions upon it so as to enjoy these rights within permissible limits while simultaneously performing their duties and to apply these principles into their professional lives
3. Ingrain the structure of our polity and role of Judiciary in maintaining the basic structure of the Constitution
4. Attain knowledge of the Emergency provisions, when and how it is imposed, to know the additional powers the bestowed upon the Government at times of Emergency and to understand the Amendment procedure

Detailed Syllabus

Unit	**Description**	**Duration**
1.	Nature, Characteristics and Sources of Indian Constitution	2
2.	Fundamental rights and Fundamental duties – Concept of State, Right to Equality under Articles 14 and 15, Right to certain freedoms under Article 19, Right to Life and liberty under Article 21, Right to religion under Article 25 and 26, Right to remedy under Article 32 and Fundamental duties	6
3.	Indian Judiciary – Concept of Supreme Court and High Courts, Appointment of Judges, Independence of Judiciary, Jurisdictions of Supreme Court and High Courts	3
4.	Emergency Provisions – Concept of National Emergency under Article 352, Financial Emergency under Article 360 and President rule under Article 356 of the Constitution	4
	Total	**15**

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

Signature
(Head of the Department)

Text Books

1. Dr. Durga Das Basu, *Introduction to the Constitution of India*, 24th Edition, Lexis Nexis, 2019.

Reference Books

1. P. M. Bakshi, *The Constitution of India*, 17th Edition, Universal Law Publishing, 2020.
2. J. N. Pandey, *Constitutional Law of India*, 57th Edition ,Central Law Agency, 2020.
3. N. A. Palkhivala, *We the people*, UBS Publishers Distributors, 1999.

Signature
(Head of the Department)

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Program: B Tech (All Program except CSBS, CSDS-311) / MBA Tech (All Program)/ B Tech Integrated (Computer/Mechanical)	**Semester:** I / II/V/VI
Course: Critical Thinking	**Code:** 702BS0C007

Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	**Practical Hours per week**	**Tutorial Hours per week**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 100)**	**Term End Examinations (TEE) (Marks -100)**
2	0	0	0	Marks Scaled to 50	---

Pre-requisite: Nil

Course Objective

This course examines the basic nature of reasoning and the fallacies which prevent good reasoning and decision making. Both the theory and practice of critical thinking are covered. Emphasis will be on understanding the logical structure of an argument and on recognizing the influence of bias and emotional persuasion on decision making.

Course Outcomes

After completion of the course, students will be able to

1. Solve problems or take decisions by processing information in a clear, logical, reasoned and reflective manner
2. Recognise, build and appraise arguments
3. Analyse contexts effectively
4. Recognise bias and its impact on decision making

Detailed Syllabus

Unit	Description	Duration
1.	**Brain and Thinking:** Introduction to Thinking, Types of Thinking, Brain and Thinking, Curiosity, Creativity and Different thinking, Critical thinking basics, Meta thinking	10
2.	**Social, Psychological Aspects of Thinking:** Top barriers to critical thinking, Rationality Bounded Rationality and its model, Fast and Slow Thinking, Objectivity, Subjectivity, Assumptions and Skepticism. Paradigm shift, Perception, prejudice and stereotype, Attribution, Heuristics, Cognitive Biases and Errors, examining critical thinking, Critical Thinking Process, Framework, & Tools, Problems and critical thinking.	10
3.	**Deductive and Inductive:** Arguments, Principle of Clarity, Truth, Deductive validity, Conditional Propositions, Inductive reasoning, Inductive inferences, Deductive v/s Inductive, Formal fallacies, Informal fallacies.	10
	Total	**30**

Text Books

1. Paul Herrick, *Think with Socrates: An Introduction to Critical Thinking*, 1st edition, 2014.
2. Lewis Vaughan, *The Power of Critical Thinking*, 5th edition, 2012,

Reference books: NA

Signature

(Head of the Department)

AY 2022-23

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Program: B Tech (All Program except CSBS, CSDS-311) / MBA Tech (All Program)/ B Tech Integrated (Computer, Mechanical)				**Semester:** I / II/V/VI	
Course: Professional Ethics				**Code:** 702BS0C005	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks-50)**	**Term End Examinations (TEE) (Marks -100 in Question Paper)**
1	0	0	1	Scaled to Marks 50	---

Pre-requisite: Nil

Course Objective

This course is designed to encourage students to inculcate human values, that will enable them to grow as a responsible human being. The course also helps students to understand how to maintain ethical conduct in discharging professional duties, which will be beneficial for them in their professional lives.

