

3 May 2024

**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE
(VJTI)**

MATUNGA, MUMBAI 400 019

(Autonomous Institute affiliated to the University of Mumbai)



Curriculum

(Scheme of Instruction & Evaluation and Course contents)

(Revision 2023)

For

First Year

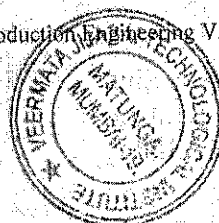
Of

**Four Year Undergraduate Programme Leading to
Bachelor of Technology (B. Tech.) Degree in Production
Engineering**

Implemented from the batch admitted in first year, 2023-24

NEP 2020 Based First year B. Tech Production Engineering V.J.T.I. 2023-2024

Head Production Engg. Deptt.
V.J.T.I., Matunga,
Mumbai - 400 019.



Vision and Mission of the Institute

Vision

To establish global leadership in the field of Technology and develop competent human resources for providing service to society.

Mission

To provide students with comprehensive knowledge of principles of engineering with a multi-disciplinary approach that is challenging

To create an intellectually stimulating environment for research, scholarship, creativity, innovation, and professional activity.

To foster relationships with other leading institutes of learning and research, alumni and industries to contribute to National and International development.

Vision and Mission of the Department

Vision

To develop technically competent and disciplined production engineers with creativity, comprehension and managerial skills to serve as a preferred provider of Manufacturing and Industrial Engineering students and services that satisfy the changing needs of all customer segments.

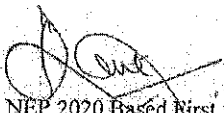
Mission

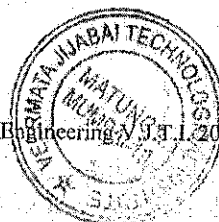
Inculcate and develop the students who will be able to design and manufacture innovative, environmentally friendly, ergonomic and cost-effective quality products and services.

Enhance the technical quality of the students to fulfil the challenges, competitions and opportunities in Production/ Industrial Engineering.

Prepare the students to solve community-related engineering problems and other complex problems by means of inculcating technical managerial skills.

Strive continuously to pursue excellence in all the areas of Manufacturing/ Industrial and enhance the department-industry/research centre interaction by means of training, internship and student projects to solve industrial problems.


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Programme Educational Objectives (PEO)

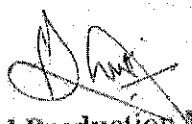
- To prepare the Graduates with a sound foundation in the mathematical, scientific and engineering fundamentals and equip them with modern tools so as to analyze, formulate, and solve real-life manufacturing and industrial engineering problems.
- To prepare graduates to become product and process design professionals for sustainable manufacturing.
- To prepare the graduates for a successful career in Indian and Multinational organizations and to excel in their Postgraduate studies.
- To encourage and motivate graduates in the art of self-learning.
- To inculcate a professional and ethical attitude, good leadership qualities, and commitment to social responsibilities in the graduates' thought process.

Programme Outcomes (PO)

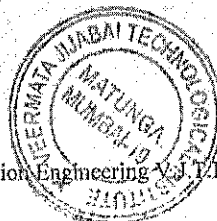
- Graduates will demonstrate basic knowledge in mathematics, science, and engineering.
- Graduates will demonstrate the ability to design and conduct experiments, interpret and analyze data, and report results.
- Graduates will demonstrate the ability to improve a production process or system that meets desired specifications and requirements.
- Graduates will demonstrate the ability to develop manufacturing-friendly products and software packages by working with multidisciplinary teams and applying the knowledge gained during engineering and science laboratory classes.
- Graduates will demonstrate the ability to identify, formulate and solve manufacturing-related problems.
- Graduates will demonstrate an understanding of their professional and ethical responsibilities.
- Graduates will be able to demonstrate effective oral and written communication.
- Graduates will have the confidence to apply engineering solutions in global and societal contexts.
- Graduates will be capable of self-education and clearly understand the value of lifelong learning.
- Graduates will be broadly educated and will have an understanding of the impact of engineering on society and demonstrate awareness of contemporary issues.
- Graduates will be familiar with modern engineering software tools and equipment to analyze manufacturing-related problems.

Programme Specific Outcomes (PSO):

- Identify, formulate, and analyze complex engineering problems to solve real-life problems in the areas of mechanical design, tool design, advanced manufacturing methods, quality assurance, and industrial Engineering.
- Graduates would provide middle-level managerial leadership-based study and practice of industrial management imparted during the program while working in design and manufacturing industries.
- To employ modern industrial engineering/ management techniques to improve the value of the product by improving the quality and reducing the cost of manufacturing.


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Credit Framework for UG Programme in Production Engineering

(Level 4.5- UG Certificate) -Semester - I

Sr.	Course Type	Course Code	Course Name	L	T	P	Hr	Cr	Examination Weightage in %			Ownership
									TA	MST	ESE	
1	BSC	R5PH1011T	Engineering Physics I	2	1	0	3	3	20	30	50	Physics
2	BSC	R5PH1011L	Engineering Physics I – Lab	0	0	2	2	1	ISCE :60		40	Physics
3	BSC	R5MA1002T	Applied Mathematics-I	2	1	0	3	3	20	30	50	Mathematics
4	ESC	R5ME1001T	Engineering Graphics	2	0	0	2	2	20	30	50	Mechanical
5	ESC	R5ME1001L	Engineering Graphics Lab	0	0	2	2	1	20	30	50	Mechanical
6	ESC	R5PE1021T	Basic Manufacturing Technology	3	0	0	3	3	ISCE: 60		40	Production
7	ESC	R5EE1022T	Basic Electrical Engineering	3	0	0	3	3	20	30	50	Electrical
8	ESC	R5EE1022L	Basic Electrical Engineering-Lab	0	0	2	2	1	ISCE :60		40	Electrical
9	VSEC	R5PE1024L	Design Thinking and Idea Lab	0	0	3	3	1.5	ISCE :60		40	Production
10	AEC	R5HS1001L	Professional Communication Skill	1	0	2	3	2	20	30	50	Humanities
11	CC1	R5PE1025L	Co-Curricular Course	0	0	3	3	1.5	ISCE:100			Production
			Total	13	2	14	29	22				


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Credit Framework for UG Programme in Production Engineering

(Level 4.5- UG Certificate) -Semester - II

Sr.	Course Type	Course Code	Course Name	L	T	P	Hr	Cr	Examination Weightage in %			Ownership
									TA	MST	ESE	
1	BSC	R5CH1012T	Engineering Chemistry	2	1	0	3	3	20	30	50	Chemistry
2	BSC	R5CH1012L	Engineering Chemistry Lab	0	0	2	2	1	ISCE :60		40	Chemistry
3	BSC	R5MA1012T	Applied Mathematics-II	2	1	0	3	3	20	30	50	Mathematics
4	ESC	R5PE1026T	Engineering Materials and Applications	2	0	0	2	2	20	30	50	Production
5	ESC	R5SE1002T	Engineering Mechanics	2	0	0	2	2	20	30	50	Structural
6	ESC	R5SE1002L	Engineering Mechanics Lab	0	0	2	2	1	ISCE 60		40	Structural
7	ESC	R5CO1002T	Programming for Problem-Solving	2	0	0	2	2	20	30	50	Computer & IT
8	ESC	R5CO1002L	Programming for Problem-Solving	0	0	2	2	1	ISCE :60		40	Computer & IT
9	PCC	R5PE1027T	Automated Manufacturing	2	0	0	2	2	20	30	50	Production
10	VSEC	R5PE1028L	Workshop Practice	0	0	3	3	1.5	ISCE :100			Production
11	IKS	R5PE1029L	Indian Knowledge System (IKS)	2	0	0	2	2	20	30	50	Production
12	CC	R5PE1030L	CC	0	0	3	3	1.5	ISCE 100			Production
			Total	14	2	12	28	22				


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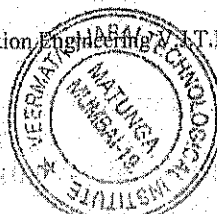
SEMESTER I

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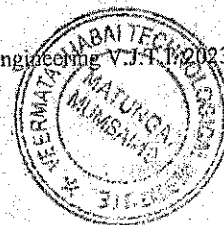
SEMESTER-I		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOUR
1	R5PH1011T	ENGINEERING PHYSICS	2-1-0	3	20	20	60	3
Course outcomes: Upon the completion of this course, the learner will be able to 1. Apply knowledge of waves, and optical devices in metrology applications. 2. Characterise Laser and apply the same to measurement, communication, and manufacturing. 3. Relate the basics of electrodynamics to engineering applications to drives, controls, satellite communications, antenna theory, etc. 4. Specify the use of the appropriate sensor for a given application 5. Comprehend nanotechnology – materials, characteristic properties, applications, modern developments, and its role in emerging innovating applications. 6. Compare the properties of new engineering materials for their current and futuristic frontier applications.								
Syllabus								
1.	Wave optics and Diffraction Huygens' principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer, Mach-Zehnder interferometer. Fraunhofer diffraction from a single slit and a circular aperture, resolving power of a grating; Applications of the diffraction grating the Rayleigh criterion for the limit of resolution and its vision application; Diffraction gratings and their resolving power.							
2.	Waves and Fiber Optics Oscillatory motion – forced and damped oscillations: differential equation and its solution – plane progressive waves–wave equation. Lasers: population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – different types of lasers: gas lasers (He-Ne, CO₂), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering, and medicine. Semiconductor lasers: homojunction and heterojunction. Fiber optics: principle, numerical aperture, and acceptance angle - types of optical fibers (material,							

