B. Tech. Program (Mechanical Engineering)

Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College affiliated to the University of Mumbai)

Scheme and detailed syllabus (DJS23)

Second Year B. Tech

In

Mechanical Engineering

(Semester III & IV)

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

Scheme for Second Year of B. Tech. Program in Mechanical Engineering: Semester III
(Autonomous-DJS23 NEP)

Sr. No.	Course Code	Courses	Teaching Scheme (hrs.)				Continuous Assessment (A) (marks)			Semester End Assessment (B) (Marks)					(A+B)	Total Credits	
			Th	P	T	Credits	Th	T/W	Total CA (A)	Th / Cb	O	P	O & P	Total SEA(B)			
1	DJS23MCPC301	Mathematics for Mechanical Engineering	2	--	--	2	40	--	40	60	--	--	--	60	100	2	**3**
	DJS23MTPC301	Mathematics for Mechanical Engineering Tutorial	--	--	1	1	--	25	25	--	--	--	--	--	25	1	
2	DJS23MCPC302	Applied Thermodynamics	3	--	--	3	40	--	40	60	--	--	--	60	100	3	**3**
3	DJS23MCPC303	Engineering Materials	2	--	--	2	40	--	40	60	--	--	--	60	100	2	**3**
	DJS23MLPC303	Engineering Materials Laboratory	--	2	--	1	--	25	25	--	25	--	--	25	50	1	
4	DJS23MCPC304	Manufacturing Processes	2	--	--	2	40	--	40	60	--	--	--	60	100	2	**2**
5	DJS23ICHSX07	Economics and Financial Management	2	--	--	2	40	--	40	60	--	--	--	60	100	2	**2**
6 #	DJS23OCOE301	Product Lifecycle Management	3	--	--	3	40	--	40	60	--	--	--	60	100	3	**3**
	DJS23OCOE302	Management Information System	3	--	--	3	40	--	40	60	--	--	--	60	100	3	
	DJS23OCOE303	Operations Research	3	--	--	3	40	--	40	60	--	--	--	60	100	3	
	DJS23OCOE304	Personal Finance Management	3	--	--	3	40	--	40	60	--	--	--	60	100	3	
	DJS23OCOE305	Public Systems and Policies	3	--	--	3	40	--	40	60	--	--	--	60	100	3	
	DJS23OCOE306	Fundamentals of Biomedical Instruments	3	--	--	3	40	--	40	60	--	--	--	60	100	3	
	DJS23OCOE307	IPR and Patenting	3	--	--	3	40	--	40	60	--	--	--	60	100	3	
	DJS23OCOE308	Entrepreneurship and Startup Ecosystem	3	--	--	3	40	--	40	60	--	--	--	60	100	3	
7	DJS23ITHSX05	Professional and Business Communication Tutorial	--	--	2	2	--	50	50	--	--	--	--	--	50	2	**2**
8	DJS23MLMD301	Python for Mechanical Engineering Laboratory	--	2	--	1	--	25	25	--	--	25	--	25	50	1	**1**
9	DJS23MLSC301	Manufacturing Processes Laboratory	--	4	--	2	--	50	50	--	--	50	--	50	100	2	**2**
10	DJS23IPSCX01	Innovative Product Development I	--	2	--	1	--	25	25	--	--	--	--	--	25	1	**1**
11	DJS23ILELX11	Community Engagement Service	--	2	--	1	--	25	25	--	--	--	--	--	25	1	**1**
		Total	**14**	**12**	**3**	**23**	**240**	**225**	**465**	**360**	**25**	**75**	**0**	**460**	**925**	**23**	

Any 1 Open Elective from given list.

Prepared by Checked by Head of the Department Principal

Scheme for Second Year of B. Tech. Program in Mechanical Engineering: Semester IV
(Autonomous-DJS23 NEP)

Sr. No.	Course Code	Courses	Teaching Scheme (hrs.)				Continuous Assessment (A) (marks)			Semester End Assessment (B) (Marks)					(A+B)	Total Credits	
			Th	P	T	Credits	Th	T/W	Total CA (A)	Th / Cb	O	P	O & P	Total SEA(B)			
1	DJS23MCPC401	Numerical and Statistical Techniques	2	--	--	2	40	--	40	60	--	--	--	60	100	2	**3**
	DJS23MLPC401	Numerical and Statistical Techniques Laboratory	--	2	--	1	--	25	25	--	--	--	--	--	25	1	
2	DJS23MCPC402	Mechanics of Materials	3	--	--	3	40	--	40	60	--	--	--	60	100	3	**4**
	DJS23MLPC402	Mechanics of Materials Laboratory	--	2	--	1	--	25	25	--	25	--	--	25	50	1	
3	DJS23MCPC403	Advanced Manufacturing Processes	3	--	--	3	40	--	40	60	--	--	--	60	100	3	**3**
4	DJS23ICHSX08	Universal Human Values	2	--	--	2	40	--	40	60	--	--	--	60	100	2	**3**
	DJS23ITHSX08	Universal Human Values Tutorial	--	--	1	1	--	25	25	--	--	--	--	--	25	1	
5 #	DJS23OCOE401	Project Management	3	--	--	3	40	--	40	60	--	--	--	60	100	3	**3**
	DJS23OCOE402	Cyber Security, Policies and Laws	3	--	--	3	40	--	40	60	--	--	--	60	100	3	
	DJS23OCOE403	Advanced Operations Research	3	--	--	3	40	--	40	60	--	--	--	60	100	3	
	DJS23OCOE404	Corporate Finance Management	3	--	--	3	40	--	40	60	--	--	--	60	100	3	
	DJS23OCOE405	Corporate Social Responsibility	3	--	--	3	40	--	40	60	--	--	--	60	100	3	
	DJS23OCOE406	Bioinformatics	3	--	--	3	40	--	40	60	--	--	--	60	100	3	
	DJS23OCOE407	Human Resource Management	3	--	--	3	40	--	40	60	--	--	--	60	100	3	
	DJS23OCOE408	Digital Marketing Management	3	--	--	3	40	--	40	60	--	--	--	60	100	3	
	DJS23OCOE409	Logistics and Supply Chain Management	3	--	--	3	40	--	40	60	--	--	--	60	100	3	
6	DJS23ILHSX06	Design Thinking Laboratory	--	2	--	1	--	25	25	--	--	--	--	--	25	1	**1**
7	DJS23MLSC401	Computer Aided Machine Drawing Laboratory	--	4	--	2	--	50	50	--	--	50	--	50	100	2	**2**
8	DJS23MLSC402	Advanced Manufacturing Processes Laboratory	--	4	--	2	--	50	50	--	--	50	--	50	100	2	**2**
9	DJS23IPSCX02	Innovative Product Development II	--	2	--	1	--	25	25	--	--	--	--	--	25	1	1
		Total	**13**	**16**	**1**	**22**	**200**	**225**	**425**	**300**	**25**	**100**	**0**	**425**	**850**	**22**	

Any 1 Open Elective from given list.

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Continuous Assessment (A):

Course	Assessment Tools	Marks	Time (min.)
Theory	a. Term test 1 (based on 40 % syllabus)	15	45
	b. Term test 2 (next 40 % syllabus)	15	45
	c. Assignment / course project / group discussion / presentation / quiz/ any other.	10	--
	Total Marks (a + b + c)	40	--
Audit course	Performance in the assignments / quiz / power point presentation / poster presentation / group project / any other tool.	--	As applicable
Laboratory	Performance in the laboratory and documentation.	25	
Tutorial	Performance in each tutorial & / assignment.	25	
Laboratory &Tutorial	Performance in the laboratory and tutorial.	50	

The final certification and acceptance of term work will be subject to satisfactory performance upon fulfilling minimum passing criteria in the term work / completion of audit course.

Semester End Assessment (B):

Course	Assessment Tools	Marks	Time (hrs.)
Theory / * Computer based	Written paper based on the entire syllabus.	60	2
	* Computer-based assessment on the college premises.		
Oral	Questions based on the entire syllabus.	25	As applicable
Practical	Performance of the practical assigned during the examination and the output / results obtained.	25	2
Oral & Practical	Project based courses - Performance of the practical assigned during the examination and the output / results obtained. Based on the practical performed during the examination and on the entire syllabus.	as per the scheme	2

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Program: Mechanical Engineering	**S.Y. B. Tech**	**Semester: III**
Course: Mathematics for Mechanical Engineering (DJS23MCPC301)		
Course: Mathematics for Mechanical Engineering Tutorial (DJS23MTPC301)		

Pre-requisite: --

1. Mathematics-I and Mathematics-II
2. Vector algebra and vector differentiation.

Objectives:

1. To inculcate an ability to relate engineering problems to mathematical context.
2. To provide a solid foundation in mathematical fundamentals required to solve engineering problems.
3. To inculcate an ability to use the fundamentals of linear algebra to solve mechanical engineering problems.
4. To study the basic principles of linear algebra, vector calculus, and transforms like Laplace and Fourier.

Outcomes: On completion of the course, the learner will be able to:

1. Evaluate functions of square matrices using eigenvalues and eigenvectors.
2. Use Laplace and Inverse Laplace to solve Ordinary Differential Equations.
3. Expand periodic functions into infinite Fourier series and represent them as Fourier integrals. Interpret Fourier transform and inverse Fourier transform.
4. Correlate the mechanical engineering problem with vector integration and solve them.

Mathematics for Mechanical Engineering (DJS23MCPC301)		
Unit	**Description**	**Duration**
1	**Linear Algebra** Characteristic equation, Eigenvalues and Eigenvectors with properties. Cayley-Hamilton theorem. Diagonalizability of matrices. Functions of square matrix.	**05**
2	**Laplace Transform (LT)** LT of standard functions such as 1, t^n,e^{at}, sin *at*, cos *at*, sinh *at*, cosh *at*. Linearity property of Laplace Transform, First Shifting property, Change of Scale property of L.T. (without proof) $L\{t^n f(t)\}, L\left\{\frac{f(t)}{t}\right\}, L\left\{\int_o^t f(u)\,du\right\}, L\left\{\frac{d^n f(t)}{dt^n}\right\}$	**04**
3	**Inverse Laplace Transform** Linearity property, Partial fractions method and convolution theorem. Applications to solve ordinary differential equations with one dependent variable with given boundary conditions. **Laplace Transform of special functions** (Flip classroom - self-study) Heaviside Unit step function, Dirac Delta function, Periodic functions	**04**
4	**Fourier Series** Definition, Dirichlet's conditions, Fourier series of periodic function with period 2π & 2*l*. Even and odd functions, Half range sine and cosine series, Parseval's identities (without	**09**

	proof) **Fourier Transform (FT):** Fourier integral theorem (only statement), Fourier transform, Fourier sine & cosine transforms, Inverse Fourier Transforms	
5	**Vector Integration** Green's theorem (without proof) for planes, Stokes theorem and Gauss divergence theorem (without proof and verification).	**04**
	Total	**26**

Mathematics for Mechanical Engineering Tutorial (DJS23MTPC301)	
Exp.	**Suggested Topics for Tutorial**
1	Eigenvalues, Eigenvectors and Diagonalisation
2	Cayley Hamilton Theorem and Functions of square matrix
3	Laplace Transform
4	Inverse Laplace Transform
5	Application of Laplace Transform
6	Fourier Series Expansion
7	Half Range Fourier Series Expansion
8	Fourier Transform
9	Vector Integration
10	Vector Integration

Minimum eight tutorials from the above suggested list or any other tutorial based on syllabus will be included, which would help the learner to apply the concept learnt. Mini project relevant to the subject may be included, which would help the learner to apply the concept learnt.

Books Recommended:

Textbooks:

1. Seymour Lipschutz and Marc Lipson, "Linear Algebra", 4th Edition, Schaum's outlines, 2008.
2. Gilbert Strang, "Linear Algebra and its Applications", 4th Edition, Cengage, 2005.
3. B. S. Grewal, 'Higher Engineering Mathematics', Khanna Publication.

Reference Books:

1. Erwin Kreyszig, 'Advanced Engineering Mathematics', Wiley India
2. Deisentoth, Faisal, Ong, 'Mathematics for machine learning', Cambridge University Press.

Program: Mechanical Engineering	S.Y. B.Tech	Semester: III
Course: Applied Thermodynamics (DJS23MCPC302)		

Objectives:

1. To familiarize the concepts of Energy in general and Heat and Work in particular.
2. To study the fundamentals of quantification and grade of energy.
3. To study the effect of energy transfer on the properties of substances in the form of charts and diagrams.
4. To familiarize application of the concepts of thermodynamics in vapour power and gas power cycles.