Course Outcomes

After completion of the course, students would be able to

1. Understand the engineering code of ethics and be able to apply them as necessary,
2. Understand moral complexities in many engineering activities and decision-making processes,
3. Understand some of the contemporary issues in the engineering professions,
4. Effectively communicate their knowledge and understanding of engineering ethics.

Detailed Syllabus

Unit	Description	Duration
1.	**Introduction to Ethics-** • Concept of morals and ethics, • Study of engineering ethics; • Laws and ethics; • Personal and professional ethics.	2
2.	**Professional Practice in Engineering-** • Common morality ASME code of ethics, • Technical codes and standards, • Accepted standards of Engineering practice and the standard of care.	2
3.	**Ethics as design-doing justice to moral Problem-** • Discuss about ethics as a design to solve moral problems • Comparison between moral problems and engineering design problems; • Moral lessons from design problems; • Implications of the dynamic character of problem situations.	2
4.	**Rights and Responsibilities of Engineers-** • Moral responsibilities; • Conflicts of interests; • Confidentiality, • Engineers, organizations and ethics,	4

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

	• Engineer-manager relationships; • loyalty; • The concept of whistleblowing.	
5.	**Responsibility for the Environment-** • Rapid Technological growth and depletion of resources, • Reports of the Club of Rome. • Limits of growth: sustainable development • Energy Crisis: Renewable Energy Resources • Environmental degradation and pollution. • Eco-friendly Technologies. • Environmental Regulations, • Environmental Ethics • Appropriate Technology, • Movement of Schumacher; later developments of Technology and developing notions. • Problems of Technology transfer, • Technology assessment impact analysis. • Problems of man, machine, interaction, • Impact of assembly line and automation. • Human centered Technology	5
	Total	**15**

Text Books

1. M.W. Martin and R. Schinzinger, Ethics in Engineering, 2nd Edition, McGraw-Hill, 2005.
2. Charles B. Fleddermann, Engineering Ethics, 3rd Edition, Pearson, 2007.
3. P.A. Vesilind and A. S Gunn, Engineering Ethics and Environment, 1st Edition , Cambridge University Press, 1998.

Reference Books

1. Caroline Whitbeck, Ethics in Engineering – Practice and Research, 2nd Edition, Cambridge University Press, 2011.

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Program: B Tech (Artificial Intelligence, Artificial Intelligence and Machine Learning, Artificial Intelligence and Data Science) / MBA Tech (Artificial Intelligence)				**Semester :** II	
Course: Probability and Random Variables				**Code:** 702BS0C021	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- 100 in Question Paper)**
2	0	1	3	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Knowledge of Permutation, Combination and Pre-Calculus.

Course Objective

To equip the students with intermediate to advanced level concepts and tools in probability and statistics that help them tackle relevant problems within engineering domain.

Course Outcomes

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

1. Know the concept of probability and random variables
2. Solve problems involving conditional probability and moments
3. Demonstrate understanding of the applications of various probability distributions, measures of central tendency to solve real life problems
4. Analyse the different probability density functions and their applications

Detailed Syllabus

Unit	Description	Duration
1.	**Probability** Concept of experiments, sample space, event. Definition of Combinatorial Probability. Conditional Probability, Mutually exclusive events, Joint probability of related and independent events, Statistical independence, Total Probability theorem, Bayes theorem.	6
2.	**Random Variables** Random Variables, Cumulative Distribution function, Probability Density Function, Mathematical expectation and its properties, Moments (including variance) and their properties, interpretation, Moment generating function.	8
3.	**Two dimensional Random Variables** Joint PDF's and CDF's, Conditional PMF and PDF, Marginal PDF, Conditional Mean &Variance, Rule for Independence, Covariance and correlation of random variables	8

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

Signature
(Head of the Department)

4.	**Probability distributions** Discrete probability distributions: Binomial, Poisson and Geometric distributions, Uniform distribution. Continuous probability distributions: Exponential, Normal distribution, Chi-square, t, F distributions.	8
	Total	**30**

Text Books

1. T. Veerarajan, *Probability, Statistics and Random Processes*, 3rd edition, Tata McGraw-Hill 2003, 2008.
2. S. M. Ross, *Introduction of Probability Models*, Academic Press, N.Y.
3. A. Goon, M. Gupta and B. Dasgupta, Fundamentals of Statistics, vol. I & II, World Press.

Reference Books

1. S. M. Ross, *A first course in Probability*, 10th Edition, Prentice Hall, 2018.
2. I. R. Miller, J.E. Freund and R. Johnson, *Probability and Statistics for Engineers*, 4th Edition, PHI.
3. A. M. Mood, F.A. Graybill and D.C. Boes, *Introduction to the Theory of Statistics*, McGraw Hill Education.
4. Anthanasios Papoulis, S. Unnikrishna Pillai, *Probability, Random Variables and Stochastic Processes*, 4th edition, Tata McGraw-Hill 2002, 2008.