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	refractive index, mode) – losses associated with optical fibers - fiber optic sensors: pressure and displacement.
3	Electrodynamics and Electromagnetic Waves Gauss's law for electrostatics, Gauss's law for magnetostatics, Faraday's Law and Ampere's circuital law; Maxwell's equations. The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; the relation between electric and magnetic fields of an electromagnetic wave; energy carried by electromagnetic waves and examples. Momentum carried by electromagnetic waves and resultant pressure. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.
4.	Physics of Sensors Resistive sensors: a) Temperature measurement: PT100 construction, calibration, b) Humidity measurement using resistive sensors, Pressure sensor: Concept of pressure sensing by capacitive, flex, and inductive method, Analog pressure sensor: construction working and calibration and applications. Piezoelectric transducers: Concept of piezoelectricity, use of piezoelectric transducers as the ultrasonic generator, and application of ultrasonic transducer for distance measurement, liquid, and air velocity measurement. Optical sensor: Photodiode, construction, and use of photodiode as ambient light measurement and flux measurement. Pyroelectric sensors: Construction and working principle, application of pyroelectric sensor as a bolometer.
5.	Nanotechnology Nanomaterials: Introduction, Fullerenes, Carbon nanotubes, Nanowires. Properties (Optical, electrical, magnetic, structural, mechanical). Surface to volume ratio. Two main approaches in nanotechnology -The bottom-up technique and the Top-down technique. Applications of nanomaterials - Catalysis, Electronics & Telecommunication, Medicines, and Energy Sciences. Tools for characterization of Nanoparticles: Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Atomic Force Microscope (AFM). Methods to synthesize Nanomaterials: Ball milling, Sputtering, Vapour deposition, Solgel
6	New Engineering materials Liquid crystals: Nematic, Smectic, and cholesteric phases, Liquid crystal display. Multiferroics: Type I & Type II multiferroics and applications, Magnetoresistive Oxides: Magnetoresistance,



	GMR and CMR materials, introduction to spintronics.
7.	Ultrasonics Generation of sound waves, construction and working principle, types of ultrasound generators, Ultrasound transmission modes, Ultrasound imaging, and instrumentation;
	Text Books
1.	Bhattacharya D.K. and Poonam T: Engineering Physics, Oxford University Press
2.	Gaur, R.K. and Gupta S.L: Engineering Physics, Dhanpat Rai Publishers
3.	Pandey, B.K. and Chaturvedi S: Engineering Physics, Cengage Learning India
	References
1	Bhattacharya and Nag: Engineering Physics, Khanna Book Publishing Co. P Ltd.
2	T. Pradeep: NANO -The Essentials: Understanding Nanoscience and Nanotechnology, McGraw Hill Education.
3	Jacob Fraden: Handbook of Modern Sensors Physics design and application, Springer
4	David Griffiths: Introduction to Electrodynamics, Cambridge University Press.
5.	Arther Beiser: Concepts of Modern Physics, Tata McGraw Hill
6	Francis Jenkins and Harvey White: Fundamentals of Optics, McGraw Hill International Edition.
7	K. Thyagarajan, A. K. Ghatak: LASERS Theory and Applications, Macmillan India Ltd.
8	Resnick Halliday and Krane: Physics (Volume I & II), Willey India

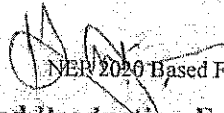
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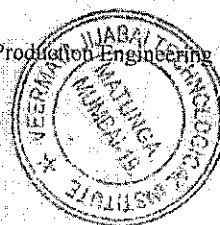
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SEMESTER-I		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOUR
1	R5PH1011L	ENGINEERING PHYSICS LAB	0-0-2	1	ICSE 60		40	2
Objectives 1. To improve the knowledge about the theory learned in the class. 2. Provide Hands-on experience with basic optical instruments 3. To improve the ability to analyze experimental results and write laboratory reports. Course outcomes: On the completion of this course, the learner will able to 1. Demonstrate proficiency in making measurements using the spectrometer/interferometer. 2. Make measurements of wavelength 3. Analyze interference pattern 4. Determine the radius of curvature of a lens using Newton's Rings. 5. Perform simulation to study new engineering materials and nanotechnology 6. Determine the velocity of ultrasound in a liquid medium and use ultrasonics for flaw detection.								
Syllabus 1. Any eight experiments from the following 1. Wavelength and energy measurement of spectral lines using the spectrometer. 2. Determination of width of a slit using single slit diffraction experiment (LASER source) 3. Determination of the radius of curvature of a lens using Newton's ring setup 4. Determination of wavelength using a Diffraction grating (Hg/Na source/LASER Source) 5. Determination of the number of lines on the grating surface using LASER Source. 6. Determination of Numerical Aperture of an optical fibre. 7. Study of divergence of the laser beam 8. Study different types of sensor characteristics- Resistive sensors, piezoelectric, optical, pyroelectric 9. Flaw detection using Ultrasonic. 10. Ultrasonic Interferometer to determine the velocity of ultrasound in a liquid medium. 11. Simulation study of orientational ordering in Nematic-like 2D liquid crystal. 12. Simulation experiments based on nanotechnology using open-source simulation software like Avogadro, Chimera, JMOL, etc.								

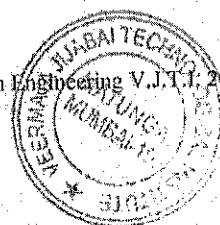

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SEMESTER-I		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOUR
1	R5MA1002T	Applied Mathematics -I	2-1-0	3	20	20	60	3
Course Objectives: The goal of this course is to achieve conceptual understanding and retain the best traditions of traditional calculus. The syllabus is designed to provide the basic calculus tools mainly for modeling engineering problems mathematically and obtaining solutions. This is a foundation course that mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics, and computer science, among other disciplines. Course outcomes: The objective of this course is to familiarize prospective engineers with techniques in calculus, multivariate differentiation, and integration. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well in tackling the more advanced levels of mathematics and applications that they would find useful in their disciplines. 1. Characterize a linear system in terms of number of solutions, whether it is consistent or not. 2. Compute eigenvalues and eigenvectors of a square Matrix and determine if it diagonalizable 3. Calculate functional value of some point in a neighborhood using Taylor's series expansion and find the limit of a function at a point or at infinity using L'Hospital's rule. 4. Determine if an infinite series is convergent or not using suitable test. 5. Be familiar with the theorems of differentiability such as mean value theorem and interpret it geometrically. 6. Evaluate partial derivatives and implement/ apply it to find minima and maxima of a multivariate function. Also Find directional derivatives and gradient and illustrate geometric meaning with the help of sketches. 7. Apply definite integration to evaluate surface areas and volumes of revolution and evaluate improper integrals. 8. Evaluate multiple integrals for regions in a plane and find volume, area bounded by the curves, mass, center of gravity of solid geometric figures.								

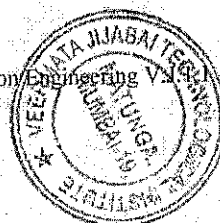
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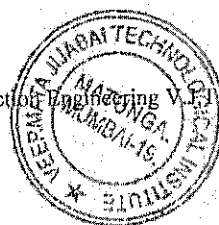


	9. Characterize complex variables in terms of analyticity, find harmonic conjugates and study geometric properties of conformal mappings.
	Syllabus
1.	Linear Algebra: (8 hours) Rank of a matrix, System of linear equations- check for consistency, Eigenvalues & eigenvectors of a matrix, Diagonalization, Cayley-Hamilton theorem, Minimal polynomial, Finding Inverse and Powers of a matrix.
2.	Differential Calculus: (10 hours) Mean value theorem, Rolle's theorem, Indeterminate form, L'Hospital's rule, Taylor's theorem and Truncation error, Partial Derivatives, Chain rule, Total Derivative, Differentiation of an implicit function, Directional Derivative, Gradient, maxima, minima and saddle points of a multivariable function, Lagrange's multipliers method, tangent plane and normal line, Convergence of sequence and series, Tests for convergence -ratio test, root test, p-series test, comparison test, alternating series test, absolute convergence test.
3.	Integral Calculus: (10 hours) Evaluation of definite integration to find surface areas and volumes of revolution, Introduction to Improper Integrals and Gamma functions and its properties, Multiple integrals, change of order of integration in double integrals, Change of variables (Cartesian to polar), Triple integrals (Cartesian, cylindrical and spherical co-ordinates). Applications: areas and volumes, Center of mass and Gravity (constant and variable densities);
4.	Complex Variables: Differentiation Complex Functions- Limits, Continuity and differentiability, Analytic functions, Cauchy Riemann equations, Harmonic conjugates, Conformal mappings, Linear fractional transformations and their properties..
5.	Multivariable Calculus (Integration): (10 hours) Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, spheres, and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Gradient, curl, and divergence, Theorems of Green, Gauss, and Stokes.
	Text Books
1.	Reena Garg: Mathematics -I (Calculus & Linear Algebra), Khanna Publishing

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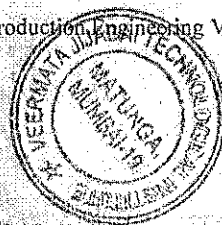
2.	G V Kumbhojkar: Applied Mathematics-I, II and III, Jamnadas and Co
	References
1	B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers
2	Ramana B.V: Higher Engineering Mathematics, Tata McGraw Hill, New Delhi
3	Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons,
4	N.P. Bali and Manish Goyal: A Textbook of Engineering Mathematics, Laxmi Publications.
5	P N Wartikar and J N Wartikar: A Textbook of Applied Mathematics, Vol I and II, Pune Vidyarthi Griha Prakashan Pune