Outcomes: On completion of the course, the learner will be able to:

1. Demonstrate application of the first law of thermodynamics to flow and non-flow system
2. Analyze thermodynamic cycles including vapour power cycles, refrigeration cycles, and heat pump.
3. Use thermodynamic relations in the evaluation of thermodynamic properties.
4. Use steam table and Mollier chart to compute thermodynamics interactions
5. Evaluate the performance of air standard cycles.
6. Demonstrate application of the first law of thermodynamics to air conditioning processes

Applied Thermodynamics (DJS23MCPC302)		
Unit	**Description**	**Duration**
1	**Application of First Law of Thermodynamics**: First law of thermodynamics for a closed system undergoing processes, First Law of Thermodynamics applied to open system – Steady Flow Energy Equation, Perpetual motion Machine of First kind. Application of first law of thermodynamics to open Systems like Steam Nozzle, Boiler, Steam Turbine, Pump, Heat Exchanger.	6
2	**Second Law of Thermodynamics**: Limitation of first law of thermodynamics, Thermal Reservoir – Source and Sink, Concept of Heat Engine, Heat Pump and Refrigerator, Second law of thermodynamics – Kelvin Planck and Clausius Statements. Equivalence of Clausius and Kelvin Planck Statement, Reversible and Irreversible Process. Causes of Irreversibility, Perpetual Motion Machine of Second Kind, Need of Carnot theorem and its corollaries, Carnot cycle, Thermodynamic Temperature Scale and its equivalence with Ideal Gas Scale. **Entropy:** Clausius Inequality, Clausius Theorem, Entropy is Property of a system, Isentropic Process, Temperature Entropy Plot and its relationship with heat interactions, Entropy Principle, Entropy change During a Process. Interpretation of concept of entropy.	9
3	**Thermodynamic Relations**: Reciprocal Relation, Cyclic Relation Property relations, Maxwell Relations, TdS equations, Heat capacity relations, Volume Expansivity, Isothermal Compressibility, Clausius- Clapeyron Equation. **Exergy:** High grade and Low-Grade Energy, Available and Unavailable Energy, Dead State, Available energy with respect to a process and a cycle.	4
4	**Properties of Pure Substance:** Pure substance and Phase changes: Phase change processes of pure substance, Property diagrams for phase change process (T-v, T-s and p-h diagrams), Understanding of Steam Table and Mollier chart.	9

	Vapour Power cycle: Carnot cycle and its limitations as a vapour cycle, Rankine cycle with different turbine inlet conditions, mean temperature of heat addition, Methods to improve thermal efficiency of Rankine cycle – Reheat cycle and Regeneration Cycle.	
5	**Gas Power cycles:** Assumptions of Air Standard Cycle, Analysis of Otto cycle, Diesel Cycle and Dual cycle (Numericals included).	6
6	**Psychometrics of Air –Conditioning Processes:** Need for air conditioning, Principle of psychrometry, Basic Psychometric properties, Need of psychometric chart and plotting basic psychometric properties on psychometric chart	**5**
	Total	**39**

Books Recommended:

Text books:

1. P K Nag, Thermodynamics, Tata McGraw Hill Publishers.
2. Onkar Singh, Thermodynamics, New Age International.
3. P Chattopadhyay, Engineering Thermodynamics, Oxford University Press India

Reference Books:

1. Yunus A. Cengel and Michael A. Boles, Thermodynamics: An Engineering Approach, 7th edition, TMH
2. Michael J. Moran and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, Wiley Publications.
3. Claus Borgnakke and Richard E. Sonntag, Fundamentals of Thermodynamics, Wiley Publications.

Program: Mechanical Engineering	S.Y. B.Tech	Semester: III
Course: Engineering Materials (DJS23MCPC303)		
Course: Engineering Materials Laboratory (DJS23MLPC303)		

Pre-requisite: Knowledge of Basic crystal structures and properties

Objectives:

The basic objective of this course is to nurture the participants with comprehensive understanding of engineering materials and related concepts.

1. To impart knowledge on materials selection based on properties and application requirements, crystal defects, mechanical behavior of materials subjected to different loads and basic characterization methods.
2. To understand alloy phase diagrams and its application, iron-iron carbide phase diagram, exposure to microstructural development in ferrous materials, heat treatment processes and their effect on structure and properties of materials.
3. To know the effect of alloying elements in ferrous materials.
4. To learn nonferrous and nonmetallic materials.

Outcomes: On completion of the course, the learner will be able to:

1. Acquire knowledge on materials classification and selection, structure-property correlation, imperfections and deformation mechanism in crystalline material and demonstrate the sample preparation for various microscopy and microstructural information obtained by it.
2. Identify and comprehend failure modes of engineering materials and related issues.
3. Interpret phase diagram, describe iron-iron carbide system and understand the microstructural development and property changes in steels and cast irons.
4. Select and justify proper industrial heat treatment process for steel in order to obtain desirable properties to suit application requirements.
5. Analyze the effect alloying elements in steel and learn alloy steels.
6. Classify nonferrous and nonmetallic materials and recognize their need to cater the engineering demand.

Engineering Materials (DJS23MCPC303)		
Unit	**Description**	**Duration**
1	**Introduction to Engineering Materials and Basic Characterization Techniques** Engineering Materials: Brief history, Classification of solid engineering materials, structure-property correlations, defects in crystal etc. Deformation in Crystalline Material: Elastic and Plastic deformation, deformation by slip and twin, slip systems, critical resolved shear stress. Strain Hardening effect, frank reed source, recovery, recrystallization and grain growth. Principle, construction, operation and applications of light microscopy and electron microscopy.	05

2	**Materials Failure** Modes of Failure: failure by plastic deformation, ductile fracture, brittle fracture. Ductile to brittle transition temperature (DBTT). Fatigue Failure: Definition, Examples, Types of fluctuating stresses, fatigue test, S-N Curve, Macro and micro structural aspects of fatigue, prevention of fatigue, concept of thermal and corrosion fatigue. Creep Failure: Definition, Examples, Creep test, Creep Curve, Effect of stress and temperature on creep behavior of material, and Creep resistant materials.	04
3	**Solidification and Alloy Phase Diagrams:** Solidification: Nucleation and growth of crystals, formation of solid solutions, and Hume Rothery rule. Basics of phase diagram: Construction of unary, binary, ternary and isomorphous phase diagrams, Gibb's phase rule, Tie line and lever rule, Invariant Reactions etc. Study of Polymorphism in Pure iron and Iron – Iron carbide phase diagram: Construction, important phases, composition, temperature and phase transformation etc. Slow cooling behavior of hypoeutectoid steel, hypereutectoid steel and cast iron. Types of cast irons and their industrial applications.	04
4	**Heat Treatment in Steels** Purpose of Heat treatment, Heat treatment cycle, Microstructures and Properties associated with Annealing, Normalizing, Quenching, and Tempering, Martempering, and Maraging Heat treatment process. Construction, interpretation and application of TTT and CCT diagrams. Hardenability and Jominy End Quench test. Surface/Case Hardening Methods: Carburizing, Nitriding, Carbonitriding and Cyaniding.	04
5	**Alloying Elements and Alloy Steels** Common alloying elements in steels and their effect on structure and properties of steel. Ferrite & Austenite Stabilizers, Strong Carbide forming elements. Effect of alloying elements on Iron – Iron carbide diagram, TTT & CCT diagram and Hardenability of steel. Stainless steel and HSS: Composition, Types, Properties and Applications.	04
6	**Study of Nonferrous and Nonmetallic materials** Classification, Properties and Industrial Applications of light metals and alloys (alloys of Al, Cu, Ti etc), Ceramics, Polymers and Composites.	05
	Total	**26**

Engineering Materials Laboratory (DJS23MLPC303)	
Exp.	**Suggested experiments**
1	Study and Demonstration of Light/Optical/Metallurgical Microscope.
2	Metallographic sample preparation.
3	To study the microstructures of plain carbon steels and cast irons.
4	To study the microstructures of nonferrous materials.
5	To study the heat treatment of steel (Annealing, Normalizing, Quenching) and to investigate the variation in hardness and microstructure of heat treated specimens
6	To study the tempering characteristic of hardened steel.
7	To determine the hardenability of steel by Jominy End Quench Test
8	Fatigue Test
9	To perform any Two non-destructive testing. (Magnetic particles inspection, Dye penetrant test, Ultrasonic testing)

Minimum eight experiments from the above-suggested list or any other experiments based on syllabus will be included, which would help the learner to apply the concept learnt.

Assignments based on syllabus, Mini project or case study/literature based seminar/presentation relevant to the subject may be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. William D. Callister, David G. Rethwisch, Materials Science and Engineering: An Introduction, 10th Edition, John Wiley and Sons, 2020.
2. G. E. Dieter, Mechanical Metallurgy, 3rd Edition, McGraw Hill International New Delhi, 2017.
3. William F Smith, Javed Hasemi and Ravi Prakash, Materials Science and Engineering, 5th Edition, McGraw Hill Publications, 2017.
4. S. H. Avner, Introduction to Physical Metallurgy, McGraw Hill, 2017.
5. V Raghavan, Physical Metallurgy: Principles and Practice, 3rd Edition, PHI Learning Pvt. Ltd., 2015.
6. W. Bolton, Engineering Materials Technology, 3rd Edition, (Oxford) Butterworth-Heinemann, 2001.
7. C.P. Sharma, Engineering Materials (Properties and applications of metals and alloys), Prentice Hall India Learning Private Limited, 2004.

Reference books:

1. Michael F. Ashby, Materials Selection in Mechanical Design, 5th Edition, Elsevier, Butterworth-Heinemann, 2016
2. Henry Tindell, Engineering Materials, The Crowood Press ltd., 2014.
3. Donald R Askeland, Wendelin J Wright, Essentials of Materials Science and Engineering, 3rd Edition, Cengage Learning, 2013.

4. Krishnan K. Chawla, Composite Materials – Science and Engineering, 3rd Edition, Springer, 2013.
5. C. Suryanarayana, Experimental Techniques in Materials and Mechanics, by, CRC press, Taylor & Francis Group, 2011.
6. T.V. Rajan, C.P. Sharma, and Ashok Sharma, Heat Treatment: Principles and Techniques, 2nd edition, PHI Learning Pvt Ltd., 2011.
7. June Gunn Lee, Computational Material Science, CRC Press, 2011.
8. Winson O Soboyejo, T.S. Srivatsan, Advanced Structural Materials, CRC press, Taylor and Francis Group, 2011.
9. R. K. Rajput, S. Chand, Engineering Materials and Metallurgy, and Company Ltd., 2006.
10. Sanjay K. Muzumdar, Composites Manufacturing – Materials, Product, and Process Engineering, CRC Press, 2002.

Program: Mechanical Engineering	S.Y. B.Tech	Semester: III
Course : Manufacturing Processes (DJS23MCPC304)		

Objectives:

1. To impart knowledge of manufacturing processes like casting, forging, rolling, metal cutting.
2. To familiarize the students with unconventional machine tools & machining processes.
3. To train the students in machining various operations on CNC to enrich their practical skills.
4. To educate the students about ethical, environmental and safety standards.

Outcomes: On completion of the course, the learner will be able to:

1. Identify various metal casting and metal joining processes, analyze various defects, their probable causes and remedial measures.
2. Identify various metal forming processes, analyze various defects, their probable causes and remedial measures.
3. Describe types of machine tools, illustrate machine tools capabilities, limitations of machining operations to generate cylindrical, and planar components.
4. Understand the working principle and applications of CNC machines to execute various operations using canned cycles and subroutine.
5. Determine the operation planning sequences by analyzing the part prints for estimating the manufacturing time, to cater to the manufacturing requirements.

Manufacturing Processes (DJS23MCPC304)		
Unit	**Description**	**Duration**
1	**Introduction to Manufacturing Processes:** Need and classification of manufacturing process based on based on additive and subtractive process, chip-less and chip-removal processes. **Metal Casting Process** - Expendable and Permanent Mould Casting Processes – sand casting, investment casting, shell moulding, die casting, centrifugal casting, vacuum casting, casting defects and their remedies.	04
2	**Rolling**: Principles and process characteristics, rolling types, rolling parameters, Thread rolling, Production of seamless tubes through rolling, defects, and remedies in rolling process. **Forging**: Basic operations, types of forging, forging hammers/ presses, forging stages, forging applications, defects, and remedies in forging process. **Extrusion:** Equipment and principles, types of extrusion, direct, indirect, impact, continuous, hydrostatic, tube extrusion, metal flow in extrusion, defects and remedies in extrusion, wire drawing process. **Sheet Metal Operations**: Theory in press working, different elements of a press tool, press working operations.	07

3	**Metal Cutting Process:** Merchant theory of metal cutting, Machine tools required to generate cylindrical and planar components. Machine tools required for finishing and super finishing processes. Machine tools required for thread cutting and gear cutting. **Metal Joining Processes -** Classification of welding, fusion welding, solid state welding, soldering and brazing processes. Welding defects, inspection & testing of welds, Safety in welding.	05
4	**CNC Basics and Hardware** DNC, Motion controller, Interpolation, Adaptive control system, Spindle drive, Axis drive, Actuation and feedback devices, ATC, APC, Tool pre-setter, Touch probe system. **CNC Tooling and Programming** CNC Turning and Milling tools. Types of controllers, Tool nose radius and length compensation. Canned cycle, Looping, Jumping and Subprogram. Turning and Vertical Machining centre programming.	07
5	**Manufacturability assessment of given product design.** **Classifying operations** - Basic process operation, principal process and auxiliary process. **Preliminary part print analysis.** **Process planning** for a given component.	03

Books Recommended:

Text books:

1. Mikell P. Groover, "Fundamentals of Modern Manufacturing, Materials, Processes and Systems", John Wiley & Sons, Inc, 7th edition, 2020.
2. Serope Kalpakjian and Steven R. Schmid "Manufacturing Processes for Engineering Materials", Pearson, 6th edition, 2017.
3. P. N. Rao, "CAD/CAM - Principles and Applications", Tata McGraw Hill, 3rd edition, 2017.
4. Ghosh & Mallik, "Manufacturing Science", Affiliated East-West Press, 3rd edition, 2010.
5. O. P. Khanna, "Welding Technology", Dhanpat Rai publication, 1st edition, 2015
6. Eary and Johnson, "Process engineering for manufacturing", Prentice-Hall, 1962.

Program: Common to all Programs.	Group B	S.Y B. Tech.	Semester: III
Course: Economics and Financial Management (DJS23ICHSX07)			

Pre-requisite: Knowledge of Economics and Finance domain current affairs.

Objectives:

1. To describe the relationships among variables to analyse economic issues.
2. To Explain the function of the market and prices as an allocative mechanism.
3. To identify key macroeconomic indicators and measures of economic change, growth, and development
4. To understand basic concepts of financial management and their application in investment and financing decisions
5. To explore the relationship between Financial Management and Financial Statements.