Tutorial Work

8 to 10 Tutorial exercises based on the syllabus.

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Program: B Tech (All Program except CSBS, CSDS, CSDS-311) / MBA Tech (All Program)/ B Tech Integrated (Computer, Mechanical)				**Semester:** I /II /V/VI	
Course : Elements of Biology				**Code:** 702BS0C049	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- 100)**
3	0	0	3	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite Nil

Course Objective

The principal objective of this course is to provide a basic understanding of biological mechanisms of living organisms from the perspective of engineers. To encourage engineering students to think about solving biological problems with engineering tools. To make them aware of the application of engineering principles in biology and engineering robust solutions inspired by biological examples.

Course Outcomes

After successful completion of the course, student will be able to-

1. Convey that all forms of life have the same building blocks and yet the manifestations are diverse
2. Identify and classify microorganisms while understanding molecular basis of DNA as a genetic material for information transfer
3. Classify enzymes and distinguish between different mechanisms of enzyme action

Detailed Syllabus

Unit	Description	Duration
1.	**Introduction** Convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from - Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.	3

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

2.	**Classification** Convey that classification per se is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification.Discuss classification based on (a) cellularity-Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion - aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus	6
3.	**Genetics** Convey that "Genetics is to biology what Newton's laws are to Physical Sciences" Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.	6
4.	**Biomolecules** Convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.	5
5.	**Enzymes** Convey that without catalysis life would not have existed on earth Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic- parameters. Why should we know these parameters to understand biology? RNA catalysis.	5

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

6.	**Information Transfer** The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.	6
7.	**Macromolecular analysis** How to analyses biological processes at the reductionistic level Proteins-structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	5
8.	**Metabolism** The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy Charge.	5
9.	**Microbiology** Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.	4
	Total	**45**

Text Books

1. Arthur T. Johnson, *Biology For Engineers,* 2nd edition, CRC Press Taylor & Francis group, 2018.
2. Prescott, L.M J.P. Harley and C.A. Klein, *Microbiology*, 7th edition, McGraw-Hill Higher Education. 2008.

Reference Books

1. Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B., *Biology: A global approach*, 10th edition, Pearson Education Ltd. 2014.
2. Nelson, D. L.; Lehninger, A. L.; and Cox, M. M., *Principles of Biochemistry*, 8th edition, W.H. Freeman, 2020.

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

_____

Signature

(Head of the Department)

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Program : B Tech /MBA Tech				**Semester :** III/IV/V/VI	
Course : Principles of Economics and Management				**Code:** 702TG0C001	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks - 100)**
3	---	---	3	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: NIL

Course Objective

This course provides basic orientation towards economic (micro and macroeconomics) principles and help them understand the functions of management. This course also aims to understand issues dealing with small-scale economic phenomena and concepts such as prices and output of firms, industries and resource owners along with examining market impact of technological change with regards to understand broader aspects of the economy and its environment.

Course Outcomes

After completion of the course, the student will be able to -

1. Illustrate basic concepts of economics (demand, supply, elasticity, scarcity) and explain behaviour on individual, households and firm and Handle economic data and write economic report,
2. Analyse and evaluate the impact of Economic Policies and its implication on the Business Environment,
3. Demonstrate and determine the students towards basic management principles and act as foundation for higher levels of learning and to be able to handle basic functions of management (planning, organizing, coordination, and control).

Detailed Syllabus

Unit	Description	Duration
1	**Introduction** Definition of Economics, Types of Economic Systems, Problem of Scarcity of Economic Resources. **Demand and Supply** Demand Curve and Supply Curve, Equilibrium of Demand and Supply, Shift in Demand and Supply. **Application of Demand and Supply** Price Elasticity of Demand, Price Elasticity of Supply, Factors which influence Elasticity, Elasticity and Revenue.	6