SEMESTER-I		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOUR
1	R5ME1001T	Engineering Graphics	2-0-0	2	20	20	60	2
COURSE OBJECTIVE(S): The objective of this Course is to provide basic knowledge about Engineering Drawing. Detailed concepts are given in projections, technical drawing, dimensioning, and specifications, so useful for a student in preparing for an engineering career. Course Outcomes: All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural, and industrial) in which the skills of CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer-designed CAD laboratory using engineering software. On the completion of this course, the learner will able to: 1. To prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability 2. To prepare you to communicate effectively 3. To prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice.								
Course contents: Traditional Engineering Graphics: Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; Intersection, Shortest Distance. Computer Graphics: Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM). (Except for the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)								

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8.	Annotations, layering, and other functions Covering applying dimensions to objects, applying annotations to drawings; Setting up and use of layers to create drawings, Creating, editing, and using customized layers; Changing line lengths through modifying existing lines (extending/lengthening); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning, and scale multi-views of dwelling
9	Demonstration of a simple team design project that illustrates Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to the ceiling; Introduction to Building Information Modelling (BIM).
	Text Books
1.	Pradeep Jain, A.P. Gautam, and Ankita Maheshwari: Engineering Graphics and Design, Khanna Book Publishing
2.	M.B. Shah and B.C. Rana: Engineering Drawing, Pearson Education India.
3.	N. H. Dubey: Engineering Drawing, Nandu Publishers & Printers
	References
1.	Narayana K.L. and P Kannaiah: Textbook on Engineering Drawing, Scitech Publishers.
2.	N.D. Bhatt and V.M. Panchal: Engineering Drawing, Charotar Publishing.
3.	CAD Software Theory and User Manuals

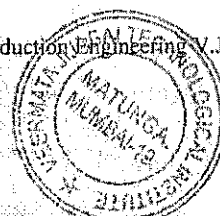
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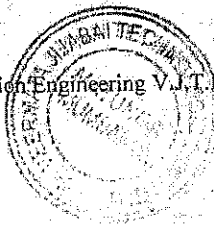


SEMESTER-I		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOUR
1	R5ME1001L	Engineering Graphics Lab	0-0-2	1	ICSE: 60		40	1
COURSE OBJECTIVE(S): The objective of this Course is to provide basic knowledge about Engineering Drawing. Detailed concepts are given in projections, technical drawing, dimensioning, and specifications, so useful for a student in preparing for an engineering career. Course Outcomes: All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural, and industrial) in which the skills of CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer-designed CAD laboratory using engineering software. On the completion of this course, the learner will able to: 1. Draft various Geometrical Elements used in Engineering Practice using CAD software. 2. Draft projections of various objects and their representation and dimensioning using CAD software. 3. Visualize any object through Isometric Projections and interpret drawings of engineering parts and objects.								
Course contents:								
Syllabus								
Computer screen, layout of the software, standard tool bar/menus and description of most commonly used tools bars, navigational tools. Co-ordinate system and reference planes. Definitions of HP, VP. Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of co-ordinate points, lines, axes, polylines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, offset, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning, line conventions material conventions and lettering Minimum 10 Exercises based on above mentioned topics with minimum two problems in each Exercise.								

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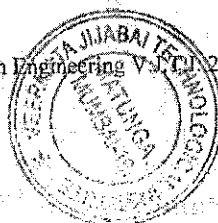
Text Books	
1.	Pradeep Jain, A.P. Gautam, and Ankita Maheshwari: Engineering Graphics and Design, Khanna Book Publishing
2.	M.B. Shah and B.C. Rana: Engineering Drawing, Pearson Education India.
3.	N. H. Dubey: Engineering Drawing, Nandu Publishers & Printers
References	
1.	Narayana K.L. and P Kannaiah: Textbook on Engineering Drawing, Scitech Publishers.
2.	N.D. Bhatt and V.M. Panchal: Engineering Drawing, Charotar Publishing.
3.	CAD Software Theory and User Manuals



SEMESTER-I		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOURS
1	R5PE1021T	Basic Manufacturing Technology	3-0-0	3	20	20	60	3
Objectives: 1. To familiarize machine tools and basic manufacturing processes like casting, machining, forming, welding, shaping of plastics, powder metallurgy, etc. 2. Grasp the capabilities and limitations of the manufacturing process 3. To impart the fundamentals of modern manufacturing processes – Additive manufacturing, micromachining, and nanotechnology. 4. Acquaint with the processing of Integrated Circuits Course outcomes: On the completion of this course, the learner will able to 1. Comprehend the basic principles and concepts that govern the manufacturing processes, including material properties, manufacturing methods, and production systems. 2. Identify various manufacturing techniques with products based on their unique characteristics, potential benefits and limitations. 3. Aware of machine tools and pieces of equipment – structure, functions, capabilities and limitations. 4. Comprehend processes of AM, applications and role in modern manufacturing. 5. Appreciate processes of MEMS, roles and applications 6. Appreciate nanotechnology, properties of nanomaterials and applications.								
Syllabus								
NOTE: The course is intended to provide an overview of modern manufacturing processes so the student will understand the underlying principles, capabilities, and limitations of these processes and be able to relate them with products seen in the real world. Details and analysis are NOT necessary at this stage.								
1.	Definition and importance. Classification of processes. Metal Casting – principle and overview of casting technology, melting and Pouring, Solidification, and Cooling. Capabilities and limitations. Sand casting, die casting. Metal Forming- Bulk-forming (Rolling, Extrusion, forging, drawing) and sheet metal forming (cutting, bending, forming, coining). Hot and cold working.							

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	Metal cutting – Basic Machine tools – structure, functions, capabilities and limitations. cutting operations turning, milling, drilling, shaping grinding. Cutting tool materials and cutting parameters. Machining time calculations. Capabilities and limitations. Welding – Arc, Resistance, and Oxygas welding. Types of joints and types of welds. Welding electrodes and arc welding equipment.
2.	Powder Metallurgy Characterization of Engineering Powders, Production of Metallic Powders, Blending/mixing, compaction, and Sintering, secondary operations. Applications of PM.
3.	Shaping Processes for Plastics Properties of Polymer Melts. Extrusion - process, equipment, die configurations, and extruded products. Injection Moulding. Blow molding.
4.	Rapid Prototyping and Additive Manufacturing (AM) Fundamentals of AM. Starting material and typical process. Liquid polymer- stereolithography. Powders-3D printing, Molten material- fused deposition modeling, Solid sheets - laminated object manufacturing. Applications of AM.
5.	Processing of Integrated Circuits IC and overview of IC processing - production of electronic grade silicon, crystal growing, wafer shaping, optical lithography, IC packaging (Only general description) Electronics Assembly and Packaging -Electronics Packaging and Hierarchy, PCB.
6.	Microfabrication Technologies Types of Microsystem Devices. Microsystem types – Microsensors, Microactuators, Microstructures and micro components, Microsystems, and Micro-instruments. Applications - Ink-Jet Printing Heads, Thin-Film Magnetic Heads, Compact Discs, Automotive, Medical.
7.	Nanofabrication Technologies Nanotechnology Products and Applications. classification of products and applications. Nanofabrication Processes.
	Text Books
1.	Mikell Groover; Fundamentals of Modern Manufacturing, PHI.
2.	P.N. Rao: Manufacturing Technology Vol. I and II, Tata McGraw Hill.
3.	Hajra Choudhury: Workshop Technology: Vol. I and II, Media Promoters and Publishers.

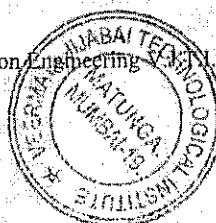
	Metal cutting – Basic Machine tools – structure, functions, capabilities and limitations. cutting operations turning, milling, drilling, shaping grinding. Cutting tool materials and cutting parameters. Machining time calculations. Capabilities and limitations. Welding – Arc, Resistance, and Oxygas welding. Types of joints and types of welds. Welding electrodes and arc welding equipment.
2.	Powder Metallurgy Characterization of Engineering Powders, Production of Metallic Powders, Blending/mixing, compaction, and Sintering, secondary operations. Applications of PM.
3.	Shaping Processes for Plastics Properties of Polymer Melts. Extrusion - process, equipment, die configurations, and extruded products. Injection Moulding. Blow molding.
4.	Rapid Prototyping and Additive Manufacturing (AM) Fundamentals of AM. Starting material and typical process. Liquid polymer- stereolithography, Powders-3D printing, Molten material- fused deposition modeling, Solid sheets - laminated object manufacturing. Applications of AM.
5.	Processing of Integrated Circuits IC and overview of IC processing - production of electronic grade silicon, crystal growing, wafer shaping, optical lithography, IC packaging (Only general description) Electronics Assembly and Packaging -Electronics Packaging and Hierarchy, PCB.
6.	Microfabrication Technologies Types of Microsystem Devices, Microsystem types – Microsensors, Microactuators, Microstructures and micro components, Microsystems, and Micro-instruments. Applications - Ink-Jet Printing Heads, Thin-Film Magnetic Heads, Compact Discs, Automotive, Medical.
7.	Nanofabrication Technologies Nanotechnology Products and Applications. classification of products and applications. Nanofabrication Processes.
	Text Books
1.	Mikell Groover: Fundamentals of Modern Manufacturing, PHI.
2.	P.N. Rao: Manufacturing Technology Vol. I and II, Tata McGraw Hill.
3.	Hajra Choudhury: Workshop Technology: Vol. I and II, Media Promoters and Publishers.