Outcomes: On completion of the course, learner will be able to:

1. Analyse individual decision making, how prices and quantities are determined in product and factor markets, microeconomic and macroeconomic outcomes
2. Analyse the performance and functioning of government, RBI, markets, and institutions in the context of social and economic problems.
3. Analyse the current economic status of India at global levels and provision in budget to address economic issues at national level.
4. Describe an understanding of the overall role and importance of the finance function.
5. Analyse financial performance and make appropriate inferences.

Economics and Financial Management (DJS23ICHSX07)		
Unit	**Description**	**Duration**
1	**Introduction to Economics** Fundamentals of Economics, Definition and scope of economics, the nature of the economic problem, finite resources and unlimited wants, definitions of the factors of production and their rewards, definition of opportunity cost, the influence of opportunity cost on decision making. **Microeconomics and Macroeconomics** The role of markets in allocating resources, the market system, introduction to the price mechanism, Demand, Supply and Price determination, Price elasticity of demand and supply (PED).	06
2	**Role of Government and RBI** Money, Banking, Households, Firms, economies and diseconomies of scale, Market Structure, Fiscal Policy, Monetary Policy, Economic Growth, causes and consequences of recession, causes of economic growth, measurement of economic growth **i**nflation and deflation, living standards, indicators of living standards	04
3	**Government Policies** Last 20 years Journey of Indian Economy, Measures taken to grow Indian Economy, Meaning of India is the world's fifth-largest economy by nominal	04

	GDP and the third-largest by purchasing power parity (PPP), On a per capita income basis, India ranked 139th by GDP (nominal) and 127th by GDP (PPP) (Data reference year 2023), Comparison of top 5 largest economies in world, Discuss key points of India latest union budget and its impact on Indian economy and citizens, Meaning of Initiatives like Make in India, Digital India, Skill India etc. and expected impact on Indian Economy	
4	**Overview of Financial Management** Fundamentals of financial management, principles and functions of the financial management, Strategy, methods, and techniques of the financial management, Overview of financial instruments, financial markets, financial Institutions	04
5	**Overview of Financial Statements** Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios;	08
		26

Books Recommended:

Text books:

1. Gaurav Datt & Biswajit Nag, "Datt & Sundharam's Indian Economy", S. Chand Publications, 73rd Edition,2024
2. Prasanna Chandra, "Fundamentals of Financial Management", McGraw Hill Publications, 7th Edition, 2020

Reference Books:

1. Burkhard Heer, " Public Economics: The Macroeconomic Perspective", Springer International Publications,2019
2. Raj Kumar Sen "Indian Economy: Economic Ideas, Development, and Financial Reforms", Deep & Deep Publications, 2008
3. Dr. V. C. Sinha "Indian Economy: Performance and Policies", SBPD Publications,2021
4. C. Paramasivan, T. Subramanian, "Financial Management" , New Age Publications,2009
5. Sandeep Goel, "Financial Management Practices in India" , Taylor & Francis Publications,2016

Program: Open Elective for all Programs	S.Y B.Tech.	Semester: III
Course: Product Life Cycle Management (DJS23OCOE301)		

Pre-requisite:

1. Basic Management knowledge

Objectives:

1. To familiarize the students with the need, benefits and components of PLM.
2. To acquaint students with Product Data Management & PLM strategies.
3. To give insights into new product development program and guidelines for designing and developing a product.
4. To familiarize the students with Virtual Product Development.
5. To acquaint students with the need of Environmental aspects in PLM & its implementation.

Outcomes: On completion of the course, the learner will be able to:

1. Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
2. Illustrate various approaches and techniques for designing and developing products.
3. Acquire knowledge in applying virtual product development tools.
4. Acquire knowledge in implementation of Environmental aspects in PLM.

Product Life Cycle Management (DJS23OCOE301)		
Unit	**Description**	**Duration**
1	**Introduction to Product Lifecycle Management (PLM):** Product Lifecycle management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications. **PLM Strategies:** Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM.	**07**
2	**Product Design and Development:** Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase.	**07**
3.	**Methodological Evolution of Product Design:** Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering, Life Cycle Approach, Characteristic Features of Life Cycle Approach. The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process. New Product Development (NPD) and Strategies, Product Configuration and Variant Management.	**10**

	Integration of Environmental Aspects in Product Design: Sustainable Development Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design, Tools and techniques for integrated design, Implementation of international standards.	
4	**Product Data Management (PDM):** Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation. **Virtual Product Development Tools:** For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modelling and simulations in Product Design, Examples/Case studies.	**07**
5	**Engineering Methods for product Duration design & evaluation:** Durability of Products and Components, Design for Fatigue, Infinite Life Approach, Design for Finite Life. **Product Recovery Planning & Analysis:** Approach to the Recovery Problem, Method for Recovery Cycles Planning, Calculation Models for Recovery Cycles Planning, Basic procedure, Determinant Factors for Recovery, Effective Component Reusability, Recovery Fractions, Extension of Useful Life.	**08**
	Total	**39**

Books Recommended:

Textbooks:

1. John Stark, ― Product Lifecycle Management: Paradigm for 21st Century Product Realisation‖, Springer-Verlag, 2004. ISBN: 1852338105
2. Fabio Giudice, Guido La Rosa, Antonino Risitano, ― Product Design for the environment-A life cycle approach‖, Taylor & Francis 2006, ISBN: 0849327229

Reference Books:

1. Saaksvuori Antti, Immonen Anselmie, ― Product Life Cycle Management‖, Springer, Dreamtech, ISBN: 3540257314
2. Michael Grieve, ― Product Lifecycle Management: Driving the next generation of lean thinking‖, Tata McGraw Hill, 2006, ISBN: 0070636265
3. François Villeneuve, Luc Mathieu, Max Giordano ―Product Life-Cycle Management: Geometric Variations. (2010). United Kingdom: Wiley.

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Program: Open Elective for all Programs		S.Y B.Tech.	Semester: III
Course: Management Information System (DJS23OCOE302)			

Pre-requisite:

Nil

Objectives:

1. The course is blend of management and technical field.
2. Discuss the roles played by information technology in today's business and define various technology architectures on which information systems are built.
3. Define and analyze typical functional information systems and identify how they meet the needs of the firm to deliver efficiency and competitive advantage.
4. Identify the basic steps in systems development.

Outcomes: On completion of the course, the learner will be able to:

1. Explain the fundamental concepts of the management information systems used in business.
2. Describe IT infrastructure and its components and its current trends.
3. Use the tools and technologies for accessing information from databases to improve business performance and decision making
4. Identify and explain the security and ethical challenges in MIS along with the measures to be taken
5. Select a suitable social computing platform for the given requirements that integrates AI and IoT.
6. Explain the processes involved in the information system within the organization includes information acquisition and enterprise and global management technologies.

Management Information Systems (DJS23OCOE302)		
Unit	**Description**	**Duration**
1	**Foundation Concepts** • Definition and scope of Management Information Systems (MIS) in business, • Functional area information system, • The components of information systems, • Impact of IT on organizations and society, • Business Process – BPR and BPI. • Business Pressure, Organizational responses. • Competitive Advantage and Strategic IS's.	04
2	**Information Technology Infrastructure** • Overview of IT infrastructure, • Hardware and software, • Computer systems: End user and enterprise, • Computing computer peripherals: Input, output, and storage technologies, • Application software: End user applications,	05

	• System software: Computer system management, • Data resource management: Technical foundations of database management, Managing data resources, Big data, Data warehouse and data marts, Knowledge management, • Networks: The networked enterprise (wired and wireless), Pervasive computing, Cloud computing models,	
3	**MIS Tools and applications for Decision making** • ERP and ERP support of business • Business intelligence (BI): Managers and Decision Making. • Decision Support System (DSS): types, components, Data mining. • Executive information system. • Role of AI in decision making. • Role of predictive analytics and data visualization in business	10
4	**Security and Ethical Challenges** • Information security fundamentals • Key principles of information security • Common threats and vulnerabilities in MIS • Security measures and controls • Access control mechanisms: authentication, authorization, and accounting (AAA) • Encryption techniques and cryptographic protocols • Ethical, and societal challenges of IT • Legal and regulatory framework • Privacy Policies	08
5	**Social Computing (SC)** • Web 2.0 and 3.0: static and dynamic platform, integration with AI and IoT • SC in business-shopping: leveraging social media platforms, Social listening and sentiment analysis • Social computing in Customer Relationship Management (CRM) • Marketing, operational and analytic CRM • E-business and E-commerce – B2B B2C, E-commerce platforms and payment gateways • Mobile commerce: growth trends, mobile wallets, contactless payments, shopping apps and platforms	06
6	**Information System within Organization** • Acquiring Information Systems and Applications: Various System development life cycle models • Enterprise and Global Management of Information Technology: Managing Information Technology, Managing Global IT • Business processes and information systems	06
	Total	**39**

Books Recommended:

Textbooks:

1. A. K. Gupta, "Management Information System", S. Chand Limited, 2010.
2. K. K. Ghosh, Saini Das, and S. Mukherjee, "Management Information System", Management, IIT, Kharagpur, 2021.

Reference Books:

1. J. A. O'Brien, G. Marakas, "Management Information Systems", McGraw-Hill Companies, Incorporated, 2006.
2. K. Rainer, B. Prince, "Management Information Systems", Wiley, 2016.

Web References

- Management Information System (https://nptel.ac.in/courses/110105148)
- Management Information System (https://archive.nptel.ac.in/courses/110/105/110105148/)

Program: Open Elective for all Programs	**S.Y B. Tech.**	**Semester: III**
Course: Operations Research (DJS23OCOE303)		

Pre-requisite: Knowledge of

1. Mathematics.
2. Probability

Objectives:

1. Formulate a real-world problem as a linear programming problem and able to solve.
2. Understand the optimisation tools that are needed to solve linear programming problems.

Outcomes: On completion of the course, learner will be able to:

1. Formulate the real-world optimisation problem into a Linear Programming Problem (LPP) and analyse the solution obtained using LPP optimisation models.
2. Solve Linear Programming Problems using transportation and assignment models.
3. Apply Decision Theory to determine the optimal course of action when a number of alternatives are available, and their consequences cannot be forecast with certainty and uncertainty.
4. Apply Game Theory for decision making under conflicting situations where there are one or more opponents (players).
5. To breaking down a large problem into smaller sub problems and solved recursively or iteratively using Dynamic Programming models.

Operation Research (DJS23OCOE303)		
Unit	**Description**	**Duration**
1	**Introduction to Operations Research**: Introduction, Structure of the Mathematical Model, Limitations of Operations Research. **Linear Programming**: Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP, Graphical method, Simplex Method, Penalty Cost Method or Big M-method, Two Phase Method.	12
2	**Transportation Problem**: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: MODI method. **Assignment Problem**: Introduction, Mathematical Formulation of the Problem, Hungarian Method Algorithm, Processing of n Jobs Through Two Machines and m Machines, Graphical Method of Two Jobs m Machines Problem Routing Problem	08

3	**Decision Theory:** Steps in Decision Theory approach, Decision-making Environment, Decision making under condition of certainty, Decision making under condition of uncertainty, Decision making under condition of risk, Maximum likelihood criterion.	06
4	**Game Theory**: Competitive games, rectangular game, saddle point, minimax/maximin method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games.	06
5	**Dynamic programming**: Characteristics of dynamic programming. Dynamic programming approach for Priority Management employment smoothening, capital budgeting, Stagecoach/Shortest Path, cargo loading and Reliability problems.	07
	Total	**39**

Books Recommended:

Textbooks:

1. Operations Research - An Introduction: Taha, H. A., Pearson Education, 2022.
2. Operations Research, Gupta, P. K. and Hira, D. S., S. Chand Publications, 2014.

Reference Books:

1. Operations Research: Introduction to Models and Methods, Boucherie, R. J., Tijms, H. and Braaksma, A., 2021.
2. Introduction to Operations Research: Hiller, F. S. and Liebermann, G. J., McGraw-Hill Higher Education, 2010.
3. Operations Research: Principles and Practice: Ravindran, A., Phillips, D. T. and Solberg, J. J., Wiley India Pvt. Limited, 2009.

Program: Open Elective for all Programs	S.Y B.Tech.	Semester: III
Course: Personal Finance Management (DJS23OCOE304)		

Pre-requisite:

1. Nil

Objectives:

1. To create awareness and educate consumers on access to financial services.
2. To make the students understand the basic concepts, definitions and terms related to direct taxation.
3. To help the students compute the Goods and Service Tax (GST) payable by a supplier after considering the eligible input tax credit.
4. To familiarize the students with microfinance for accelerating the expansion of local microbusinesses.

Outcomes: On completion of the course, learner will be able to:

1. Understand the Indian financial system.
2. Use a framework for financial planning to understand the overall role finances play in his/her personal life.
3. Compute income from salaries, house property, business/profession, capital gains and income from other sources.
4. Compute the amount of CGST, SGST and IGST payable after considering the eligible input tax credit.
5. Understand how Microfinance can help in financial inclusion.