Approved in Academic Council dated 14.02.2020 for Academic year 2022-23

2	**Market Structure /Industry Analysis Types of Competition** Monopoly, Oligopoly, Monopolistic Competition, Perfect and Imperfect Competition, Government Policies towards Industries. Circular Flow of Economy, Structures, Role of Government, Business Cycles. **Macroeconomics** National Income – Gross Domestic Product (GDP), Gross National Product (GNP), Inflation – Cost Push and Demand Pull Inflation, Unemployment, Philips Curve.	6
3	**Functions of Central Bank, Money supply, RBI & Monetary Policy. (Current Credit Policy to be critiqued) Stabilization Policy** Role of Fiscal Policy. Demand and Consumer Behavior: Utility and Marginal Utility. New Economic Policy: Liberalization, Privatization and Globalization	6
4	**Theory of Production** Law of Diminishing Returns, Returns to Scale, Productivity. Analysis of Costs: Types of Costs – Total Cost, Fixed Cost, Variable Cost, Marginal Cost, Impact of Marginal Cost on Average Cost.	6
5	**Introduction to Management** Management & Organizations, Management History. Understanding Management Thought, Contribution of F.W. Taylor, Henry Fayol, Elton – Mayo Contexts- Constraints & Challenges. Planning: Managers as Decision Makers, Foundations of Planning, Strategic Management.	9
6	**Organizing** Line and Staff Relationships, Centralization and Decentralization, Role of Delegation, Managing Human Resources, Managing Teams. Leading and Motivation: Basic Concepts and Practices –Maslow's, Herzberg, McClelland 's Theory of Achievement.	6
7	**Controlling** Introduction to Controlling Inventory, Quality Control. Orientation towards Finance, Marketing, Human Resources and Operation Departments.	6
	Total	**45**

Text Books

1. Samuelson and Nordhaus, *Economics Special Indian Edition*, 20th edition Tata McGraw Hill Publication, 2020
2. Mishra and Puri, *Indian Economy*, 36th Revised Updated Edition, Himalaya Publishing House, 2018

Approved in Academic Council dated 14.02.2020 for Academic year 2022-23

3. Koontz. H. and Weihrich H., *Essentials of Management: An International, Innovation and Leadership Perspective,* 10th reprint Edition, McGraw Hill Education (India), 2018
4. Deviga V. and Karunagaran M., *Principles of Economics*, 3rd Edition, Oxford University Press, 2013

Reference Books

1. Mankiw Gregory, *Economics: Principles and applications*, Cengage Learning, 2011
2. Robbins et al., *Management*, 14th Edition, Pearson India, 2019

Signature
(Head of the Department)

Signature
(Dean)

Approved in Academic Council dated 14.02.2020 for Academic year 2022-23

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Program: B Tech and MBA Tech. (All branches except CSEDS, CSBS and Civil)				**Semester:** I/II	
Course: Digital Manufacturing Laboratory				**Code:** 702MEOC016	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks-50)**	**Term End Examinations (TEE) (Marks -100)**
0	2	0	1	Marks Scaled to 50	-

Pre-requisite: -

Course Objective

The course aims to introduce digital fabrication tools and methods. It familiarizes the students with various principles of 3D printing along with solid modeling, part slicing and fabrication using Fused deposition modelling (FDM) process.

Course Outcomes

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

1. Describe FDM Technology
2. Prepare given model for 3D printing
3. Create products of complex geometries using 3D printer

Detailed Syllabus

Unit	Description	Duration
1	**Introduction to Digital Manufacturing and Technical Design** Overview of 3D printing laboratory equipment, pre-fabricating requirements – printer bed size, hardware and materials required.	**02**
2	**3D Printing Process Steps** 3D printing concepts for converting CAD model into real parts, process steps involved in 3DP, creation of solid model, conversion to STL file, slicing the file or select a STL model from online resources, machine set up, build.	**06**
3	**3D Printing with Fused Deposition Modeling (FDM)** Operating principle and workflow of a Fused Deposition Modeling (FDM) 3D Printing machine, effect of layer thickness, infill density, part orientation and overhang angles on FDM printed parts, study of lithophane.	**10**
4	**Project Involving Ideation, Design and 3D Printing** Briefing of idea, designing of product, solid model creation, final fabrication using 3D printer.	**12**
	Total	**30**

Text Books

1. Noorani, Rafiq, *3D Printing: Technology, Applications, and Selection*, 1st edition, CRC Press, 2017.
2. Filemon Schöffer, Ben Redwood, Brian Garret, *The 3D Printing Handbook: Technologies, design and applications*, 3D Hubs, 2017

Reference Books

1. Chua, C. L., Lim, K., *Rapid Prototyping: Principles and Applications*, 3rd Edition, World Scientific Publishing Co. Pte. Ltd., 2010

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Laboratory Work
6 to 8 laboratory exercises (and a mini project) based on the syllabus.