References	
1.	Amitabh Ghosh and Asok Mullick: Manufacturing Science, East West Affiliate (EWA)
2.	Serope Kalpakjian and Steven Schmid: Manufacturing, Engineering, and Technology, Pearson Education
3.	DeGarmo, Black, and Koshner: Materials and Process in Manufacturing, John Wiley & Sons Inc.
4.	R.K. Jain: Production Technology, Khanna Publication.
5.	Gerling: All About Machine Tools, TMH.

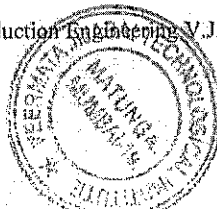
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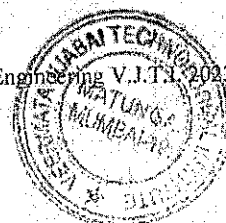


SEMESTER-I		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOURS
1	RSEE1022T	Basic Electrical Engineering	3-0-0	3	20	20	60	3
Course Objective: The objective of this Course is to provide the students with an introductory and broad treatment of the field of Electrical Engineering. Course outcomes: On the completion of this course, the learner will able to 1. Apply knowledge of DC circuits for analysing network theorems. 2. Analyse single-phase and three-phase AC circuits 3. Apply DC machine characteristics to practical applications 4. Understand working principles, characteristics, limitations and applications of commonly used electrical machinery such as electric motors, and transformers. 5. Comprehend the working principles, characteristics and applications of switch gears, batteries and lamps.								
Syllabus								
1.	DC Current D. C. Circuits covering, Ohm's Law and Kirchhoff's Laws; Analysis of series, parallel and series-parallel circuits excited by independent voltage sources; Power and energy; Electromagnetism covering, Faradays Laws, Lenz's Law, Fleming's Rules, Statically, and dynamically induced EMF; Concepts of self-inductance, mutual inductance and coefficient of coupling; Energy stored in magnetic fields;							
2.	AC Current Single Phase A.C. Circuits covering, Generation of sinusoidal voltage- definition of average value, root mean square value, form factor and peak factor of sinusoidal voltage and current and 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, series, parallel and series-parallel circuits; Three Phase A.C. Circuits covering, Necessity and Advantages of three-phase systems, Generation of three-phase power, the definition of Phase sequence, balanced supply and balanced load; Relationship between line and phase values of balanced star and delta connections; Power in balanced three-phase circuits, measurement of power by two-wattmeter method;							


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3.	Transformers Transformers covering, Principle of operation, and construction of single phase transformers (core and shell types). EMF equation, losses, efficiency and voltage regulation; Synchronous Generators covering, Principle of operation; Types and constructional features; EMF equation;
4.	DC Machines DC Machines cover, working principle of DC machine as a generator and a motor; Types and constructional features; EMF equation of generator, the relation between EMF induced and terminal voltage enumerating the brush drop and drop due to armature reaction; DC motor working principle; Back EMF and its significance, torque equation; Types of D.C. motors, characteristics and applications; Necessity of a starter for DC motor;
5.	Three-Phase Induction Motors Three Phase Induction Motors covering; Concept of rotating magnetic field; Principle of operation, types and constructional features; Slip and its significance; Applications of squirrel cage and slip ring motors; Necessity of a starter, star-delta starter.
6.	Switchgear, Batteries and Lamps Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup. Lamps- fluorescent, CFL, LED. Electrical measuring instruments principle and applications- energy meter, megger, tong tester.
	Text Books
1.	Ritu Sahdev: Basic Electrical Engineering, Khanna Book Publishing
2.	Mittel and Mittal: Basic Electrical Engineering, Tata McGraw Hill.
3.	Nagrath I.J. and D. P. Kothari: Basic Electrical Engineering, Tata McGraw Hill.
	References
1.	B.L. Theraja: A Textbook of Electrical Technology Vol-I and II, S. Chand Publishing
2.	Kulshreshtha D.C: Basic Electrical Engineering, Tata McGraw Hill.
3.	Rajendra Prasad: Fundamentals of Electrical Engineering, Prentice Hall
4.	Edward Hughes: Electrical and Electronic Technology, Pearson Education

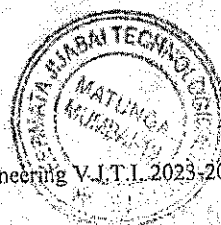


SEMESTER-I		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOURS
1	R5EE1023L	Basic Electrical Engineering Lab	0-0-2	1	ISCE 60		40	2
Course Objective: 1. To impart the basic concept of network analysis and its application. 2. To provide the basic concept of ac circuits analysis and its application. 3. To illustrate the operation of machines and transformer. Course outcomes: On the completion of this course, the learner will able to 1. Interpret and analyse the behaviour of DC circuits using network theorems. 2. Perform and infer experiment on single phase AC circuits. 3. Demonstrate experiment on three phase AC circuits. 4. Understand the basic characteristics of transformers and electrical machines								
Syllabus								
1.	Suggested List of laboratory experiments (Minimum Eight): A minimum two experiments from each course outcome shall be covered 1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors. 2. To measure output voltage across load resistor/current through load resistor and verify the result using Mesh and Nodal analysis. 3. Verification of Superposition Theorem. 4. Verification of Kirchhoff's laws for a given circuit 5. Verification of Thevenin's Theorem. 6. Verification Norton's Theorem. 7. Verification Maximum Power Transfer Theorem. 8. To find the resistance and inductance of a coil connected in series with a pure resistance using three voltmeter method. 9. To find the resistance and inductance of a coil connected in parallel with a pure resistance using three ammeter method. 10. To find resonance conditions in a R-L-C series resonance circuit 11. To find resonance conditions in a R-L-C parallel resonance circuit.							

	12. To measure relationship between phase and line, currents and voltages in three phase system (star & delta) 13. To measure Power and phase in three phase system by two wattmeter method. 14. To find the equivalent circuit parameters by conducting OC and SC test on single phase transformer 15. To demonstrate cut-out sections of DC machine. 16. To demonstrate cut-out sections of single phase transformer.
	Text Books
1.	Ritu Sahdev: Basic Electrical Engineering, Khanna Book Publishing
2.	Mittel and Mittal: Basic Electrical Engineering, Tata McGraw Hill.
3.	Nagrath I.J. and D. P. Kothari: Basic Electrical Engineering, Tata McGraw Hill.
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3.	Rajendra Prasad: Fundamentals of Electrical Engineering, Prentice Hall
4.	Edward Hughes: Electrical and Electronic Technology, Pearson Education


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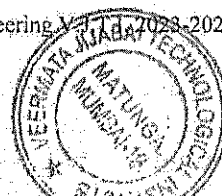
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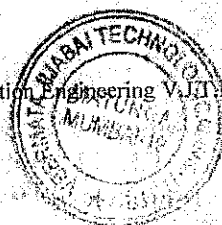
SEMESTER-I		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOURS
1	R5PE1024L	Design Thinking and Idea Lab	0-0-3	1.5	ISCE 60		40	3
Course Objective The objective of this course is to provide new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing innovative products which useful for a student preparing for an engineering career. Course outcomes: On the completion of this course, the learner will able to 1. Compare and classify the various learning styles and memory techniques and Apply them in their engineering education 2. Analyze emotional experience and Inspect emotional expressions to better understand users while designing innovative products 3. Develop new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products 5. Propose real-time innovative engineering product designs and Choose appropriate frameworks, strategies, and techniques during prototype development 4. Perceive individual differences and their impact on everyday decisions and further Create a better customer experience.								
Syllabus								
1.	Learning and Remembering Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting. Understanding the Memory process, Problems in retention, Memory enhancement techniques							
2.	Emotions: Experience & Expression Understanding Emotions: Experience & Expression, Assessing Empathy, Application with Peers							
4.	Basics of Design Thinking Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) – Empathize, Define, Ideate, Prototype, Test							
4.	Being Ingenious & Fixing Problem							

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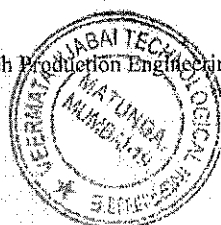


	Understanding Creative thinking process, and Problem-Solving, Testing Creative Problem Solving
5.	Process of Product Design and prototype Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design, Examples of best product designs and functions, Assignment – Engineering Product Design, Meaning of prototype, Rapid Prototype Development process, Testing, Sample Example, Test Group Marketing
6	Celebrating the Difference Understanding Individual differences & Uniqueness, Group Discussion and Activities to encourage the understanding, acceptance and appreciation of Individual differences
7.	Design Thinking & Customer Centricity Practical Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product Design
8.	Feedback, Re-Design & Re-Create Feedback loop, Focus on User Experience, Address “ergonomic challenges, User focused design, rapid prototyping & testing, final product, Final Presentation – “Solving Practical Engineering Problem through Innovative Product Design & Creative Solution”.
	Text Books
1.	E Balaguruswamy (2022), Developing Thinking Skills (The Way to Success), Khanna Book Publishing Company.
	References
1.	
2.	