Personal Finance Management (DJS23OCOE304)		
Unit	**Description**	**Duration**
1	**Overview of Indian Financial System**: Characteristics, Components and Functions of Financial System. Financial Instruments and Financial Markets, Financial inclusion. **Introduction to Personal Finance** Personal Financial Planning in Action, Money Management Skills, Taxes in Your Financial Plan, Savings and Payment Services. Consumer Credit: Advantages, Disadvantages, Sources and Costs.	07
2	**Personal Financial Management** **Loans:** Home, Car, Education, Personal, Loan against property and Jewel loan. **Insurance:** Types of Insurance – ULIP and Term; Health and Disability Income Insurance, Life Insurance. **Investment:** Investing Basics and Evaluating Bonds, Investing in Stocks and Investing in Mutual Funds, Planning.	07
3	**Income Tax** **Income Tax Act Basics**- Introduction to Income Tax Act, 1961 **Heads of Income and Computation of Total Income and Tax Liability**- Heads of Income and Computation of Total Income under various heads, Clubbing Provisions, Set off and carry forward of Losses, Deductions, Assessment of Income and tax	09

	liability of different persons. **Tax Management, Administrative Procedures and ICDS -** TDS, TCS and Advance Tax Administrative Procedures, ICDS.	
4	**Goods and Services Tax** GST Constitutional framework of Indirect Taxes before GST (Taxation Powers of Union & State Government); Concept of VAT: Meaning, Variants and Methods; Major Defects in the structure of Indirect Taxes prior to GST; Rationale for GST; Structure of GST (SGST, CGST, UTGST & IGST); GST Council, GST Network, State Compensation Mechanism, Registration. **Levy and Collection of GST** Taxable event- "Supply" of Goods and Services; Place of Supply: Within state, Interstate, Import and Export; Time of supply: Valuation for GST-Valuation rules, taxability of reimbursement of expenses; Exemption from GST: Small supplies and Composition Scheme: Classification of Goods and Services	08
5	**Introduction to Micro – finance** Micro-Finance: Definitions, Scope & Assumptions, Types of Microfinances, Customers of Micro-finance, Credit Delivery Methodologies, SHG concept, origin, Formation & Operation of Self-Help Groups (SHGs). **Models in Microfinance** - Joint Liability Groups (JLG), SHG Bank Linkage Model and GRAMEEN Model: Achievements & Challenges. **Institutional Mechanism** Current Challenges for Microfinance, Microfinance Institutions (MFIs): Constraints & Governance Issues, Institutional Structure of Microfinance in India: NGO-MFIs, NBFC-MFIs, Co-operatives, Banks, Microfinance Networks and Associations; Demand & Supply of Microfinance Services in India, Impact assessment and social assessments of MFIs	08
	Total	**39**

Books Recommended:

Textbooks:

1. Banking and Financial Sector Reforms in India, by Asha Singh, M.S. Gupta, Serials Publication.
2. Indian Banking Sector: Essays and Issues (1st) , by M.S. Gupta & J.B. Singh, Serials Publication.
3. Basics Of Banking & Finance, by K.M. Bhattacharya O.P. Agarwal, Himalaya Publishing House.
4. Agricultural Finance and Management, by S. Subba Reddy, P. Raghu Ram.
5. The Indian Financial System and Development, by Dr.Vasant Desai, Himalaya Publishing House; Fourth Edition.
6. Income Tax Management, Simple Way of Tax Management, Tax Planning and Tax Saving, By Sanjay Kumar Satapathy.
7. Direct Tax System Income Tax by Dr. R. K. Jain, SBPD Publications.
8. Simplified Approach to GST Goods and Services Tax, By S K Mishra, Educreation Publishing.
9. Introduction To Microfinance, By Todd A Watkins, World Scientific Publishing Company

Program: Open Elective for all Programs	S.Y B.Tech.	Semester: III
Course: Public Systems and Policies (DJS23OCOE305)		

Pre-requisite:

1. Basic Knowledge of Social science and Current affairs

Objectives:

1. To explain public policy and its operations with special focus on policy relating to Government finance.
2. To analyze and evaluate the impact of public policy on firms and the economy at large.

Outcomes: On completion of the course, the learner will be able to:

1. Understand the importance of public systems in a fast-changing environment in the global context.
2. Analyse the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.
3. Explain public policy and its operations with special focus on policy relating to Government finance.
4. Make policies and know about the happenings in the world, in the nation and those in their locality.
5. Analyze and evaluate the impact of public policy on firms and the economy at large and work under various fields as policymakers.

Public Systems and Policies (DJS23OCOE305)		
Unit	**Description**	**Duration**
1	**Introduction and Overview of Public Systems**: Ideology of Public Systems; Mechanistic and Organic view of Society and Individuals, The Legal Framework; Federal Government; State and Local Governments, Government growth; The size of Government.	10
2	**Public Sector in the Economics Accounts:** Public Sector in the circular flow; Public Sector in the National Income Accounts.	06
3	**Public Choice and Fiscal Politics:** Direct Democracy; Representative Democracy; The Allocation Function; The Distribution Function; The Stabilization Function; Coordination of Budget Functions; The Leviathan Hypothesis.	08
4	**Introduction and Overview of Public Policy:** Markets and Government; Social goods and Market failure, public expenditure and its evaluation; Cost Benefit Analysis, Public policy and Externalities, Taxation Policy and its impact, Income distribution, redistribution and social security issues Fiscal & Budgetary Policy, Fiscal Federalism in India.	10

5	**Case Studies in Expenditure Policy: Public Services** A) National Defense B) Highways C) Outdoor Recreation D) Education	05
	Total	**39**

Books Recommended:

Reference Books:

1. Charles J, Wheelan, "Introduction to Public Policy", W.W. Norton & Company, New York, 2011.
2. Thomas R, Dye, "Understanding Public Policy", Prentice Hall, 2008.
3. Anderson, James E, "Public Policy-Making: An Introduction", Boston, 2011.
4. Avasthi & Maheshwari, "Public Administration", Lakshmi Narain Agarwal, 2008.
5. Mohit Bhattacharya, "New Horizons of Public Administration", Jawahar Publishers, New Delhi, 2011
6. Nicholas Henry, "Public Administration and Public Affairs", Prentice Hall of India, New Delhi, 2017.
7. Harvey S Rosen and Ted Gayer, "Public Finance" 10th Edition, McGraw-Hill Education, 2013.
8. Richard A Musgrave and Peggy B Musgrave, "Public Finance in Theory and Practice", 5th Edition, Mcgraw Hill Book, 2017.

Program: Open Elective for all Programs	S.Y B.Tech.	Semester: III
Course: Fundamentals of Biomedical Instruments (DJS23OCOE306)		

Pre-requisite:

1. Basic knowledge of Human Anatomy
2. Basic knowledge of Electronics

Objectives:

1. To understand the basic principles and working of various medical instruments.
2. To familiarize the learners with the various medical imaging modalities, their operating principles, instrumentation and clinical applications.

Outcomes: On completion of the course, the learner will be able to:

1. Associate & describe the different physiological processes taking place within the human body.
2. Identify the use of biomaterials and apply principles of various transducers & sensors.
3. Demonstrate the working principle of various medical instruments.
4. Demonstrate principles used in imaging modalities and analysis.
5. Identify different processes used in telemetry and telemedicine.

Fundamentals of Biomedical Instruments (DJS23OCOE306)		
Unit	**Description**	**Duration**
1	**Basic Human Physiology** • **Cell:** Electrical activity of excitable cells (Structure and functions of cell. Polarization and depolarization of cell) • **Cardiovascular System**: Heart, Conductive tissues of heart, Cardiac cycle, Heart Valves, System and Pulmonary Circulation, Transmission of Cardiac Impulse, Blood Pressure, ECG (Einthoven's Triangle, Various leads and Waveforms). • **Muscle Physiology**: Muscle physiology and aspects of skin resistance. Generation of EMG • **Nervous System**: Different parts, their functions. Reflex actions and reflex arc, Function of Sympathetic and Parasympathetic nervous system. Generation of EEG	04
2	**Biomaterial, Transducers and Sensors:** • **Biomaterials used in fabrication of biodevices and implants**: Polymeric, Composite biomaterials, Metallic biomaterials, and Ceramic biomaterials. • Biopotential electrodes: Electrode tissue interface, Electrode electrolyte interface Electrodes used for ECG, EEG & EMG. • Transducers & sensors: temperature transducer, pulse sensor, glucose sensor, respiration sensor • Introduction of biomaterials, Classification of biomaterials	10

3	**Overview of Medical Instruments** • Classification, application and specifications of **diagnostic, therapeutic and clinical laboratory equipment** • Method of operation of these Bio Medical Instruments • ECG , EEG,EMG	08
4	**Imaging Modalities and Analysis:** • Radio graphic techniques, Computer Tomography, • MRI, PET, SPECT • Ultrasonography • Endoscopy • Thermography, Retinal Imaging • Imaging application in Biometric systems • Analysis of digital images	09
5	**Telemetry & Telemedicine:** • Introduction to Biotelemetry • Physiological parameters compliant to biotelemetry • Components of Biotelemetry system • Applications of telemetry in medical field (ECG, EEG & EMG)	08
	Total	**39**

Books Recommended:

Textbooks:

1. Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice hall of India, New Delhi,2007.
2. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.
3. Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill, New Delhi, 2 Edition, 2003.
4. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, NewYork, 1998.
5. Biomaterials Science - An Introduction to Materials in Medicine. B.D. Ratner, A.S. Hoffmann, F. J. Schoen, J. E. Lemons, Academic Press, 1997.

Reference Books:

1. Electronic Measurement and Instrumentation by Dr Rajendra Prasad
2. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
3. Curry, T. S., Dowdey, J. E., & Murry, R. C. (1990). Christensen's physics of diagnostic radiology. Lippincott Williams & Wilkins.
4. Biomaterials: An Introduction, Joon Park, R. S. Lakes, Springer Science & Business Media

Prepared by Checked by Head of the Department Principal

Program: Open Elective for all Programs	S.Y B.Tech.	Semester: III
Course: IPR and Patenting (DJS23OCOE307)		

Pre-requisite:

- NIL

Objectives:

1. To promote the knowledge of intellectual property laws of India and international treaties.
2. To encourage innovation.

Outcomes: On completion of the course, the learner will be able to:

1. Map a given project/ idea to a suitable intellectual property rights.
2. Explain the fundamentals of the patents, copyrights, and design registrations.
3. Draft applications to protect various intellectual property rights.
4. Communicate with national and/or international intellectual property organisations.

IPR and Patenting (DJS23OCOE307)		
Unit	**Description**	**Duration**
1	**Introduction to Intellectual Property Rights (IPR):** • Concept & meaning of IP and IPR. • General principles of intellectual property rights. • Need for intellectual property. • Categories of IPR instruments - Patents, Trademarks, Copyrights, Industrial. Designs, Plant variety protection, Trade secrets, Geographical Indications etc. • Ownership, assignment, licenses, infringement, validity period. • International treaties on IPR.	**03**
2	**Copyright and Design** 1. The Indian Copyright Act, 1957. 2. Meaning of copyrights and rights of copyrighted works. 3. Types of copyright. 4. Process of filing a copyright application. 5. Introduction to Designs Law – Definitions. 6. Registration of designs and procedure.	**09**
3	**Basics of Patents** • The Indian Patent Act and The Indian Patent Rules. • Conditions of patentability. • Patentable and non-patentable inventions. • Types of patent applications and patent specification. • Inventors and Applicants. • Category of applicants - natural person, small entity, startup and others. • Patent databases and patent search.	**09**

	• International Patent Classification code.	

4	**Patent Application Drafting**
	• Patent application drafting:
	  ○ Application.
	  ○ Specification.
	  ○ Claims drafting:
	  ▪ Independent and dependent claims drafting.
	  ▪ Process patent and product patent claims.
	  ○ Abstract.
	  ○ Drawings.
	  ○ Declaration as to inventorship.
	  ○ Statement and undertaking.
	• Drafting response to communications from patent office.
	  ○ Reading and understanding examination reports.
	  ○ Drafting response.
		09

5	**Procedure for Filing a Patent Application, Timelines and Fees** • Application for grant of patent. • Forms and Fees. • Request for (early) publication and / or (early) examination. • Patent examination and hearing. • Pre-grant and post-grant opposition.	**09**
	Total	**39**

Books Recommended:

Textbooks:

1. A Durafe and D Toradmalle, "Intellectual Property Rights", Wiley, 2020.
2. H Rockman, "Intellectual property law for engineers, scientists, and entrepreneurs", Wiley-IEEE Press, 2020.

Reference Books:

1. Bare Act, "The Patents Act, 1970 with The Patents Rules, 2003", Universal, 2023.
2. Bare Act, "The Copyright Act, 1957", Universal and LexisNexis, 2021.
3. Bare Act, "The Designs ACT, 2000", Commercial Law Publishers (India) Pvt. Ltd. 2021

Web Resources:

1. W. Fisher, "Maps of Intellectual Property" https://cyber.harvard.edu/people/tfisher/IP/IPMaps.htm
2. World Intellectual Property Organisation courses https://www.wipo.int/academy/en/
3. Prof. Feroz Ali, "Patent Drafting for Beginners", https://onlinecourses.nptel.ac.in/noc24_hs59/preview

Prepared by Checked by Head of the Department Principal

Program: Open Elective for all Programs	S.Y B.Tech.	Semester: III
Course: Entrepreneurship and Startup Ecosystem (DJS23OCOE308)		

Pre-requisite:
Nil

Objectives:
1. To foster an entrepreneurial mindset.
2. To guide participants in building effective Business Models.
3. To educate participants regarding Intellectual property and Fundraising for Innovative Ventures.