List of Experiments

1) To design an object using an open source software (Tinkercad).
2) To understand the working of slicing software (Repetier Host)
3) To examine the effect of layer thickness, infill density and orientation on build time and material consumption.
4) To generate code for designed object using Repetier host software for 3D printing.
5) To study the components of a Fused Deposition Modeling (FDM) 3D Printing machine.
6) To prepare FDM machine for printing the given object.
7) To print object using FDM machine.
8) To carry out post processing on the printed object.
9) To evaluate the effect of overhang angles on build quality of polylactic acid (PLA) and Acrylonitrile butadiene styrene (ABS) parts made using FDM.
10) To build parts of same geometry in PLA and ABS and compare the bending strength.
11) To create an object using lithophane technique.
12) Mini project.

Signature
(Head of the Department)

SVKM's NMIMS
Mukesh Patel School of Technology Management & Engineering

Program: B Tech/MBA Tech. (Artificial Intelligence, Computer Engineering, Information Technology) B Tech (Artificial Intelligence and Machine Learning, Artificial Intelligence and Data Science, Mechatronics Engineering, Cyber Security, Electronics & Telecommunication Engineering)	**Semester:** II/III/IV
Course: Python Programming	**Code:** 702AI0C004

Teaching Scheme				Evaluation Scheme	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks - 100)**
0	2	0	1	Marks Scaled to 50	Practical examination Marks Scaled to 50

Pre-requisite: Nil

Course Objective

The course is designed to provide basic knowledge of Python programming and how to design and program Python applications.

Course Outcomes

After completion of the course, the student will be able to -

1. Recognize various data structures and apply them in solving computational problems.
2. Understand and apply different file handling operations
3. Apply core python and object-oriented python concepts to build real world applications.
4. Implement database connectivity in python

Detailed Syllabus

Unit	Description	Duration
1	**Introduction to Python** Installation, Features, Python Interpreter and its working, Syntax and Semantics, comments, imports, indentation, variables, data types, math arithmetic, operators (comparison, logical, bitwise), expressions, print, formatting print, generating random numbers	3
2	**Python Data Structures & Flow Control** Strings, Lists, Dictionaries, Tuples, Sets; Slicing; properties, operations and methods of these data structures Conditional blocks using if, else and elif, Simple For loop, For loop using Ranges, While loops, Loop manipulation using Pass, Continue, Break List and dictionary comprehension, NumPy to create one-dimensional and two-dimensional arrays, Pandas using dataframes.	9

Signature

(Prepared by Concerned Faculty/HOD)

3	**Python Functions** Defining and calling functions, return, scope, function arguments (args and kwargs), recursive functions; Built-in functions: Lambda, Map, Filter, Reduce, Zip, Enumerate	6
4	**File and Exceptional Handling** File I/O read/write operations, open, close, with, seek, tell; manipulating files and directories Exception, Types of errors, handling an exception, try, expect, else, try-finally clause, Argument of an Exception, Raising an Exception	4
5	**Classes and Objects** Class definition, object creation, class variables and methods, accessing class attributes, meaning of self, __init__, inheritance, overriding super class	5
6	**Regular Expression and database connectivity using Python** Regular Expressions, Match function, Search function, Matching vs Searching, Wildcard, Database connectivity using SQLite3	3
	Total	**30**

Text Books:

1. Dr. R. Nageswara Rao, *Core Python Programming*, 2nd Edition, Dreamtech Pres, Wiley Publication, 2018.
2. Paul Barry, *Head first Python: A Brain Friendly guide*, 2nd Edition, O'Reilly publication, 2016.
3. Martin C. Brown, *Python: The Complete Reference*, 4th Edition, McGrawHill Education, 2018.

Reference Books:

1. Bill Lubanovic, *Introducing Python Modern computing in simple packages*, 3rd Edition, O'Reilly publication, 2019.
2. Wes McKinney, *Python for Data Analysis*, 2nd Edition, O'Reilly publication, 2017.
3. Jeeva Jose, P. Sojan Lal, *Introduction to Computing and Problem Solving with Python*, 1st Edition, Khanna Publication, 2019.

Laboratory/ Tutorial Work

8 to 10 experiments / Programming exercises (and a practicum where applicable) based on the syllabus

Signature

(Prepared by Concerned Faculty/HOD)

Program: B Tech/ MBA Tech / B Tech Integrated				**Semester :** I/ II/ III/ IV/ VI	
Course: Environmental Science				**Code:** 702CI0C014	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- ---)**
1	0	1	2	Marks Scaled to 50	--

Pre-requisite: Fundamental Knowledge of physics, chemistry and mathematics

Course Objective

This course aims to understand the multidisciplinary nature of environmental sciences, greenhouse effect and climate change. It also aims to discuss the basics of natural resources, biodiversity, environmental pollution.