SEMESTER-I		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOURS
1	R5HS1001L	Professional Communication Skills	1-0-2	2	ISCE100			3
Objectives 1. To demonstrate the fundamental concepts of interpersonal and professional communication. 2. To encourage active listening with a focus on content, purpose, ideas and tone. 3. To facilitate fluent speaking skills in social, academic and professional situations. 4. To train in reading strategies for comprehending academic and business correspondence. 5. To promote effective writing skills in business, technology and academic arenas 6. To inculcate confident personality traits along with grooming and social etiquette. Course outcomes: On the completion of this course, the learner will able to 1. Apply the principles and practices of business communication for communicating in a professional environment. 2. Design a technical document with the correctness of language, appropriate vocabulary and style. 3. Display competence in oral and visual communication. 4. Demonstrate capabilities for self-assessment and development.								
Syllabus								
1.	Basics of Business Communication a) Concept and meaning of communication b) Verbal and non-verbal communication c) barriers to the process of communication d) Channels of communication e) Role of communication in the age of information technology							
2.	Technical Writing a) Technical writing process b) Style and organization in technical writing c) objectivity, clarity, precision as defining features of technical communication d) d. Language and format of various types of business letters, reports; proposals, e-mails, minutes of meeting, research papers							
3.	Self-Development and Assessment							


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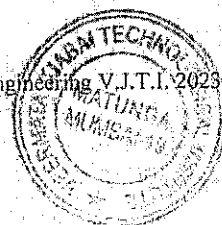


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	a) Time Management b) Perception & Attitude c) Personal Goal Setting d) Emotional Intelligence e) Team work f) Creativity
4.	Spoken Communication a) Group Discussion b) Presentation c) Interviews d) None verbal Communication e) Using Visual Aids
5.	Personality Development and Social Etiquettes 6.1. Personality Development a) Introducing Self and/or a Classmate b) Formal Dress Code 6.2. Social and Business Etiquettes a) • Formal Dining Etiquettes b) • Cubicle Etiquettes c) • Responsibility in Using Social Media d) • Showing Empathy and Respect e) • Learning Accountability and Accepting Criticism f) • Demonstrating Flexibility and Cooperation g) • Selecting Effective Communication Channels 6.3 Interview Etiquettes
	Text Books
1.	Ashraf Rizvi: Effective Technical Communication, Tata McGraw Hill.
2.	Meenakshi Raman and Sangeeta Sharma: Technical Communication, Cambridge University Press.
3.	Hory Shankar Mukharjee: Business Communication, Oxford University Press.
	References
1.	E.H. McGrath: Basic Managerial Skills for All, , PHI Learning Pvt Ltd.
2.	R. Subramanian: Professional Ethics, Oxford University Press.
3.	Barun K. Mitra: Personality Development and Soft Skills, Oxford University Press
4.	https://learnenglish.britishcouncil.org/en/english-grammar

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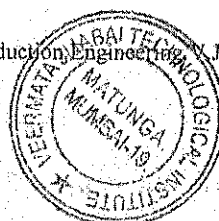
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SEMESTER-I		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOURS
11	R5PE1025L	Sports and Yoga	0-0-3	3	ICSE: 100			3
Course outcomes: On the completion of this course, the learner will able to								
1. To make the students understand the importance of sound health and fitness principles as they relate to better health. 2. To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health, and fitness. 3. To create a safe, progressive, methodical, and efficient activity-based plan to enhance improvement and minimize the risk of injury. 4. To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health.								
Syllabus								
1.	Introduction to Physical Education Physical Education – Meaning, Aims & Objectives, Changing Trends. Olympic Movement - Ancient & Modern Olympics (Summer & Winter), Olympic Symbols, Ideals, Objectives & Values							
2.	Physical Fitness, Wellness & Lifestyle Meaning & Importance of Physical Fitness & Wellness. Components of Physical fitness, Components of Health-related fitness. Components of wellness.Preventing Health Threats through Lifestyle Change. Concept of Positive Lifestyle							
3.	Fundamentals of Anatomy & Physiology in Physical Education, Sports and Yoga Anatomy, Physiology & Its Importance. Effect of exercise on the functioning of Various Body Systems. (Circulatory System, Respiratory System, Neuro-Muscular System etc.) Meaning & Importance of Kinesiology & Biomechanics in Physical Edu. & Sports							
4.	Postures Meaning and Concept of Postures. Causes of Bad Posture. Advantages & disadvantages of weight training. Concept & advantages of Correct Posture. Common Postural Deformities – Knock Knee; Flat Foot; Round Shoulders; Lordosis, Kyphosis, Bow Legs and Scoliosis.							

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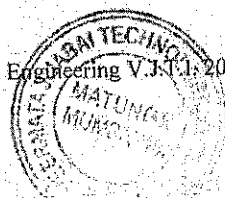
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	Corrective Measures for Postural Deformities
5.	Yoga Yoga -Meaning & Importance, Elements, Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas, Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana & Shashankasana). Relaxation Techniques for improving concentration - Yog-nidra
6.	Yoga & Lifestyle Asanas as preventive measures. Hypertension: Tadasana, Vajrasana, Pavanuktasana, Ardha Chakrasana, Bhujangasana, Shavasana. Obesity: Procedure, Benefits & Contraindications for Vajrasana, Hastasana, Trikonasana, Ardha Matsyendrasana. Back Pain: Tadasana, Ardha Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana. Diabetes: Procedure, Benefits & Contraindications for Bhujangasana, Paschimottasana, Pavanuktasana, Ardha Matsyendrasana. Asthma: Procedure, Benefits & Contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.
7.	Training and Planning in Sports Meaning of Training. Warming up and limbering down. Skill, Technique & Style. Meaning and Objectives of Planning. Tournament – Knock-Out, League/Round Robin & Combination
8.	Psychology & Sports Definition & Importance of Psychology in Physical Edu. & Sports. Define & Differentiate Between Growth & Development. Adolescent Problems & Their Management. Emotion: Concept, Type & Controlling of Emotions. Meaning, Concept & Types of Aggressions in Sports. o Psychological benefits of exercise. Anxiety & Fear and its effects on Sports Performance. Motivation, its type & techniques. o Understanding Stress & Coping Strategies.
9.	Sports Medicine and doping First Aid. Sports injuries: Classification, Causes & Prevention. Management of Injuries: Soft Tissue Injuries and Bone & Joint Injuries Doping- Meaning and Concept of Doping, Prohibited Substances & Methods, Side Effects of Prohibited Substances
10.	Sports / Games based project

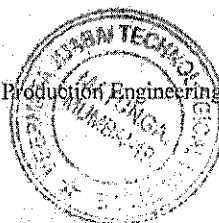
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	Following subtopics related to any one Game/Sport of choice of the student out of: Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball, Yoga etc. • History of the Game/Sport. • Latest General Rules of the Game/Sport. • Specifications of Play Fields and Related Sports Equipment. • Important Tournaments and Venues. • Sports Personalities. • Proper Sports Gear and its Importance
	Text Books/ References
1.	Ajmer Singh: Modern Trends and Physical Education
2.	Health and Physical Education – NCERT (IX and X Classes)
3.	B.K.S. Iyengar: Light On Yoga.

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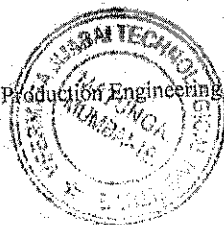


	Corrective Measures for Postural Deformities
5.	Yoga Yoga -Meaning & Importance, Elements, Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas. Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana & Shashankasana). Relaxation Techniques for improving concentration - Yog-nidra
6.	Yoga & Lifestyle Asanas as preventive measures. Hypertension: Tadasana, Vajrasana, Pawanuktasana, Ardha Chakrasana, Bhujangasana, Shavasana. Obesity: Procedure, Benefits & Contraindications for Vajrasana, Hastasana, Trikonasana, Ardha Matsyendrasana. Back Pain: Tadasana, Ardha Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana. Diabetes: Procedure, Benefits & Contraindications for Bhujangasana, Paschimottasana, Pawanuktasana, Ardha Matsyendrasana. Asthma: Procedure, Benefits & Contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.
7.	Training and Planning in Sports Meaning of Training. Warming up and limbering down. Skill, Technique & Style. Meaning and Objectives of Planning. Tournament – Knock-Out, League/Round Robin & Combination
8.	Psychology & Sports Definition & Importance of Psychology in Physical Edu. & Sports. Define & Differentiate Between Growth & Development. Adolescent Problems & Their Management. Emotion: Concept, Type & Controlling of Emotions. Meaning, Concept & Types of Aggressions in Sports. o Psychological benefits of exercise. Anxiety & Fear and its effects on Sports Performance. Motivation, its type & techniques. o Understanding Stress & Coping Strategies.
9.	Sports Medicine and doping First Aid. Sports injuries: Classification, Causes & Prevention. Management of Injuries: Soft Tissue Injuries and Bone & Joint Injuries Doping- Meaning and Concept of Doping, Prohibited Substances & Methods, Side Effects of Prohibited Substances
10.	Sports / Games based project



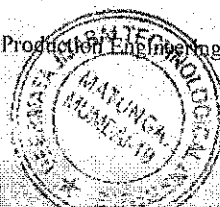
	Following subtopics related to any one Game/Sport of choice of the student out of: Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball, Yoga etc. • History of the Game/Sport. • Latest General Rules of the Game/Sport. • Specifications of Play Fields and Related Sports Equipment. • Important Tournaments and Venues. • Sports Personalities. • Proper Sports Gear and its Importance
	Text Books/ References
1.	Ajmer Singh: Modern Trends and Physical Education
2.	Health and Physical Education – NCERT (IX and X Classes)
3.	B.K.S. Iyengar: Light On Yoga.