Outcomes: On completion of the course, the learner will be able to:
1. Effectively Navigate the Global Startup Landscape:
2. Cultivate an Entrepreneurial Mindset.
3. Create Effective Business Models.
4. Understand the significance of Intellectual Property rights.
5. Master Fundraising Strategies

Unit	Description	Duration
1	**Understanding the Entrepreneurial Ecosystem** • Introduction to Entrepreneurship and Startups • Role of Entrepreneurship in economy • Global and Local Entrepreneurial Landscapes • Role of Incubators and Accelerators • Case Studies of Successful Startups	6
2	**Developing a Startup Mindset** • Cultivating an Entrepreneurial Mindset • Market Analysis and Segmentation • Opportunity Recognition • Innovation and Idea Generation • Feasibility Analysis of Business Ideas • Role of innovation in Entrepreneurship • Fostering creativity • Practical Exercises and Workshops on Creative Problem Solving	8
3	**Business Model Development** • Introduction to Business Models • Lean Startup Methodology • Prototyping and Minimum Viable Product (MVP) • Financial Projections and Budgeting • Various forms of Business Ownership • Compliance and Legal Regulations • Operations and Supply Chain Management • Human Resource Management	10

	• Developing a marketing Strategy • Managing Growth Challenges	
4	**Technological Innovation and Intellectual Property** • Technology and Entrepreneurship • Intellectual Property Basics (Patents, Trademarks, Copyrights) • Patent Search and Analysis • Strategies for Protecting Intellectual Property • Ethical Considerations in Technology and Innovation	**8**
5	**Fundraising and Investment Strategies** • Fundraising Options for Startups • Angel Investors and Venture Capital • Crowdfunding Platforms • Financial Modelling for Startups • Crafting an Effective Pitch	**7**
		39

Books Recommended:

1. Alexander Osterwalder and Yves Pigneur, Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, John Wiley & Sons, Jul2010.
2. Peter Thiel and Blake Masters, Zero to One: Notes on Startups, or How to Build the Future, Virgin Books, 2015.
3. Alejandro Cremades, The Art of Startup Fundraising: Pitching Investors, Negotiating the Deal, and Everything Else Entrepreneurs Need to Know" by, John Wiley & Sons, Inc., Hoboken, New Jersey, 2016.
4. Christensen, Clayton M. The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail. Boston, MA: Harvard Business School Press, 1997.
5. Brad Feld and Jason Mendelson, Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist, Wiley; 4th edition, 1 October 2019.

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

Program: Common to all Programs.	Group B	S.Y B. Tech.	Semester: III
Course: Professional and Business Communication Tutorial (DJS23ITHSX05)			

Objectives:

1. To inculcate professional and ethical attitude at the workplace
2. To enhance communication and interpersonal skills
3. To develop effective employability skills
4. To hone written skills for technical documentation

Outcomes: On completion of the course, the learner will be able to:

1. Apply group discussion techniques in professional situations
2. Use employability skills to optimize career opportunities
3. Employ storytelling techniques for effective presentation
4. Prepare technical documents using appropriate style, format, and language
5. Analyze the concept of professional ethics
6. Demonstrate interpersonal skills in professional and personal situations

Professional and Business Communication (DJS23ITHSX05)		
	The course is designed to equip students with essential skills, crucial for navigating the contemporary job market successfully and fostering a positive work environment through effective communication and collaboration. The assignments comprise of a combination of interactive activities, discussions, case studies and real-world simulations, to help students, not only to ace job interviews and professional interactions, but also to contribute positively to the ethical and productive functioning of any organization. For the project work, students must prepare and present a well-researched and persuasive business proposal, in groups, integrating the skills and knowledge acquired throughout the course.	
Unit	**Description of Tutorial Activities**	**No of Assignments**
1	**Group Discussion:** Purpose of a GD, types of GD, criteria for evaluating GD, Dos and Don'ts of GD **Activity:** *The students will be divided into groups of 8-12 and each group will be given a topic/case to discuss within a given time frame. Each student will submit a write-up on their observations of the GD.*	1
2	**Employment Skills** **Resume Writing:** Types of resumes, structure, content, and formatting of resume **Activity:** *The students will prepare and submit their individual resume according to the professional requirements.* **Interview Skills:**	2

	Types and modes of interview, Preparation for interview, Dos and Don'ts of interview, frequently asked questions during interview **Activity:** *The students will submit a write-up on the FAQs and participate in mock interviews*	
3	**Corporate Story Telling:** Elevator pitch, product stories, event stories, stories in presentations, storytelling in SOPs and interviews, storytelling to manage conflict or to motivate. **Activity:** *The students will be divided into groups of 8-12 and asked to give a team presentation using storytelling technique and submit the hardcopy of the ppt.*	1
4	**Technical Writing and Documentation** **Business Proposal Writing:** Types of business proposals, format of proposal, language and style, presentation of proposal **Meeting Documentation:** Planning layout of meetings, observing meeting decorum, drafting notice, agenda, and minutes of meeting **Activity:** *The students will be divided into groups of 8-12 and each group will conduct a mock meeting based on an agenda and submit a writeup of the meeting documentation.*	1
5	**Professional Ethics:** Effective work habits, accountability, integrity, and excellence **Activity:** *The students will be divided into groups of 8-12 and each group will analyse a case involving an ethical issue and submit the writeup.*	1
6	**Interpersonal Skills** **Team Building:** Difference between group and team, importance of teamwork, strategies to be a good team player **Activity:** *The students will be divided into groups of 8-12 and each group will be assigned a task to be accomplished as a team, for which they will submit the writeup.* **Leadership:** Types of leadership, leadership styles, case studies **Activity:** *Each student will submit a writeup involving a leader they admire, analysing various aspects of his leadership style.* **Time Management:** Importance of time management, cultural views of time, 80/20 rule, time wasters, setting priorities and goals **Activity:** *Each student will submit a writeup about a case involving time management.*	2

Batchwise tutorial work of minimum eight assignments from the above suggested list or any other assignments based on the syllabus will be included, which would help the learner to apply the concepts learnt.

Books Recommended:

1. Fred Luthans, *"Organizational Behavior",* McGraw Hill, edition
2. Lesiker and Petit, *"Report Writing for Business",* McGraw Hill, edition
3. Huckin and Olsen, *"Technical Writing and Professional Communication",* McGraw Hill
4. Wallace and Masters, *"Personal Development for Life and Work",* Thomson Learning, 12th edition
5. Heta Murphy, *"Effective Business Communication",* Mc Graw Hill, edition
6. Sharma R.C. and Krishna Mohan, *"Business Correspondence and Report Writing",* Tata McGraw-Hill Education
7. Ghosh, B. N., *"Managing Soft Skills for Personality Development",* Tata McGraw Hill. Lehman,
8. Bell, Smith, "Management Communication" Wiley India Edition, 3rd edition.
9. Dr. Alex, K.," Soft Skills", S Chand and Company
10. Subramaniam, R., "Professional Ethics" Oxford University Press.
11. Sandeep Das, "How Business Story Telling Works: Increase Your Influence and Impact" Penguin Random House India Pvt. Ltd.

Evaluation Scheme:

Continuous Assessment (A):

Term Work: - 50 marks.

Term Work shall comprise of:

Minimum 8 assignments: 25 marks.

Business Proposal presentation: 25 marks.

Program: Mechanical Engineering	S.Y. B.Tech	Semester: III
Course: Python for Mechanical Engineering Laboratory (DJS23MLMD301)		

Pre-requisite: - Structured Programming using C

Objectives:

1. To understand the coding environment of Python Programming
2. To apply python coding skills for various Mechanical problems.

Outcomes: On completion of the course, the learner will be able to:

1. Understand the coding environment of Python software.
2. Understand the basics of Python
3. To read, analyse and visualize data.
4. To apply the python skills for Mechanical problems.

Python for Mechanical Engineering Laboratory (DJS23MLMD301)		
Unit	**Description**	**Duration**
1	**Introduction to Python:** Python history, Introduction to Anaconda, Spyder IDE, how to go about programming, understanding of the layout of the programming environment and spyder.	**04**
2	**Basics of Python:** Assignment Statement, variable and datatypes, Loops, Strings, Lists, Operators, Arrays, Sorting, Functions and Dictionaries.	**06**
3	**Data Handling and Manipulation:** Reading Data, Introduction to Pandas Dataframe and Numpy, Data Visualization, exploratory Data Analysis.	**06**
4	**Using Python for Mechanical Applications (Design, Thermal and Manufacturing.**	**10**
	Total	**26**

Python for Mechanical Engineering Laboratory (DJS23MLMD301)	
Sr. No.	**Suggested Programs**
1	Program to demonstrate the input function
2	Program to calculate the discounted price of a product
3	Program to calculate BMI Index
4	Program to print the multiplication table of 7
5	Program to calculate the sum of first n integers
6	Program to print the factorial of a given number
7	Program to manage visitors at a police station
8	Program to perform mathematical operations on a sequence of 5 numbers entered by the user
9	Program to calculate area and perimeter
10	Program to print numbers in descending order

11	Program to perform numerical operations on a list
12	Program to find second maximum and second minimum in a list
13	Program to print numbers which are not multiples of 5
14	Program to flip digits of a binary number
15	Program to demonstrate Fizz buzz game
16	Program to draw a square in Turtle
17	Program to draw letter E in Turtle
18	Program to draw concentric circles in Turtle
19	Program to draw a pentagon in Turtle
20	Program to draw diagonally opposite squares in Turtle
21	Program to demonstrate understanding of try/except
22	Program to build a password generator
23	Program to plot natural frequency/time period against static deflection
24	Program to plot displacement, velocity and acceleration for a given spring mass system as separate plots
25	Program to plot displacement, velocity and acceleration for a given spring mass system on a single plot
26	Program to determine driving tensions of a belt drive
27	Program to determine current in an electric circuit which comprises of three closed loops
28	Program to determine displacement, velocity and acceleration of a particle with a known motion

Minimum 25 programs from the above suggested list or any other program based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Reference Books:

1. Problem Solving and Programming; S. Kuppuswamy, S. Malliga, C.S. Kanimozhi Selvi, K. Kousalya; 2019; Tata McGraw Hill.
2. Introducing Python Modern Computing in Simple Packages; Bill Lubanovic; 1 st edition; 2014; O'Reilly Media
3. Python: The Complete Reference; Martin C; 1 st edition; 2018; Tata MacGrawHill
4. Core Python Programming; R. Nageswara Rao; 2 nd edition; 2018; DreamTech Press
5. Let Us Python; Yashavant Kanetkar; 2019; BPB Publication

Laboratory: (Term work)

Term work shall consist of minimum 25 programs, 1 Mini Project.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 20 Marks

ii. Mini Project: 05 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Program: Mechanical Engineering	S.Y B. Tech	Semester: III
Course Code: Manufacturing Process Laboratory (DJS23MLSC301)		

Objectives:

1. To impart the knowledge of machine tools and basic machining processes like turning, drilling,boring, broaching, milling, shaping, planning, slotting, and grinding etc.
2. To provide an insight to different machine tools, accessories, and attachments.
3. To train the students in machine operations to enrich their practical skills.
4. To inculcate team qualities and expose students to shop floor activities
5. To educate the students about ethical, environmental and safety standards.

Outcomes: learner will be able to:

1. Demonstrate precautions and safety norms followed in Machine Shop and exhibit interpersonalskills towards working in a team.
2. Read working drawings, understand operational symbols, select cutting parameter and tooling, and execute machining operations.
3. Understand the construction, working and operation of various conventional machine tools, andvarious accessories and attachments used.
4. Perform a wide range of machining operations including turning, threading, shaping, keyway cutting, indexing, and gear cutting while estimating cutting times, as well as emphasizing the significance of grinding and super finishing operations in machining processes.
5. Prepare programs, demonstrate, simulate, and operate CNC machines for various machining operations.

Exp.	Experiments
1	One job involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning on lathe machine. Exercises should include selection of cutting parameters and cutting time estimation.
2	One job involving Cutting of Gear Teeth / Hexagonal nut using Milling Machine and Cutting of V Groove / dovetail / Rectangular groove using a shaper. Exercises should include selection of cutting parameters and cutting time estimation.
3	One job (Group Job) using cylindrical grinding machine. Exercises should include selection of cutting parameters and cutting time estimation.
4	One job involving programming, simulation, and fabrication of the component on a CNC Turning centre.

Books Recommended:

Reference Books:

1. Workshop Technology by W. A. J. Chapman Vol I & II
2. Workshop Technology by Hazra Choudhary Vol. I & II

Prepared by Checked by Head of the Department Principal

Program: Mechanical Engineering	S.Y B.Tech	Semester: III
Course: Innovative Product Development I (DJS23IPSCX01)		

Objectives:

1. To acquaint the students with the process of identifying the need (considering a societal requirement) and ensuring that a solution is found out to address the same by designing and developing an innovative product.
2. To familiarize the students with the process of designing and developing a product, while they work as part of a team.
3. To acquaint the students with the process of applying basic engineering fundamentals, so as to attempt at the design and development of a successful value-added product.
4. To inculcate the basic concepts of entrepreneurship and the process of self-learning and research required to conceptualize and create a successful product.

Outcomes: On completion of the course, the learner will be able to:

1. Identify the requirement for a product based on societal/research needs.
2. Apply knowledge and skills required to solve a societal need by conceptualizing a product, especially while working in a team.
3. Use standard norms of engineering concepts/practices in the design and development of an innovative product.
4. Draw proper inferences through theoretical/ experimental/simulations and analyze the impact of the proposed design and development of the product.
5. Develop product/project management skills, interpersonal skills, self-learning and effective communication eventually preparing them to be successful entrepreneurs.

Guidelines for the proposed product design and development:

- Students shall form a team of 3 to 4 students (max allowed: 5-6 in extraordinary cases, subject to the approval of the department review committee and the Head of the department).
- Students should carry out a survey and identify the need, which shall be converted into conceptualization of a product, in consultation with the faculty supervisor/head of department/internal committee of faculty members.
- Students should recognize the essential requirements for product development and choose the most suitable design in consultation with the faculty supervisor.
- Students shall transform the most appropriate design solution into a functional model, incorporating components from their specific domain and related interdisciplinary fields.
- Throughout the two-semester duration of the activity, faculty supervisors will provide guidance to students, with a primary emphasis on self-directed learning.
- Each team is required to maintain an activity log-book, where they can document their weekly progress. The guide or supervisor should review the recorded notes and comments and provide approval on a weekly basis.
- Students should validate the design solution with appropriate justifications and compile a report in a standard format for submission to the department. Additionally, students are encouraged to make efforts to publish a technical paper, either in the institute journal ‘Techno

Focus: Journal for Budding Engineers' or in a suitable publication approved by the department's research committee or the Head of the department.