Course Outcomes

After completion of the course, the student will be able to -

1. Explain the concept of natural resources, ecosystem and biodiversity
2. Relate the various aspects of environmental pollutions with its cause and effect
3. Explain the greenhouse effect and climate change

Detailed Syllabus

Unit	Description	Duration
1	**Multidisciplinary nature of environmental science** Definition, scope and importance of environmental sciences.	**01**
2	**Natural Resources** Natural resources: Forest resources, Water resources, Mineral resources, Food resources. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.	**02**
3	**Ecosystems** Concept of an ecosystem. Structure and function of an ecosystem. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features of the following ecosystem:- a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems.	**02**
4	**Biodiversity** Definition: genetic, species and ecosystem diversity. Value of biodiversity: consumptive use, productive use. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.	**02**
5	**Environmental Pollution** Definition, Cause and effects for Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards and Solid waste pollution.	**04**
6	**The Science of Climate Change** Greenhouse effect, Global warming, Global environmental changes, Acid rain Ozone layer depletion, Carbon footprint	**04**
	Total	**15**

Text Books

1. Erach Bharucha, *Textbook of Environmental Studies*, 2nd Edition, University Press, 2019.

Reference Books

1. MP Poonia & SC Sharma, *Environmental Studies*, 1st Edition, Khanna Publishing House, 2017.
2. Rajagopalan, *Environmental Studies*, 3rd Edition, Oxford University Press, 2015.

Tutorial Work

8 to 10 Tutorial exercises based on the syllabus.

Signature
(Head of the Department)

SVKM's NMIMS
Mukesh Patel School of Technology Management & Engineering

Program: B Tech/ MBA Tech Data Science				**Semester:** II/III	
Course: Python for Data Analysis				**Code:** 702DB0C011	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks -50)**	**Term End Examinations (TEE) (Marks - 100)**
0	4	0	2	Scaled to 50 marks	Scaled to 50 Marks

Pre-requisite: Programming for problem solving

Course Objective

The aim of the course is to provide students with the knowledge of Creating Data Science Pipeline, Preparing the data, performing exploratory data analysis and apply visualization techniques. It will also educate students on preprocessing various types of information from different sources within the integrated development environment.

Course Outcomes

After completion of the course, the student will be able to -

1. Explain the role of python in data science
2. Apply the python libraries to execute, visualize and analyse data in python ecosystem
3. Analyze raw data and perform wrangling to improve data usability

Detailed Syllabus

Unit	Description	Duration
1	**Overview of Python** Basics of Python and its role in data science, data types, variables, expressions, objects and functions. Python data structures including String, Array, List, Tuple, Set, Dictionary and operations them.	07
2	**Working with Real Data** Accessing Data in Structured Flat-File Form ,Reading from a text file Reading CSV delimited format, Reading Excel and other Microsoft Office files, Sending Data in Unstructured File Form, Managing Data from Relational Databases, Interacting with Data from NoSQL Databases, Accessing Data from the Web.	09
3	**NumPy Basics** Arrays and Vectorized Computation Multidimensional Array Object, Operations between Arrays and Scalars, Basic Indexing and Slicing, Data Processing Using Arrays	07

Mukesh Patel School of Tech. Mgmt. & Engg. SVKM'S NMIMS Mumbai 56

Signature
(Prepared by Concerned Faculty/HOD)

4	**Introduction to Pandas** Essential functionality, arithmetic and data alignment, function application and mapping, Handling Missing Data, Filtering Out Missing Data, Filling in Missing Data, Other pandas Topics	10
5	**Data Loading, Storage, and File Formats** Reading and Writing Data in Text Format, reading Text Files in Pieces, Writing Data Out to Text Format, JSON data, interacting with HTML and Web APIs	07
6	**Data Visualization** Introduction to Matplotlib, Plotting Functions in pandas, Plotting Maps, Python Visualization Tool Ecosystem	03
7	**Data wrangling** Combining and merging data set, Reshaping and pivoting, Group wise operation and data Transformation, Sting Manipulation	06
8	**Time Series** Date and Time Data Types and Tools, Converting between string and datetime, Indexing, Selection, Subsetting, Date Ranges, Frequencies, and Shifting, Period Frequency Conversion, Time Series Plotting	07
9	**Financial and Economic Data Application**	04
	Total	**60**

Text Books

1. Daniel Y. Chen, *Pandas for Everyone: Python Data Analysis*, 1st edition, Pearson Education, 2018
2. Wes Mckinney, *Python for Data Analysis*, 2nd edition, O'Reilly, 2017

Reference Books

1. John Paul Mueller, *Python for Data Science for Dummies*, 1st edition, Wiley, 2015
2. Alex Galea, *Applied Data Science with Python and Jupyter*,1st edition, Packt, 2018