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SEMESTER II

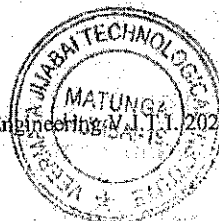
SEMESTER-II		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOURS
1	R5CH1012T	Engineering Chemistry	2-1-0	3	20	20	60	3
Course outcomes: On the completion of this course, the learner will able to 1. Illustrate the concept of emission spectroscopy and describe the phenomena of fluorescence and phosphorescence in relation to it. 2. Explain the concept of electrode potential and Nernst's theory and relate it to electrochemical cells. 3. determining the quality of fuel, calorific value and quantifying the oxygen required for combustion and manufacture of solid, liquid and gaseous fuels. 4. Identify different types of corrosion and suggest control measures in industries. 5. Demonstrate knowledge of polymers, fabrication methods, and conducting polymers in various industrial fields. 6. Illustrate the principles of green chemistry and study environmental impact. 7. Determine a lubricant for a given application.								
Syllabus								
1.	Spectroscopy: Introduction: Principle of spectroscopy, Classification of spectroscopy – atomic and molecular, selection rules. Table of the relation between electromagnetic spectrum, types of spectroscopy, and energy changes. Emission spectroscopy- Principle, Instrumentation, and Applications (Flame Photometry). Introduction to fluorescence and phosphorescence, Jablonski diagram, application of fluorescence in medicine only.							
2.	Electrochemistry Introduction, the concept of electrode potential, Nernst equation, types of electrochemical cells, the concept of standard electrode with examples, electrochemical series, simple numerical.							
3.	Fuels and Combustion Definition, classification, characteristics of a good fuel, units of heat. Calorific value- Definition, Gross or Higher calorific value & Net or lower calorific value, Dulong's formula & numerical for calculations of Gross and Net calorific values. Solid fuels- Analysis of coal- Proximate and Ultimate Analysis- numerical problems and							



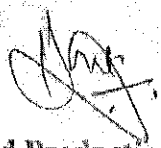
	significance. Liquid fuels- Petrol- Knocking, Octane number, Cetane number, Antiknocking agents, unleaded petrol, oxygenates (MTBE), catalytic converter. Combustion- Calculations for the requirement of only oxygen and air (by weight and by volume only) for given solid & gaseous fuels.
4.	Corrosion Direct chemical corrosion, Electrochemical corrosion, and its reaction mechanisms, Types of electrochemical corrosion, (differential aeration, galvanic, concentration cell), Electrochemical corrosion like Pitting, Inter granular, Soil, and Waterline. Factors affecting corrosion, Protection of corrosion, Applications with few practical problems of corrosion.
5.	Lubricants Types of lubricants, Mechanism of lubrication, Physical and Chemical properties of lubricants, additives lubricants, Selection of lubricants
6.	Polymers and Composites Introduction: Definition- Polymer, polymerization, Properties of Polymers, Molecular weight (Number average and Weight average), Numerical problems on molecular weight, the effect of heat on polymers (glass transition temperature), Viscoelasticity, Conducting Polymers, Classification- Thermoplastic, and Thermosetting polymers; Compounding of plastic, Fabrication of plastic by Compression, Injection, Transfer and Extrusion moulding, Preparation, properties, and uses of PMMA and Kevlar Composites: Basics of composites, Composition and Characteristic properties of composites. Types of Composites: Particle, Fiber, Reinforced, Structural, applications
7.	Green Chemistry and Synthesis of Drugs Introduction – Definition, significance Twelve Principles of Green chemistry, numerical on atom economy. Conventional and green synthesis of Adipic acid, Indigo, Carbaryl, Ibuprofen, Benzimidazole, Benzyl alcohol, % atom economy, and their numerical. Green fuel- Biodiesel.
	Text Books
1.	S. S. Dara and S. S. Umare :A Textbook of Engineering Chemistry, S. Chand & Company
2.	P. C. Jain and Monika Jain : Engineering Chemistry, Dhanpat Rai & Co.
3.	C.V. Agarwal and C.P. Murthy: Engineering Chemistry, BS Publications
	References

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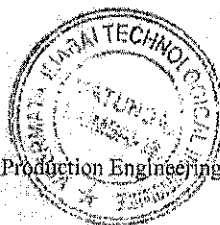
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1.	V.K.Ahluwalia : Green Chemistry: A textbook, Alpha Science International
2.	Shashi Chawla: A Text Book of Engineering Chemistry , Dhanpat Rai & Co.
3.	S. Vairam, P. Kalyani and Suba Ramesh: Engineering Chemistry, Wiley India
4.	Shikha Agarwal:Engineering Chemistry - Fundamentals and Applications, Cambridge University Press.



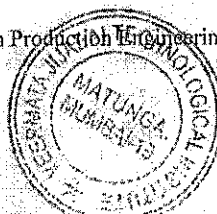
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SEMESTER-II		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOURS
1	R5CH1012L	Engineering Chemistry Lab	0-0-2	1	ISCE 60		40	2
Course outcomes: On the completion of this course, the learner will able to 1. Determine moisture and ash content of coal 2. Analyze flue gas 3. Determine saponification and acid value of oil 4. Determine flash point of a lubricating oil 5. Synthesize a drug and a biofuel. 6. Determine na/k and emf of cu-zn system								
Syllabus								
1.	<i>Any eight experiment</i> 1. Determination of Moisture and ash content of coal. 2. Determination of the percentage of Nitrogen in the given coal sample. 3. Flue gas analysis using Orsat's apparatus. 4. Saponification value of oil 5. Acid value of oil 6. Determination of toxic elements by Flame photometry 7. Determination of Na/K by Flame photometry. 8. Preparation of Biodiesel from edible oil. 9. To estimate the emf of Cu-Zn system by Potentiometry. 10. Synthesis of Aspirin. 11. Determination of Flash point of a lubricant using Abel's apparatus 12. Determine the concentration of a solution by Spectrophotometric method 13. 12. To estimateNickel in the alloy steel sample.							
References								
1.	Lab. Manual for Engineering Chemistry - Dr.S.K.Basin&Dr. S.K. Rani, Dhanapat Rai Publishing Company							
2.	Practical Manual for Chemistry of Engineering Materials - D.D. Shah, Nandu Publication, Mumbai							

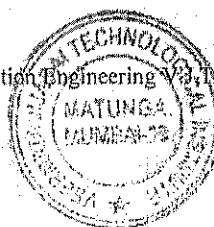

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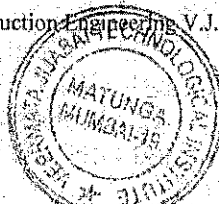
3.	Post Graduate Practical Chemistry - H.N. Patel, S.P. Turakhia, S.S. Kelkar, S.R. Puniyani, Himalaya Publishing House
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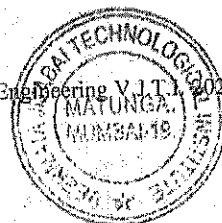
SEMESTER-II		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOURS
	R5MA1012T	Applied Mathematics-II	2-1-0	3	20	20	60	3
Course outcomes: On the completion of this course, the learner will able to 1. Solve first order Differential equations using different techniques. 2. Find the complete solution of a differential equation with constant coefficients in terms of complementary function and particular integral. 3. Study complex power series, classify singularities of a function, evaluate line integrals and apply residue theorem to evaluate real integrals. 4. Develop better understanding of scalar and vector fields and apply gradient to solve problems involving normal vectors to level surfaces. 5. Apply the integral theorems such as Stoke's theorem, Green's theorem and Gauss divergence theorem to evaluate line, surface and volume integrals and give physical interpretation of curl and divergence of a vector field. 6. Apply techniques of Separation of variables to solve PDEs such as wave equations, heat equations and Laplace equation.								
Syllabus								
2.	Ordinary Differential Equations: First order equations (linear and nonlinear); Bernoulli's equations, higher order linear differential equations with constant coefficients, Complementary functions and Particular integrals by operator method, method of variation of parameters, Method of Undetermined coefficients, Euler-Cauchy equation; initial and boundary value problems.							
3.	Partial Differential Equation: Classification of second order linear PDEs, Method of Separation of variables, Solutions of one-dimensional Heat equation, First and second order wave equation, Two- dimensional Laplace equation.							
4.	Complex Variable – Differentiation: (8 hours): Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.							



5.	Complex Variable – Integration: (8 hours): Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.
	Text Books
1.	Reena Garg: Engineering Mathematics, Khanna Book Publishing Company
2.	G V Kumbhojkar: Applied Mathematics-I, II and III, Jamnadas and Co
	References
1.	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers
2.	Ramana B.V.: Higher Engineering Mathematics, Tata McGraw Hill New Delhi
3.	Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 2006.
4.	N.P. Bali and Manish Goyal: A textbook of Engineering Mathematics, Laxmi Publications.
5.	P N Wartikar & J N Wartikar: A Textbook of Applied Mathematics Vol I and II, Pune Vidyarthi Griha Prakashan Pune

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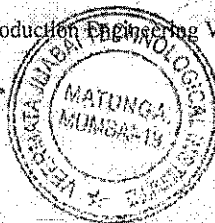
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SEMESTER-II		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOURS
1	R5PE1026T	Engineering Materials and Applications	2-0-0	2	20	20	60	2
Course outcomes: On the completion of this course, the learner will able to 1. Demonstrate different types of engineering materials and their applications 2. Correlate the internal structure of materials and their mechanical properties 3. quantify the mechanical integrity of materials and their failure criteria 4. Interpret of equilibrium phase diagrams of alloys 5. use heat treatment methods to tailor the properties of Fe-C alloys.								
Syllabus								
1.	Engineering Materials and Classification Metals, plastics, ceramics and composites; Relevant properties (physical, mechanical, thermal, electrical, chemical), cost; Range of applications; Material designation and standards; Ashby diagrams; Selection criteria and process							
2.	Mechanical Properties and Testing Tensile, compression, torsion, fatigue, fracture and wear tests; Young's modulus; Relations between true and engineering stress-strain curves; Generalized Hooke's law; Yielding and yield strength; ductility, resilience, toughness and elastic recovery; Hardness measurement their relation to strength; SN curve, endurance and fatigue limits; Introduction to non-destructive testing (NDT).							
3.	Metal and Alloys Iron and steel; Stainless steel and tool steels; Copper & its alloys – brass, bronze & cupro-nickel; Aluminium & Al-Cu-Mg alloys; Nickel based superalloys & Titanium alloys; Phase diagrams and interpretation of microstructure; Iron Iron-carbide phase diagram and cooling (TTT) diagrams.							
4.	Heat Treatment Heat treatment of Steel; Annealing, tempering, normalizing, spheroidising, austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening							
5.	Polymers, Ceramics and Composites:							