- The focus should be on self-learning, capability to design and innovate new products as well as on developing the ability to address societal problems. Advancement of entrepreneurial capabilities and quality development of the students through the year long course should ensure that the design and development of a product of appropriate level and quality is carried out, spread over two semesters, i.e. during the semesters III and IV.

Guidelines for Assessment of the work:

- The review/ progress monitoring committee shall be constituted by the Head of the Department. The progress of design and development of the product is to be evaluated on a continuous basis, holding a minimum of two reviews in each semester.
- In the continuous assessment, focus shall also be on each individual student's contribution to the team activity, their understanding and involvement as well as responses to the questions being raised at all points in time.
- Distribution of marks individually for the both reviews as well as for the first review during the subsequent semester shall be as given below:
    - Marks awarded by the supervisor based on log-book: 10
    - Marks awarded by review committee: 10
    - Quality of the write-up: 05

A candidate needs to secure a minimum of 50% marks.

Review/progress monitoring committee may consider the following points during the assessment.

- In the semester III, the entire design proposal shall be ready, including components/system selection as well as the cost analysis. Two reviews will be conducted based on the presentation given by the student's team.
    - First shall be for finalization of the product selected.
    - Second shall be on finalization of the proposed design of the product.
- In the semester IV, the expected work shall be procurement of components/systems, building of the working prototype, testing and validation of the results based on work completed in semester III.
    - First review is based on readiness of building the working prototype.
    - Second review shall be based on a presentation as well as the demonstration of the working model, during the last month of semester IV. This review will also look at the readiness of the proposed technical paper presentation of the team.

The overall work done by the team shall be assessed based on the following criteria;

1. Quality of survey/ need identification of the product.
2. Clarity of Problem definition (design and development) based on need.

3. Innovativeness in the proposed design.
4. Feasibility of the proposed design and selection of the best solution.
5. Cost effectiveness of the product.
6. Societal impact of the product.
7. Functioning of the working model as per stated requirements.
8. Effective use of standard engineering norms.
9. Contribution of each individual as a member or the team leader.
10. Clarity on the write-up and the technical paper prepared.

• The semester reviews (III and IV) may be based on relevant points listed above, as applicable.

Guidelines for Assessment of Semester Reviews:

- The write-up should be prepared as per the guidelines given by the department.
- The evaluation of the product's design and development will involve a presentation and demonstration of the working model by the student team. This assessment will be conducted before a panel of Internal and External Examiners, preferably with more than five years of experience in industry or research organizations. The Head of the Institution approves the selection of these examiners. The presence of an external examiner is desirable only for the second presentation during semester IV. Additionally, students are required to present an outline of the technical paper they have prepared during the final review in semester IV.

Program: Common to all Programs.	Group: B	S.Y B. Tech.	Semester: III
Course: Community Engagement Service (DJS23ILELX11)			

Pre-requisite:

1. Fundamentals of core branch
2. Communication Skills

Objectives:

1. To sensitise the student / learner into recognising community level problems & challenges and give them an opportunity to engage in activities for solving the same.

Outcomes: On completion of the course, the learner will be able to:

1. Applies knowledge understandings acquired from one's academic study/ field/ discipline for community level education, information dissemination by participation and engagement in community welfare activities.
2. Identify and experience commitment for community engagement activities that reinforce sense of belongingness and gratitude towards societal cause.
3. Witness diversity in communities and cultures and demonstrate change in approach / attitude as, an evidence of unconditional acceptance.
4. Recognise, experience and value, effectiveness of working in a team, demonstrating co-existence of the roles - sincere worker and effective leader.

Unit	Description
1	**Open Activities** • Participation in: blood donation camps organizer / donor, day-long tree plantation or afforestation / seed dispersal / cleanliness (water bodies, surrounding etc.) drives. • Literacy drives for children / youth / adults. One day hand holding activities in work-shop conduct for under privilege kids in the areas of – basic science, math, technical skill demonstration and building.
2	**Technical (Program core related)** • Cyber-crime, security awareness and vulnerabilities – sensitization, information dissemination and awareness sessions in indicated focus areas. Promotion and Sensitization for Sustainable living – focusing on solar power, water recycling, e-waste responsible disposal, waste recycling etc. in indicated focus areas. Focus areas: residential societies, schools, under-privileged areas, governments /private offices, and similar other establishments. **OR** **Field Survey** Reporting on proactively conducted survey in the areas of resource management for – water, vegetables, electricity, crops etc.

Activities to be performed
Among the listed activities students are expected to complete one open activity mandatorily, and one technical (program core) OR field survey activity. The activities mentioned are exemplary in nature and any other additional activity of similar nature too can be undertaken by the learners, provided it is approved and endorsed by the faculty mentor / head of the department.

Suggested Activities

1. Undertaking cyber safety / security awareness sensitization drive / program especially for un-initiated students / individuals in schools / colleges / residential complex / offices etc. Typical suggested tabulation.

Participant No.	Name	Age	School/ College/ Residence/ Office	Email	Contact Number	Awareness Level	Remarks

2. Energy / Power assessment for establishments (societies, schools, colleges, residential complex, shops etc.) involving computing power devices ratings, power consumption over operating period, calculating energy cost from tariff card / rates for every group of appliances / devices or equipment. Typical suggested tabulation pattern.

Device/Appliance Group	Number of appliances / devices	Power Rating (kW)	Operating Hours (h/day)	Energy Consumption (kWh/day)	Tariff Rate (Rs. / kWh)	Energy Cost (Rs.)
Lighting Fixtures						
Ceiling Fans						
Air Conditioner (AC)						
Security Systems						
Water Pump						

3. Traffic light monitoring viz-e-viz average traffic density on road. Analysing the data and commenting on results. Evaluating and comparing impact on road repairs related lane blockage and proportional recommendation for lights timing variations. Typical suggested tabulation pattern.

Sr. No.	Timestamp	Traffic Density	Traffic Light Status	Road Repair Status	Remarks

4. Help compute green footprint of select number of household (per member) - say 10 houses of 3+ members. This is for evaluating dependence upon non green energy sources and habits and changes in lifestyle for attempts at their reductions. Learners are encouraged to use typically available online carbon-footprint calculators. The table herewith maybe used for reference calculations.

House No.	House hold Name	Number of Members	Energy Usage (kWh)	Water Usage (liters)	Waste Production (kg)	Transportation Habits	Green Footprint

5. Compulsion of having a borewell for non-potable water supply in city residential complexes is a modern-day rule. Increased pace of re-development, as well as number of occupants in given area, has resulted in increased number of borewells being dug within and outside city limits. Reduced yield, quality and quantity of water adds to the recurring maintenance cost of borewells, especially in the city areas. Poor water recharge systems along-with depleting open soil cover area in wake of wall-to-wall of concrete carpet aggravate the problem. Study, analyse and report a residential society's – capacity of water requirement, present day borewells in action, approximate yield, maintenance cost and frequency, borewell flushing iterations in wake of redevelopment in neighborhood. A typical tabulation mechanism for inferences can be as below:

Borewell No.	Location	Depth (ft)	Yield (Liters/Day)	Water Quality	Maintenance Cost (Rs.)	Remarks

6. Detection of Adulteration in food / fruits / vegetables / milk / mava /saffron etc. or contamination of potable drinking water.
   Ex. Adulteration in fruits could be apple waxing, injecting chemicals in watermelon, pomegranate etc. to give it a bright red color, artificial ripening of mangos etc.
   For a given activity, samples from more than one area, specifically from mofussil /interiors / 'gaothans' etc, may be obtained, to evaluate sample purity or extent of adulteration. Learners are encouraged to use online resources provided by 'Food Safety and Standards Authority of India' (*fssai*), for handholding in requisite procedures.
   YouTube link:
   Food Safety and Standards Authority of India: goo.gl/Y8Lzbu
   Ex. 1 Milk Adulteration: https://www.youtube.com/watch?v=pbnmeRUBxKk
   Ex.2 Watermelon Adulteration: https://www.youtube.com/watch?v=yrLAj7oJies

Product	Adulterant	Testing Method	Result	Remarks

Certificates and Formats:

Activity Endorsement Certificate

Date:

Community engagement service is a mandatory course, of two credits, introduced at second year of engineering under the autonomous structure of the institute.

Course objective: To sensitise the student / learner into recognising social problems & challenges and give them an opportunity to engage in activities for solving the same.

Course outcomes:

1. Knowledge application: Applies knowledge understandings acquired from one's academic study/ field/ discipline for community level education, information dissemination by participation and engagement in community welfare activities.
2. Commitment for cause: Identify and experience commitment for community engagement activities that reinforce sense of belongingness and gratitude towards societal cause.
3. Diversity: Witness diversity in communities and cultures and demonstrate change in approach / attitude as an evidence of unconditional acceptance.
4. Team: Recognise, experience and value effectiveness of working in a team, demonstrating co-existence of the roles - sincere worker and effective leader.

This is to certify that Mr./Ms. _____ bearing SAP ID _____ is a student of S.Y. B.Tech., _____ branch of engineering. He / She is a bonafide student of SVKM's Dwarkadas J. Sanghvi College of Engineering, Mumbai. He / She is reliable, sincere, hardworking and capable of conducting _____ _____activity in your premises. We request you to kindly allow for the conduction of the activity and we also solicit your earnest co-operation in the same.

Signature
Name of Department Head:

Disclaimer

(This form must be read, signed, and submitted prior to the beginning of the community service activity.)

Student Details	**Activity Details**
Name	
SAPID	Date
Program	Time
Class/Div	Address

I, the undersigned _____ accept the following terms and conditions unconditionally:

1. I accept and understand that the community activity identification and selection has been done willingly by me.
2. I undertake to convey that, I am apparently in good health and well-being, and suffer no physical impairment that would or should prevent my participation in the activity.
3. I undertake to bear all related expenses and risk of travel related to the activity and shall not hold any personnel from the institute responsible with regards to claims and / or loss in the process of conduct of activity.
4. I undertake that my parents or legal/local guardians are aware of said activity and agree to above mentioned terms and conditions.

Student's name & signature: _____

Parent or Guardian's name & signature: _____

Guidelines for Assessment of the work

• The review/progress monitoring committee shall be constituted by the Head of the Department. The progress of selected/assigned activities is to be evaluated on a continuous basis, holding at-least one review in the semester.

• In the continuous assessment, focus shall also be on each individual student's contribution to the team activity, their understanding and involvement as well as responses to the questions being raised at all points in time.

• Each group needs to submit following forms to respective supervisor after conducting both the activities,

- Activity Conduction Report
- Participant Feedback (online / offline)
- Participant Attendance (online / offline)
- Survey Report
- Participation certification

Forms for Technical Activity:

1. Activity Conduction Report

Sr. No.	**Name of the Activity**	
1	Date of Activity	
2	Activity type Open / Technical	
3	Activity objectives	
4	Place of Activity	
5	SAP id and Names of students	
6	Name of the Association	
7	Activity description	
8	No. of participants	
9	Photos (Geo tagged)	

2. Participant feedback (online / offline):

Sr. No.	**Indicators**	**Scale: 1 (Lowest) to 5 (Highest)**
1	The objectives of the training were clearly defined.	
2	The content was organized and easy to follow.	
3	This training experience will be useful to me.	
4	The trainer was knowledgeable about the training topics.	
5	The training objectives were met	

Evaluation Scheme:

Continuous Assessment (A):

Term Work: - 25 marks, distribution as herewith:

1.Rubric for Open Ended Activity (10 marks)

- Participation certificate/proof

2.Rubric for Technical Activity (15 marks)

Sr. No.	**Performance Indicators** (Maximum marks per indicator are given in bracket)	**Marks**
1	Pre-requisite documents (permission letter, presentation material, permission letters, etc.) [05 marks]	
2	Participant Feedback [05 marks]	
3	Participant attendance [05 marks]	
	TOTAL	

OR

3.Rubric for Field Survey Activity:

Sr. No.	**Performance Indicators** (Maximum 03 marks per indicator)	**Marks**
1	Topic selection	
2	Survey preparation	
3	Field work	
4	Analysis	
5	Report writing	
	TOTAL	

Prepared by Checked by Head of the Department Principal

Semester IV

Program: Mechanical Engineering	S.Y. B. Tech	Semester: IV
Course: Numerical and Statistical Techniques (DJS23MCPC401)		
Course: Numerical and Statistical Techniques Laboratory (DJS23MLPC401)		

Pre-requisite: --

3. Basics of Probability.
4. Mathematics I and Mathematics II.
5. Mathematics for Mechanical Engineering.

Objectives:

5. To apply differential equations to solve the applications in the domain of design, thermal, fluid mechanics, structural, etc.
6. To interpret statistical measures for quantitative data.
7. To develop regression models and predict the system's behavior for the experimental and field failure data.
8. To apply the laws of probability and probability distributions for modeling and analyzing the data.
9. To understand uncertain occurrences in data in a logical manner.

Outcomes: On completion of the course, the learner will be able to:

1. Analyze the statistical data using the concepts of correlation and regression.
2. Solve partial differential equations by applying numerical methods.
3. Apply the theoretical discrete and continuous probability distributions in the relevant application areas.
4. Examine data using different hypothesis tests and make conclusions about acceptance and rejections of sample data.
5. Apply the Chi-Square test to assess relationships between variables and interpret the significance of the results in real-world contexts. Analyze the variances of multiple variables simultaneously.