Laboratory/ Tutorial Work

8 to 10 programming exercises (and a practicum) based on the syllabus

Signature
(Prepared by Concerned Faculty/HOD)

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Program: B Tech/ MBA Tech				**Semester:** III/IV/V/VI	
Course : Management Accounting for Engineers				**Code: 702TF0C001**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks - 100)**
2	---	---	2	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: NIL

Course Objective

The course provides a conceptual understanding of various aspects of cost accounting – cost ascertainment, cost analysis, and use information for managerial decision making

Course Outcomes

After completion of the course, the student will be able to -

1. Explain the concepts of Financial and Cost Accounting
2. Build a cost sheet of a product
3. Plan a flexible budget
4. Analyse the various costs and variances in costs
5. Recommend a suitable decision

Detailed Syllabus

Unit	Description	Duration
1	Conceptual framework of Financial Accounting	4
2	Introduction to Cost and Management Accounting	2
3	**Cost** Concepts and Classification	2
4	Material Control	4
5	Single or Output costing	2
6	Marginal Costing and CVP analysis	4
7	Standard Costing and Variance Analysis	4
8	Budgeting	4
9	Activity Based Costing	4
	Total	**30**

Text Book

1. Lal. J., & Srivastava, S, *Cost accounting*, Tata McGraw Hill , 5/e, New Delhi, 2013
2. Ramanathan, S., *Accounting for Management* , latest reprint Oxford University Press, New Delhi, 2014

Approved in Academic Council dated 14.02.2020 for Academic year 2022-23

Reference Books

1. Horngren, C., Datar, S. & Rajan, M , *Cost accounting: A managerial emphasis*, Pearson Publication, 15/e ,New Delhi , 2014
2. Khan, M.Y., & Jain, P.K., *Management Accounting*, Tata Mc- Graw Hill , 7/e ,New Delhi, ,2007

Signature
(Head of the Department)

Signature
(Dean)

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management & Engineering

Program: B Tech/MBA Tech (All branches except CSBS and CSDS)					**Semester:** I / II
Course: Engineering Graphics and Design					**Code**: 702ME0C001
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks-50)**	**Term End Examinations (TEE) (Marks-100)**
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: -

Course Objectives

This course is aimed at providing basic understanding of the fundamentals of Engineering Graphics; mainly visualization, graphics theory, standards & conventions of drawing, the tools of drawing and the use of drawings in engineering applications. The course has been structured to include sufficient simulations which would aid the student in visualization of three-dimensional objects and developing the drawing.

Course Outcomes

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

1. Interpret and communicate drawings effectively using different types of curves, lines, planes
2. Analyze the concepts of projections and section of right regular solids with their development
3. Apply the techniques, skills, and modern tools to create projections of machine components with the help of software

Detailed Syllabus

Unit	**Description**	**Duration**
1.	**Introduction to Engineering Drawing** Principles of engineering graphics and their significance, usage of drawing instruments, lettering, numbering; Conic sections (ellipse, parabola, hyperbola - general method only) including the rectangular hyperbola; cycloid, epi-cycloid, hypo-cycloid and involutes.	04
2.	**Projections of Lines and Planes** Introduction to projections of points, conventions; points locating in all quadrants. **Projections of Lines** Introduction, lines inclined to one plane and parallel to other plane, lines inclined to both planes. **Projections of Planes** Introduction, types of planes, plane surface inclined to both reference planes, projection of auxiliary planes	05
3.	**Projections of Regular Solids** Introduction to projection of regular solids, types of solids; Projections of regular solids (prisms, pyramids, cylinders, cones) covering those inclined to both the reference planes	05

4.	**Section and Development of Regular Solids** Introduction to section and development of regular solids; Section of regular prisms, pyramids, cylinders, cones; Development of surfaces of right regular solids namely prisms, pyramids, cylinders and cones.	04
5.	**Orthographic Projections** Principles of orthographic projections, conventions used in quadrant formation, conversion of isometric models to orthographic views and vice-versa, orthographic views of geometrical solids and objects from industry.	04
6.	**Sectional Orthographic Projections** Principles of sectional orthographic projection, need of sectional views, types of sections, hatching of sectioned part and principles, sectional orthographic views of geometrical solids and objects from industry.	04
7.	**Isometric Projections** Principles of isometric projection-isometric scale, isometric views, conventions; isometric views of lines, planes, simple and compound solids; conversion of orthographic views to isometric models to and vice-versa; isometrics projections of given views.	04
	Total	**30**

Text Books

1. N. D. Bhatt, V. M. Panchal and P. R. Ingle, *Engineering Drawing*, 53rd Edition, Charotar Publishing House, 2014.

Reference Books

1. M. B. Shah and B. C. Rana, *Engineering Drawing*, 2nd Edition, Pearson Education, 2014.
2. K. Venugopal and V. Prabhu Raja, *Engineering Drawing + AutoCAD*, 6th edition, New Age International (P) Ltd. Publishers, 2011.