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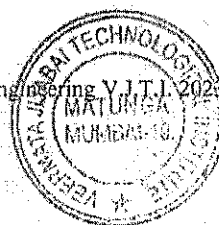
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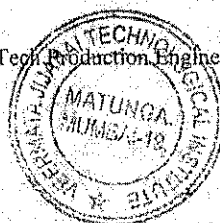
	Polymers – Classification and applications; Polymerization techniques; Ceramics – Oxide ceramics, ceramic insulators, bio-ceramics and Glasses; Composites –Reinforcement, matrix, metal matrix composites, ceramic composites, polymer composites; Other advanced materials – biomaterials, optical materials, high temperature materials, energy materials, and nanomaterials
6	Electrical and Magnetic Materials Conducting and resisting materials – types, properties and applications; Semiconducting materials – properties and applications; Magnetic materials – Soft and hard magnetic materials and applications; Superconductors and dielectric materials – properties and applications; Smart materials; Sensors and actuators; Piezoelectric, magnetostrictive and electrostrictive materials.
	Text Books
1.	William Callister: Materials Science and Engineering, Wiley India (P) Ltd
2.	V. Kodgire: Material Science & Metallurgy, Everest Publication House-Pune.
	References
1.	K. G. Budinski and M.K. Budinski: Engineering Materials”, PHI India
2.	V. Raghvan; Physical Metallurgy, PHI, New Delhi.
3.	V. Raghvan: Introduction to Material Science, PHI, New Delhi.
4.	Sidney Avner: Introduction to Physical Metallurgy, Tata-McGraw Hill.
5.	U. C. Jindal: Material Science and Metallurgy, Pearson India

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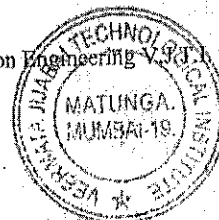
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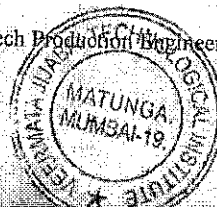
SEMESTER-II		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOURS
	R5SE1002T	Engineering Mechanics	2-0-0	2	20	20	60	2
Course outcomes: On the completion of this course, the learner will able to 1. Illustrate the concept of force, moment and apply the same along with the concept of equilibrium in two and three dimensional systems with the help of FBD. 2. Demonstrate the understanding of Centroid and its significance and locate the same. 3. Correlate real life application to specific type of friction and estimate required force to overcome friction. 4. Establish relation between velocity and acceleration of a particle and analyze the motion by plotting the relation 5. Illustrate different types of motions and establish Kinematic relations for a rigid body 6. Analyze particles in motion using force and acceleration, work-energy and impulse momentum principles.								
Syllabus								
1.	1.1 System of Coplanar Forces: Classification of force systems, Principle of transmissibility, composition and resolution of forces. 1.2 Resultant: Resultant of coplanar and Non-Coplanar (Space Force) force system (Concurrent forces, parallel forces and non-concurrent Non-parallel system of forces). Moment of force about a point, Couples, Varignon's Theorem. Force couple system. Distributed Forces in plane.							
2.	Centroid and moment of inertia (MI) Center of gravity and centroid. Use of axis of symmetry. Centroid of simple figures from the first principle and of composite sections. MI and polar MI. Radius of Gyration. MI from the first principles, of standard sections and composite sections.							
3.	3.1 Equilibrium of System of Coplanar Forces: Conditions of equilibrium for concurrent forces, parallel forces, and nonconcurrent non-parallel general forces and Couples. Equilibrium of rigid bodies free body diagrams.							



	3.2 Equilibrium of Beams: Types of beams, simple and compound beams, type of supports and reaction: Determination of reactions at supports for various types of loads on beams. (Excluding problems on internal hinges)
4.	Friction: Revision of Static Friction, Dynamic/ Kinetic Friction, Coefficient of Friction, Angle of Friction, Laws of Friction. Concept of Cone of friction. Equilibrium of bodies on an inclined plane. Application to problems involving wedges and ladders.
5.	Kinematics of Particle: The motion of particles with variable acceleration. General curvilinear motion. Tangential & Normal component of acceleration, Motion curves (a-t, v-t, s-t curves). Application of concepts of projectile motion and related numerical.
6.	Kinematics of Rigid Body: Translation, Rotation and General Plane motion of Rigid body. The concept of Instantaneous center of rotation (ICR) for the velocity. Location of ICR for 2 link mechanism. Velocity analysis of rigid body using ICR
7.	7.1 Kinetics of a Particle: Force and Acceleration: -Introduction to basic concepts, D'Alemberts Principle, concept of Inertia force, Equations of dynamic equilibrium, Newton's second law of motion. (Analysis limited to simple systems only.) 7.2 Kinetics of a Particle: Work and Energy: Work Energy principle for a particle in motion. Application of Work – Energy principle to a system consists of connected masses and Springs. 7.3 Kinetics of a Particle: Impulse and 7.3 Momentum: Principle of linear impulse and momentum. Impact and collision: Law of conservation of momentum, Coefficient of Restitution. Direct Central Impact and Oblique Central Impact. Loss of Kinetic Energy in the collision of inelastic bodies.
8.	Shear Force (SF) and Bending Moment (BM) Diagrams SF and BM. Sign Conventions. Relationship between load intensity, SF and BM. SF diagram (SFD) and BM diagram (BMD). SFD and BMD for few standard cases. Short cut procedures.
9.	Vibrations Types of vibrations, Definitions, Simple Harmonic Motion (S.H.M.), Work done by harmonic force, Principle of superposition applied to SHM, Beats, Fourier theorem and problems.



	Undamped (Single Degree of Freedom) Free Vibrations – Derivations for spring-mass systems, Methods of Analysis, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and Problems.
	Text Books
1.	R. C. Hibbeler: Engineering Mechanics- Statics and Dynamics, Pearson India
2.	Beer and Johnston: Engineering Mechanics, Tata McGraw Hill
3.	Bhavikatti S.S. and Rajashekarappa K.G: Engineering Mechanics, New Age International (P) Limited publishers
	References
1.	K. L. Kumar and Veenu Kumar: Engineering Mechanics, Tata McGraw-Hill
2.	A K Tayal: Engineering Mechanics, Umesh Publication
3.	F. L. Singer: Engineering Mechanics,
4.	Engineering Mechanics by Shaum Series
5.	Engineering Mechanics (Statics) by Meriam and Kraige, WileyBools
6.	Engineering Mechanics (Dynamics) by Meriam and Kraige, WileyBools

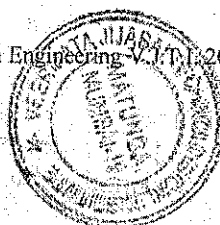


SEMESTER-II		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOURS
	R5SE1002L	Engineering Mechanics Lab	0-0-2	1	ISCE 60		40	2
Course outcomes: On the completion of this course, the learner will able to 1. Perform experiments to verify the laws of static equilibrium including friction. 2. Perform experiments to find out the unknown forces in plane and space trusses. 3. Perform experiments to compute the frequency of vibration of dynamic SDOFs. 4. Perform experiments to understand the applications of laws of kinematics and dynamics equilibrium.								
Syllabus								
Any eight experiments based on the following topics: 1. Bell Crank Lever 2. Simple Beam 3. Simple Jib Crane 4. Link Chain 5. Screw Jack (Friction) 6. Shear Leg Apparatus 7. 'g' by falling weight method 8. Plane motion of bodies 9. M.I. of fly wheel 10. Compound pendulum 11. Torsional pendulum 12. Principle of conservation of energy (connected bodies with flywheel) 13. Stiffness of spring								

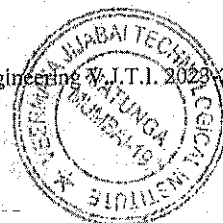
SEMESTER-II		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOURS
1	R5CO1002T	Programming for Problem-Solving	2-0-0	2	20	20	60	2
Course outcomes: On the completion of this course, the learner will able to 1. Develop algorithmic solutions to simple computational problems 2. Read, write, and execute by hand simple programs. 3. Structure simple programs for solving problems. 4. Decompose a program into functions. 5. Represent compound data using lists, tuples, and dictionaries. 6. Read and write data from/to files in Programs								
Syllabus								
1.	Algorithmic Problem Solving Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, and simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.							
2.	Data, Expressions, Statements Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.							
3.	Control Flow, Functions Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search							
4.	Data Structure (Lists, Tuples, Dictionaries) Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods;							

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	advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram
5.	Files, Modules, Packages Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.
	Text Books
1.	E. Balagurusamy: Problem-Solving and Python Programming
2.	Ashok Kamthane and Amit Kamthane: Programming and Problem Solving with Python Tata Mcgraw Hill
	References
1.	Stormy Attaway: Matlab: A Practical Introduction to Programming and Problem-Solving, Butterworth-Heinemann