Numerical and Statistical Techniques (DJS23MCPC401)		
Unit	**Description**	**Duration**
1	**Regression Analysis:** Statistical diagram: scattered diagram. Correlation: Karl Pearson's Coefficient of correlation and its mathematical properties, Spearman's Rank correlation and its interpretations. The measure of association between two variables. Linear Regression. **Partial Differential Equations [PDE]:** Bender-Schmidt Method and Crank- Nicolson method.	**07**
2	**Probability:** Discrete and Continuous random variables, Probability mass and density function, Probability distribution for random variables, Expected value, and Variance. **Probability distributions:** Discrete – Binomial, Poisson. Continuous - Normal.	**09**
3	**Test of Hypotheses:** **Sampling distribution:** Test of Hypothesis. Level of significance, critical region. One-tailed and two-tailed tests. Interval Estimation of population parameters. Large and small samples. **Test of significance for large samples:** Test for significance of the difference between	**06**

	samples mean and population means, Test for significance of the difference between the means of two samples. **Test of significance of small samples:** Student's t-distribution and its properties, Test for significance of the difference between samples mean and population means, Test for significance of the difference between the means of two Samples, paired t-test.	
4	**Chi Square Distribution:** Chi-square test, Test for the Goodness of fit, Association of attributes. **Analysis of Variance (F-Test):** One-Way classification, Two-way classification (short-cut method).	**04**
	Total	**26**

Numerical and Statistical Techniques Laboratory (DJS23MLPC401)	
Sr. No	**Suggested experiments** (Experiments should be performed using suitable software package/ programming language whenever required)
1	Develop a program to compute the correlation coefficient and analyse the relationship between two variables.
2	Generate a program to perform linear regression, determine the regression line equation, and analyse the fit.
3	Write a program to numerically solve PDEs using the explicit Bender-Schmidt method for heat conduction problems.
4	Develop a program to solve PDEs using the implicit Crank-Nicolson method for time-dependent problems.
5	Create a program to compute the expected value and variance for a given set of data or probability distribution.
6	Design a program to generate and analyse binomial or Poisson distributions for various parameters.
7	Write a program to generate and analyse normal distribution curves with specified mean and variance.
8	Write a program to perform a Z-test for large sample hypothesis testing and interpret the results
9	Develop a program to conduct t-tests for comparing sample means under different conditions and draw conclusions.
10	Create a program to apply the chi-square test for goodness of fit or independence and analyse the findings.
11	Implement a program to carry out ANOVA for comparing multiple samples means and determine statistical significance.

A minimum of eight experiments from the above-suggested list or any other experiment based on the syllabus will be included, which would help the learner to apply the concept learned.

Books Recommended:

Textbooks:

- B. S. Grewal, 'Numerical Methods in Engineering and Science', Khanna Publication, 2018.
- B. S. Grewal, 'Higher Engineering Mathematics', Khanna Publication, 2012.

Reference Books:

- Erwin Kreyszig, 'Advanced Engineering Mathematics', Wiley India, 2010.

- Joe D. Hoffman, and Steven Frankel, 'Numerical Methods for Engineers and Scientists', CRC Press, 2018.
- Sheldon M. Ross, 'Introduction to Probability and Statistics for Engineers and Scientists', 5e, by Elsevier Academic Press, 2014.
- S. C. Gupta, V. K. Kapoor, 'Fundamentals of Mathematical Statistics', Sultan Chand & Sons –2020.
- P. Kandasamy, K. Thilagavathy, and K. Gunavathi, 'Numerical methods', S Chand and Company, 2006.

Web References:

- Numerical Methods for Engineers (https://nptel.ac.in/courses/127106019)
- Applied Numerical Methods (https://nptel.ac.in/courses/112104318)
- Probability and Statistics (https://nptel.ac.in/courses/111105041)

Program: Mechanical Engineering	**S.Y B. Tech**	**Semester: IV**
Course: Mechanics of Materials (DJS23MCPC402)		
Course: Mechanics of Materials Laboratory (DJS23MLPC402)		

Pre-requisite: --

1. Basic knowledge of Engineering Mechanics.
2. Basic knowledge of types of loads, free body diagram and beams.

Objectives:

1. To gain knowledge of different types of stresses, strains and deformations induced in the mechanical components due to external loads.
2. To study the distribution of various stresses in the mechanical elements that deform under loads.
3. To study the effect of component dimensions and properties of materials due to stresses and deformations.

Outcomes: On completion of the course, the learner will be able to:

1. Evaluate stresses, strains, deformation and properties of materials in mechanical components/ structures.
2. Draw SFD and BMD for different types of loads and support conditions for a beam.
3. Compute and plot direct, bending and shear stresses across sections of given beam.
4. Compute torsional shear stresses and strain energy in mechanical components.
5. Compute deflections and slopes in beams and analyze buckling phenomenon in columns and struts.

Mechanics of Materials (DJS23MCPC402)		
Unit	**Description**	**Duration**
1	**Stress and Strain:** Definition, Simple stress-strain, uni-axial, bi-axial and tri-axial stresses, tensile stress, compressive stress and shear stresses, elastic limit, Hooke's law, deformation due to self-weight, bars of varying sections, composite sections, deformation of tapering members, Thermal Stresses. Theories of failures. **Elastic Constants and their relations:** Poisson's ratio, Modulus of elasticity, Modulus of rigidity, Bulk modulus, yield stress, ultimate stress. Factor of safety, state of simple shear, relation between elastic constants, Volumetric strain for tri-axial loading. **Principal stresses and Strains:** Principal plane and principal stresses, analytical and graphical method (Mohr's circle) for determining of stresses on oblique section.	10
2	**Shear Force and Bending Moment in Beams:** Axial force, shear force and bending moment diagrams for statically determinate beams (excluding beams with internal hinges), relationship between rates of loading, shear force and bending moment. **Moment of Inertia:** Area Moment of Inertia, Parallel axis theorem, Polar moment of inertia, Principal axes, Principal moment of inertia.	6

3	**Bending stresses:** Theory of pure Bending, Assumptions, Flexural formula for straight beams, moment of resistance, bending stress distribution, Section modulus, beams of uniform strength. **Direct & Bending Stresses:** Combined stresses, Eccentricity, Stress distribution, Core /kernel of Section. **Shear Stresses:** Distribution of shear stresses for the section of beam.	7
4	**Torsion:** Torsion of circular shafts-solid and hollow, stresses in shafts when transmitting power, shafts in series and parallel. **Strain Energy:** Resilience, Proof Resilience, strain energy stored in the member due to gradually applies load, suddenly applied load, impact load. Strain energy stored due to Shear, Bending and Torsion.	8
5	**Deflection of Beams:** Deflection of Cantilever, simply supported and over hanging beams using Macaulay's or double integration method for different type of loadings. **Columns and Struts:** Buckling load, crushing load, Types of end conditions for column, Euler's column theory and its limitations, Rankine- Gordon Formula.	8
	Total	**39**

Mechanics of Materials Laboratory (DJS23MLPC402)	
Exp.	**Suggested experiments**
1	Tension test on mild steel bar (stress-strain behavior, determination of yield strength and modulus of elasticity) using a Universal Testing Machine (UTM).
2	Impact test on the metal specimen (Izod test/ Charpy test).
3	Hardness test on metals – (Brinell Hardness Number / Rockwell Hardness Number).
4	Flexural test on beam (central loading).
5	Flexural test on beam (two point loading).
6	Torsion test on mild steel bar / cast iron bar.

- Above tests are conducts as per the ASTM standard.
Minimum five experiments from the above-suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Assignments:
Minimum five assignments based on syllabus will be conducted Or Mini project relevant to the subject, which would help the learner to apply the concept learnt.

Books Recommended:
Text books:

- S. Ramamrutham, Strength of Materials, Dhanpat Rai Pvt. Ltd.
- S.S.Ratan, Mechanics of Materials, Tata McGraw Hill Pvt. Ltd.

- R. Subramanian, Strength of Materials, Oxford University Press, Third Edition 2016.

Reference Books:

- Ryder, Strength of Materials , Macmillan.
- James M. Gere and Barry J. Goodno, Mechanics of Materials , Cengage Learning.
- Gere and Timoshenko, Mechanics of Materials, CBS.
- Basavrajaiah and Mahadevappa, Strength of Materials, Khanna Publishers,New Delhi.
- Timoshenko and Youngs, Elements of Strength of Materials, Affiliated East -West Press.
- Beer, Jhonston, DEwolf and Mazurek, Mechanics of Materials , TMH Pvt Ltd., New Delhi.
- S.B. Junnarkar, Mechanics of Structures, Charotar Publication.
- Shames, Introduction to Solid Mechanics by, PHI.
- Nag and Chandra, Strength of Materials by, Wiley India.
- W.Nash, Strength of Materials, Schaum's Outline Series, McGraw Hill Publication, Special Indian Edition.

Program: Mechanical Engineering	**S.Y. B. Tech**	**Semester: IV**
Course: Advanced Manufacturing Processes (DJS23MCPC403)		

Objectives:

1. To familiarize the students with unconventional modern machine tools & manufacturing practices.
2. To familiarize oneself with various micro manufacturing techniques like Meso, Micro and Nano manufacturing.
3. To acquaint the knowledge of additive manufacturing processes, and its capabilities in the modern digital manufacturing industry.

Outcomes: learner will be able to:

1. Illustrate the fundamentals of various non-conventional machining processes, highlighting their capabilities and areas of application.
2. Understand the operation of MEMS micro devices and microsystems, including their applications and manufacturing processes, such as bulk and surface micromachining techniques.
3. Gain insights into micro machining techniques as well as the challenges and methods involved in MEMS packaging.
4. Understand the principles of various nano-finishing techniques essential for enhancing surface quality and achieving ultra-smooth surfaces at the nanoscale level.
5. Review the differences between traditional and additive manufacturing techniques, while understanding the fundamental principles of various additive manufacturing (AM) technologies, including solid-based, liquid-based, and powder-based techniques.

Module	Contents	Hrs.
01	**Unconventional machining processes:** Classification of the Non-traditional machining process. Basic principles, machines, advantage, disadvantages, and applications of water jet machining (WJM), Abrasive jet machining (AJM), abrasive water jet machining (AWJM), ultrasonic machining (USM), electrical discharge machining (EDM), chemical machining (CHM), electrochemical machining (ECM), laser beam machining (LBM), plasma arc machining (PAM), electron beam machining (EBM). **Introduction to Hybrid machining**	08
02	**MEMS Introduction:** Intrinsic Characteristics of MEMS, Components of MEMS, Applications of MEMS and Microsystems, Overview of Commonly Used Mechanical Structures in MEMS (Beams, Cantilevers, Plates, Diaphragms), and Typical Applications. **MEMS Fabrication Technology** Challenges in Meso, Micro and Nano manufacturing, Overview about micro fabrication methods: Chemical vapour deposition (CVD); physical vapour deposition (PVD), optical and electron beam lithography; dry and wet etching.	09
03	**Micro Machining** Mechanics of micro machining, difference between micro and macro machining Micro	06

	turning, Micro Milling, Micro grinding. **MEMS packaging challenges, MEMS packaging process.**	
04	**Nano Finishing Techniques** Abrasive flow machining (AFM), magnetic abrasive finishing (MAF), magneto rheological finishing (MRF), magneto rheological abrasive Flow Finishing (MRAFF), magnetic float polishing (MFP), elastic emission machining (EEM), chemical mechanical polishing (CMP).	06
05	**Additive Manufacturing (AM)** Introduction to Additive Manufacturing (AM): History of AM, traditional manufacturing v/s additive manufacturing, discussion on various materials used in AM, role of solidification rate in AM, and the influence of grain structure and microstructure in AM. **Extrusion based AM processes:** Fused deposition modelling (FDM), history of FDM, basic principles, material requirements, benefits and limitations, and post-processing. **Powder Bed Fusion AM Process:** Selective laser sintering (SLS): process workflow and material requirements, powder fusion mechanism, polymer ageing and recycling. **Vat Polymerization AM process:** Stereo lithography apparatus (SLA), history of SLA, material requirements, workflow, scan patterns, applications, benefits and limitations.	10
	Total	**39**

Books Recommended:

Reference Books:

- Jain V. K, "Advanced Machining Processes", 12th reprint, Allied Publishers Ltd, 2010.
- Hassan Abde, Gabad El Hoffy, "Advanced Machining Processes", McGraw Hill, 2005.
- Tai-Ran Hsu, "MEMS and Microsystems: Design, Manufacture, and Nanoscale Engineering", Wiley publications, 2020.
- Jain V. K, "Introduction to Micromachining", Narosa Publishing House, 2010.
- Mark J. Jackson, "Micro and Nano-manufacturing", McGraw Hill publications, 2015.
- N.P.Mahik, "Micro Manufacturing and Nanotechnology", Springer, 2006.
- M.J.Madou , "Fundamentals of microfabrication and nanotechnology Volume –II",3rd edition,CRC Press, 2011.
- Waqar Ahmed, Mark J. Jackson, "Emerging Nanotechnologies for Manufacturing",2nd Edition, Elsevier, 2015.
- Ian Gibson, David W. Rosen, Brent Stucker, "Additive manufacturing technologies: rapid prototyping to direct digital manufacturing", Springer, 2010.
- Andreas Gebhardt, "Understanding additive manufacturing: rapid prototyping, rapid tooling, rapid manufacturing", Hanser Publishers, 2011.
- O. P. Khanna, "A Textbook of Production Technology Vol.II.", Dhanpat Rai Publication, 2000.