Laboratory Work

8 to 10 experiments based on the syllabus.

_____

Signature

(Head of the Department)

Program:	B Tech Computer Science and Engineering (Data Science)	**Semester:**	II
Course:	Digital Circuits and Computer Architecture	**Code:**	

Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- 100)**
3	2	0	4	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Basic knowledge of Electronics Engineering

Course Objective

The objectives of offering this course are to provide a brief overview of Boolean Algebra, Combinational Logic, and Sequential Logic; to understanding the fundamental structure and functions of a computer, including the arithmetic and logic units, as well as the implementation of fixed-point and floating-point arithmetic and finally to learn the different ways of communication with I/O devices.

Course Outcomes

After successful completion of this course, students will be able to-

1. Understand number systems and Boolean algebra concepts in Digital Systems.
2. Apply concepts of Combinational and Sequential logic for designing Circuits.
3. Understand the fundamental structure and functioning of a computer, as well as arithmetic operations, and Central Processing Unit.
4. Understand the memory organization and working of I/O

Detailed Syllabus

Unit	Description	Duration
1.	**Boolean Algebra** Binary logic functions, Boolean Laws, Truth tables, Associative and distributive properties, De-Morgan's Theorems.	3
2.	**Combinational Logic and Circuits** Switching equations, Canonical logic forms, Sum of product & Product of sums, Karnaugh maps, Simplification of expressions,Code conversion Design : Decoder, Encoder, Priority encoder, Multiplexers as function generators, Binary Full Adder, Subtractor, BCD adder	7
3.	**Sequential Logic and Circuits** Flip Flops: Clocked and edge triggered flip-flops, SR Flip-Flop, D Flip-Flop, JK Flip-Flop, T Flip-Flop Registers: Serial input -serial output; serial input-parallel output; Parallel In -Parallel Out, Serial In -Serial Out. Design of Asynchronous and Synchronous Counters, Modulo Counters, UP- DOWN counter.	8
4.	**Basic Structure of a Computer System** Functional Units, Basic Operational Concepts, Performance Instructions: Language of the Computer, Operations, Operands Instruction representation, Logical operations, decision making, MIPS Addressing.	3
5.	**Arithmetic for Computers**	3

	Addition and Subtraction, Multiplication Division, Booth Multiplication, Floating Point Representation, Floating Point Operations	
6.	**Central Processing Unit** Major Components of CPU, Instruction Formats, Addressing Modes, Data Transfer and manipulation, Program Control, Subroutine Call and Return, RISC vs CISC, Pros and Cons of RISC and CISC.	6
7.	**Memory Organization**: Internal Memory – Memory characteristics and memory hierarchy, Cache memory: Elements of cache design, Address mapping and translation-Direct mapping, Address mapping and translation-Associative mapping, Address mapping and translation -Set associative mapping, Performance characteristics of two level memory, Semiconductor main memory- Types of RAM, DRAM and SRAM. Semiconductor main memory- Advanced DRAM organizations, Chip logic, Memory module organization. High speed memories- Associative memory, High speed memories-Interleaved memory.	10
8.	**Input and Output Unit**: Input and output- External Devices, Keyboard, Monitor, Disk drive and device driver. I/O modules- Programmed I/O, I/O modules-Interrupt Driven I/O, DMA. I/O modules- I/O channels and I/O processors, Serial transmission and synchronization.	5
	Total	**45**

Text Books

1. M. Morris Mano, *Digital Design with an Introduction to Verilog HDL*, PHI, 5th Edition 2013.
2. William Stallings, *Computer Organization and Architecture: Designing for Performance*, Pearson Education, 10th Edition 2019.

Reference books

1. R P Jain, *Modern Digital Electronics*, McGraw Hill Education, 4th Edition, 2013.
2. B. Holdsworth,*Digital Logic Design* Elsevier Science ,2nd Edition 2014.
3. Andrew Tannenbaum, Todd Austin, *Structured Computer Organization*, 6th Edition, Prentice-Hall,2013.
4. David Harris Sarah Harris, *Digital Design and Computer Architecture*, Second Edition, Elsevier Science, 2012.
5. V. Carl Hamacher and Zaky, *Computer Organization*,5th Edition, Tata Mc-Graw Hill, 2011.

Laboratory Work

8 to 10 experiments based on the syllabus.

Signature

(Head of the Department)