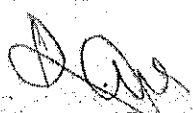
SEMESTER-II		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOURS
1	R5CO1002L	Programming for Problem-Solving Lab	0-0-2	1	ISCE 60		40	1
Course outcomes: On the completion of this course, the learner will able to 1. Develop algorithmic solutions to simple computational problems 2. Read, write, and execute by hand simple programs. 3. Structure simple programs for solving problems. 4. Decompose a program into functions. 5. Represent compound data using lists, tuples, and dictionaries. 6. Read and write data from/to files in Programs								
Syllabus Program List 1. A. Write a C++ program to calculate total and percentage of marks, also decide grade of student depending on the percentage using nested if B. Write a C++ program for menu driven calculator using switch case Statement 2. A. Write a C++ program to find Maximum and minimum element from array. B. Write a C++ program for multiplication of nXn mat 3. Write a C++ Program to reverse string and check whether it is palindrome or not. 4. A. Write a C++ program to swap numbers using call by value and call by reference. B. Write a C++ program to calculate factorial of number using recursive function 5. Write a C++ program to create class Student and display the information of n number of student using array of objects. 6. Write a C++ program to explain concept of constructor and destructor 7. A. Write a C++ program to study concept of function B. Write a C++ program to adding 2 complex numbers using an overloaded operator. 8. Write a C++ program to study multilevel inheritance and implement following hierarchy								
Text Books 1. E. Balagurusamy: Problem-Solving and Python Programming 2. Ashok Kamthane and Amit Kamthane: Programming and Problem Solving with Python Tata								

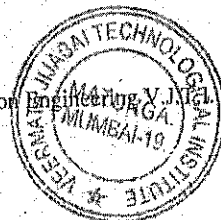
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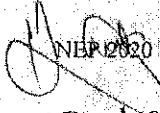


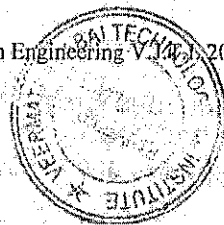
	Mcgraw Hill
	References
1.	Stormy Attaway: Matlab: A Practical Introduction to Programming and Problem-Solving, Butterworth-Heinemann


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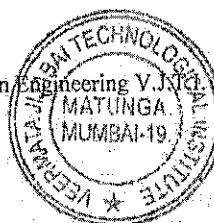
SEMESTER-II		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOURS
1	R5PE1027T	Automated Manufacturing	2-0-0	1	20	20	60	2
Course outcomes: On the completion of this course, the learner will able to 1. Display critical knowledge of structure, functions, capabilities and limitations of machine tools 2. Determine cutting parameters for key machining operations 3. Make simple calculation particularly of machining time, indexing for key machining operations 4. Explain the key components, processes, and technologies involved in automated manufacturing. 5. Outline programming steps for manufacturing simple parts. 6. Understand the basic terminology, anatomy and movements of a robot and their applications								
Syllabus								
1.	Machining Processes and Machine Tools Kinds of Motions in Machine Tool Operations. Basic Machine Tools and Operations							
2.	Lathe Machines Lathe – construction, accessories, operations. Thread cutting – single and multi-start threading, Different tools. Single point cutting tool nomenclature. Lathe machine types and their difference. Capstan and turret lathe, Machining time (Numerical). Shaper- Operations, Machines, Construction, working of quick return mechanism.							
3.	Drilling, Boring, and Broaching Fundamentals of the drilling process, twist drill geometry, tool holders. Types of drilling machines. Drilling operations, Types of drills, Deep hole drilling (fundamentals only). Reaming process, types, and geometry Boring operation & Boring machine. Machining time (Numerical) Broaching Machine: Broaching process, circular broach nomenclature and types of broaches, Advantages, and Limitations.							
4.	Milling							


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	Milling Machines, Fundamentals of the milling process, Cutters – types and geometry, Operations performed on milling machines, Dividing head, methods of indexing, Gear train calculations for helical and cam milling.
5.	Grinding and finishing processes Grinding and Finishing Processes Grinding: process, machine types, and operations, grinding wheels- composition, specification, balancing, truing, dressing, and shaping. Finishing processes: Reaming, Honing, Lapping, burnishing, polishing, buffing.
6.	Automation Automation- Fundamentals, Components, Types, Hardware (Sensors, Actuators, Interface Devices, Process Controllers). Single spindle automat and programming. Computer Numerical Control Machines – Technology, positioning system, rudimentary part programming, NC Part Programming, Applications of Numerical Control. CNC turning centers, Machining centers- horizontal spindle, vertical spindle, universal, three-axis, Characteristics and capabilities of machining centers. Working principles and applications only. Industrial Robotics- Robot Anatomy,
	Text Books
1.	Mikell Groover: Fundamentals of Modern Manufacturing, PHI.
2.	Hajra Choudhury: Workshop Technology: Machine Tools (Vol. II), Media Promoters and Publishers.
3.	P.N. Rao: Manufacturing Technology Vol. 2, Tata McGraw Hill.
	References
1.	Juneja and Sekhon: Fundamentals Of Metal Cutting And Machine Tools, New Age International
2.	Sharma P.C: A Text Book of Production Technology, S. Chand and Company
3.	Ghosh and Mulick: Manufacturing Science, East West Affiliate.
4.	Serope Kalpakjian and Steven Schmid: Manufacturing, Engineering, and Technology.
5.	Chapman: Workshop Technology Part 1, 2 and 3, Taylor & Francis.
6.	DeGarmo, Black, and Kosher: Materials and Process in Manufacturing, John Wiley & Sons Inc.
7.	R.K. Jain: Production Technology, Khanna Publication
8.	HMT Bangalore: Production Technology, McGraw Hill Education


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SEMESTER-II		B. Tech. (Production Engineering)						
SN	COURSE CODE	COURSE TITLE	L-T-P	CREDIT	TA	MST	ESE	CREDIT HOURS
1	R5PE1029T	Indian Knowledge System (IKS)	2-0-0	2	20	20	60	2

Course Objectives

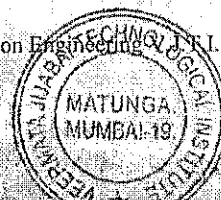
1. To provide students with a comprehensive understanding of the foundations and principles of the Indian knowledge system
2. Understanding Indian Sciences and Traditional Knowledge
3. Tracing the Evolution of Indian Art and Literature:
4. Appreciating Cultural Diversity and Regional Tradition
5. Examining the Integration of Spirituality and Daily Life
6. By the end of the Indian Knowledge System course, students should have gained a holistic perspective on the rich heritage of Indian knowledge, its historical significance, and its potential contributions to addressing contemporary challenges.

Course outcomes

On the completion of this course, the learner will be able to equip students with a well-rounded understanding of the Indian knowledge system, encouraging them to appreciate its historical significance and relevance in contemporary times while fostering critical thinking, cultural awareness, and ethical values.

1. Demonstrate a comprehensive understanding of the foundational texts and scriptures of Indian knowledge.
2. Comprehend the integration of spirituality and religious practices in daily life, recognizing their impact on personal and societal well-being.
3. Appreciate the contributions of ancient Indian scholars to fields like mathematics, astronomy, medicine, architecture, and music, recognizing their significance in shaping the world's knowledge.
4. Develop an appreciation for the diverse regional traditions and cultural practices within India, recognizing the country's unity amidst its cultural diversity.
5. Able to identify and discuss the contemporary relevance of Indian knowledge, examining how traditional wisdom can address modern challenges and contribute to global discussions.
6. Demonstrate an understanding of the ethical values embedded in Indian knowledge systems and apply them to real-world scenarios and decision-making processes.
7. Recognize the interconnectedness of Indian knowledge with other civilizations and cultures, promoting cross-cultural understanding and empathy.

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	Syllabus
1.	Indian Knowledge System (IKS) – An Introduction IKS -Meaning. Need. Organization. salient aspects Indian Knowledge System: An Overview. Why are ancient Indian science and technology relevant today? What is science? How is it different from technology? Philosophy of ancient Indian technology, how is different from modern technology? Ancient Indian Scientific methods. Glimpses of ancient Indian science and technology? Philosophical Systems Wisdom through the Ages
2.	Number System, Units of Measurements and Mathematics Number systems in India - Historical evidence, Salient aspects of Indian Mathematics, Measurements for time, distance, and weight, and the Binary system Indian Mathematics -Introduction and Unique Aspects. Indian Mathematicians and their Contributions. Algebra. Geometry. Trigonometry. Binary mathematics and combinatorial problems. Magic squares in India
3.	Engineering and Technology: Metals, Metalworking, and other applications Wootz Steel: The rise and fall of great Indian technology. The Indian S&T heritage. Mining and ore extraction. Metals and metalworking technology. Iron and steel in India. The lost wax casting of idols and artifacts. Apparatuses used for extraction of metallic components. Other applications- Irrigation systems and practices in South India; Dyes, and painting technology. Shipbuilding
	Text Books
1.	B. Mahadevan, Nagendra Pavana, Vinayak Rajat Bhat: Introduction to Indian Knowledge System: Concepts and Applications, PHI Learning.
	References
1.	Kapoor Kapil, Singh Avadhesh (2021): Indian Knowledge Systems, Vol – I & II”, Indian Institute of Advanced Study, Shimla, H., D.K. Print World Ltd;
2.	Pride of India: A Glimpse into India’s Scientific Heritage, Samskrita Bharati, New Delhi.
2.	Subbarayappa, B.V. and Sarma, K.V: Indian Astronomy: A Source Book, Nehru Centre, Mumbai.
3.	Bag, A.K. (1997). History of Technology in India, Vol. I, Indian National Science Academy, New Delhi.