Prepared by Checked by Head of the Department Principal

Program: All Program	**S.Y B. Tech**	**Semester: III / IV**
Course: Universal Human Values (DJS23ICHSX08)		
Course: Universal Human Values Tutorial (DJS23ITHSX08)		

Objectives:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life

Outcomes: On completion of the course, the learner will be able to:

On completion of this course, the students will be able to

1. Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society
2. Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.
3. Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society
4. Understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

Universal Human Values (DJS23ICHSX08)		
Unit	**Description**	**Duration**
1	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education** Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels	**4**
2	**Understanding Harmony in the Human Being - Harmony in Myself** Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body'. Understanding the Body as an instrument	**5**

	of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Self-regulation and health.	
3	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** Understanding harmony in the Family- the basic unit of human interaction, understanding values in human-human relationship; meaning of Justice and program for its fulfillment. Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family). Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family!	**9**
4	**Understanding Harmony in the Nature and Existence - Whole existence as Co-existence** Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence	**4**
5	**Implications of the above Holistic Understanding of Harmony on Professional Ethics:** Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.	**4**
	Total	**26**

Universal Human Values Tutorial (DJS23ITHSX08): (Term work)

Term work shall consist of a minimum 5 activities based on activities conducted.

The tutorials could be conducted as per the following topics: -

Activity No 1	Practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony, and co-existence) rather than as arbitrariness in choice based on liking-disliking.
Activity No 2	Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.
Activity No 3	Practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

Activity No 4	Practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.
Activity No 5	Practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. To discuss the conduct as an engineer or scientist etc.

The final certification and acceptance of term work will be subject to satisfactory performance of activities and upon fulfilling minimum passing criteria in the term work.

Books Recommended:

Text books:

- R R Gaur, R Sangal, G P Bagaria, 'Human Values and Professional Ethics' Excel Books, New Delhi, 2010.

Reference Books:

- A Nagaraj, "Jeevan Vidya: Ek Parichaya" Jeevan Vidya Prakashan, Amarkantak, 1999.
- A.N. Tripathi, "Human Values" New Age Intl. Publishers, New Delhi, 2004.
- The Story of Stuff (Book).
- Mohandas Karamchand Gandhi, "The Story of My Experiments with Truth".
- E. F Schumacher, "Small is Beautiful".
- Cecile Andrews, "Slow is Beautiful".
- J C Kumarappa, "Economy of Permanence".
- Pandit Sunderlal, "Bharat Mein Angreji Raj".
- Dharampal, "Rediscovering India".
- Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule".
- Maulana Abdul Kalam Azad, "India Wins Freedom".
- Romain Rolland, "Vivekananda". (English)
- Romain Rolland, "Gandhi". (English)

Program: Open Elective for all Programs	S.Y B.Tech.	Semester: IV
Course: Project Management (DJS23OCOE401)		

Pre-requisite:

1. Basic concepts of Management.

Objectives:

1. To familiarize the students with the use of a structured methodology/approach for every unique project undertaken, utilizing project management concepts, tools and techniques.
2. To appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure.

Outcomes: On completion of the course, the learner will be able to:

1. Explain project management life cycle and the various project phases as well as the role of project manager.
2. Apply selection criteria and select an appropriate project from different options.
3. Create a work break down structure for a project and develop a schedule based on it. Manage project risk strategically.
4. Use Earned value technique and determine & predict status of the project. Capture lessons learned during project phases and document them for future reference.
5. Differentiate between traditional waterfall approach and agile scrum methodology for software development projects.

Project Management (DJS23OCOE401)		
Unit	**Description**	**Duration**
1	**Project Management Foundation:** Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical). Project phases and stage gate process. Role of project manager, Negotiations and resolving conflicts, Introduction to project leadership, ethics in projects, Multicultural and virtual projects, Project management in various organization structures, PM knowledge areas as per Project Management Institute (PMI).	07
2	**Initiating Projects:** How to get a project started, selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter, Effective project team, Stages of team development & growth (forming, storming, norming &performing), team dynamics.	08
3	**Project Planning:** Work Breakdown structure (WBS) and linear responsibility chart, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques, PERT, CPM. Crashing project time & Resource loading and levelling (Only Theory), Project Stakeholders and Communication plan.	08

	Risk Management in projects: Risk management planning, Risk identification and risk register, Qualitative and quantitative risk assessment, Probability, and impact matrix. Risk response strategies for positive and negative risks.	
4	**Monitoring and Controlling Projects**: Planning monitoring and controlling cycle, Information needs and reporting, engaging with all stakeholders of the projects, communication and project meetings. Earned Value Management techniques for measuring value of work completed, using milestones for measurement, change requests and scope creep, Project audit, Project Contracting: Project procurement management, contracting and outsourcing. **Closing the Project:** Customer acceptance, Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report, doing a lessons learned analysis, acknowledging successes and failures.	08
5	**Agile project management:** Agile principle, Agile Manifesto, Agile process framework, Characteristics of Agile Approaches and Scrum, Benefits of Agile project management, Implementing Agile project management. **Agile Project Planning:** Comparison of Agile Project Management with Traditional Waterfall Approach, Project Planning with Scrum, Scrum Artifacts Supporting Project Planning , Scrum Events for Project Planning. Scheduling with scrum, Techniques for scrum scheduling- Poker estimation. **Agile Tools for Tracking Project Progress:** Task Boards, Burnup and Burndown Charts.	08
	Total	**39**

Books Recommended:

Text Books:

1. Project Management: A managerial approach, Jack Meredith & Samuel Mantel, 11th Edition, Wiley India.
2. Project Management: The Managerial Process, 8th edition, Erik Larson, Clifford Gray, McGraw Hill Education.
3. Agile Project Management, Jim Highsmith, Pearson Education, Low Price Edition, India.

Reference Books:

1. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 7th Ed, Project Management Institute PA, USA.
2. Project Management, Gido Clements, Cengage Learning.
3. Project Management, Gopalan, Wiley India.
4. Project Management, Dennis Lock, 9th Edition, Gower Publishing England.
5. Agile Essentials You Always Wanted to Know, Kalpesh Ashar, Vibrant Publishers U.S.A.

Program: Open Elective for all Programs	S.Y B.Tech.	Semester: IV
Course: Cyber Security, Policies and Laws (DJS23OCOE402)		

Pre-requisite:

1. Fundamentals of Computers.

Objectives:

1. Familiarize with the provisions and implications of the Digital Personal and Data Protection Act, the obligations of data fiduciaries, the rights and duties of data principals, and mechanisms for resolving breaches.
2. Equip individuals and organizations with the knowledge and tools to create secure cyber ecosystems, strengthen regulatory frameworks, and develop incident response plans.

Outcomes: On completion of the course, the learner will be able to:

1. Understand and describe the major types of cybercrime and navigate legal frameworks and regulations concerning digital personal and data protection.
2. Implement strategies for cybersecurity outlined in the National Cyber Security Policy.
3. Apply appropriate law enforcement strategies to both, prevent and control cybercrime.
4. Comprehend regulations and strategies pertaining to AI (Artificial Intelligence) and large language models.

Cyber Security, Policies and Laws (DJS23OCOE402)		
Unit	**Description**	**Duration**
1	**Cyber Crime:** Definition and Origin of the Word, Cyber Crime and Information Security, who are Cyber Criminals, Classification of Cybercrimes, E-mail Spoofing, Spamming, Cyber Defamation, Internet Time Theft, Salami Attack, Salami technique Data Diddling, Forgery, Newsgroup Spam, Online Frauds, Pornographic Offenders, Email Bombing, Password Sniffing, Credit Card Frauds.	08
2	**Cyber Offenses:** How Criminals plan them, Categories of Cyber Crimes, How Criminal Plans the Attack: Active Attacks, Passive Attacks, Social Engineering, Classification of Social Engineering, Cyber Stalking: types of Stalkers, Cyber Cafe and Cyber Crimes, Botnets, Attack Vectors, Cyber Crime and Cloud Computing.	08
3	**Indian IT Act** Cyber Crime and Criminal Justice, Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments Security aspect in Cyber-Law, The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, Security Standards: SOX, GLBA, HIPAA, NIST Cyber Security Framework (CSF).	08
4	**India's Digital Personal and Data Protection Act (2023)**	07

	Preliminary, Obligations of Data Fiduciary, Rights and Duties of Data Principal, Special Provisions, Data Protection Board of India, Powers, Functions and Procedure to Be Followed by Board, Appeal and Alternate Dispute Resolution, Penalties and Adjudication.	
5	**India's AI Regulation and Strategy** Privacy, Security and Artificial Intelligence, Differential Privacy, Security in AI. National Artificial Intelligence Strategy, Principles for Responsible AI, Information Technology (Intermediary Guidelines and Digital Media Ethics Code-2021), Draft National Data Governance Framework Policy (NDGFP), Rules against Deepfakes, Due diligence advisory for AI, AI regulations framework (June 2024).	08
	Total	**39**

Books Recommended:

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole, Sunit Belapur, Wiley-2011.
2. Understanding Cybersecurity Management in Decentralized Finance: Challenges, Strategies, and Trends by Gurdip Kaur, Springer-2023.

Reference Books:

1. The Information Technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
2. Izzat Alsmadi , The NICE Cyber Security Framework: Cyber Security Intelligence and Analytics, Springer-2023.

References (Web Resources):

1. Digital Personal Data Protection Act 2023.pdf (meity.gov.in)
2. National Cyber Security Policy (draft v1 (meity.gov.in)
3. CISO_Roles_Responsibilities.pdf
4. Standards (bis.gov.in)
5. AI, Machine Learning & Big Data Laws & Regulations | India (globallegalinsights.com)

Program: Open Elective for all Programs	S.Y B.Tech.	Semester: IV
Course: Advanced Operations Research (DJS23OCOE403)		

Pre-requisite:

1. Operation Research
2. Mathematics (Calculus)

Objectives:

1. To develop an ability to analyse the structure and mathematical model of various complex system occurring in manufacturing system, service system, and business applications.
2. To develop knowledge of the mathematical structure of linear and nonlinear optimization models.
3. To develop an understanding of the techniques used to solve linear and nonlinear optimization models using their mathematical structure.
4. To develop an understanding of the use of modelling languages for expressing and solving optimization models.

Outcomes: On completion of the course, learner will be able to:

1. Apply Duality theory to solve linear programming problem and analyse optimum solution.
2. Construct linear integer programming models and apply the O.R. algorithms and techniques to solve linear integer programming problems.
3. Determine best satisfying solution under a varying quantity of resources and priorities of the goals.
4. Set up decision models and solve nonlinear programming- unconstrained optimization problems.
5. Set up decision models and solve nonlinear programming- constrained optimization problems.

Advanced Operations Research (DJS23OCOE403)		
Module	**Description**	**Duration**
1.	**Dual Linear Programs** Primal, dual, and duality theory - The dual simplex method -The primal-dual algorithm-Duality applications. Post optimization problems: Sensitivity analysis.	06
2.	**Integer Programming** Pure and mixed integer programming problems, Solution of Integer programming problems – Gomory's all integer cutting plane method and mixed integer method, branch and bound method, Zero-one programming.	06
3.	**Goal Programming** Concept of Goal Programming, GP model formulations, Graphical method of GP, The simplex method of GP, Application areas of GP.	05
4.	**Nonlinear Programming- Unconstrained optimization** Minimization and maximization of convex functions- Local & Global optimum-Convergence-Speed of convergence. one-dimensional unconstrained optimization – Newton's method – Golden-section search method , multidimensional unconstrained optimization –Gradient method — steepest ascent (descent) method – Newton's method.	11

5.	**Nonlinear Programming- Constrained optimization** Constrained optimization with equality and inequality constraints. Lagrangian method - Sufficiency conditions - Kuhn-Tucker optimality conditions Rate of convergence - Engineering Applications Quadratic programming problems-convex programming problems.	11
		39

Books Recommended:

Text Books:

1. Operations Research, Gupta, P. K. and Hira, D. S., S. Chand Publications, 2014.
2. Operations research: Principles and applications, Srinivasan, G., Prentice Hallof India, 2007.
3. Non-Linear Programming-A Basic Introduction, Nita H. Shah, Poonam Prakash Mishra, CRC Press, 2020.

Reference Books:

1. Introduction to Operations Research, Frederick S. Hillier & Gerald J. Lieberman, McGraw-Hill: Boston MA; 8th. (International) Edition, 2005.
2. Operations Research – Principle and Practice Ravindran, Philips and Soleberg, Second Edition, John Wiley, and sons, 2007.
3. Operations Research - An Introduction: Taha, H. A., Pearson Education, 2022.
4. Operations Research: models and methods, Paul A. Jensen, Jonathan F. Bard, Wiley Publications, 2003
5. Optimization Techniques in Operation Research, C. B Gupta, I.K. International Publishing House Pvt. Limited, 2008.

Program: Open Elective for all Programs	S.Y B.Tech.	Semester: IV
Course: Corporate Finance Management (DJS23OCOE404)		

Pre-requisite:

1. Nil

Objectives:

1. Overview of Indian financial system, instruments and market.
2. Basic concepts of value of money, returns and risks, corporate finance, working capital and its management.
3. Knowledge about sources of finance, capital structure, dividend policy.

Outcomes: On completion of the course, learner will be able to:

1. Understand Indian finance system.
2. Apply concepts of time value money and risk returns to product, services and business.
3. Understand corporate finance and working capital management.
4. Take Investment and finance decisions.
5. Take dividend decisions.

Corporate Finance Management (DJS23OCOE404)		
Unit	**Description**	**Duration**
1	**Overview of Indian Financial System:** Characteristics, Components and Functions of Financial System. Financial Instruments: Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. Financial Markets: Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market. Financial Institutions: Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges.	08
2	**Concepts of Returns and Risks:** Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio. **Time Value of Money:** Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.	08

3	**Overview of Corporate Finance:** Objectives of Corporate Finance; Functions of Corporate Finance-investment Decision, Financing Decision, and Dividend Decision.: **Working Capital Management:** Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.	07
4	**Capital Budgeting:** Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value (NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR)	08
5	**Capital Structure:** Factors Affecting an Entity's Capital Structure; Overview of Capital Structure Theories and Approaches — Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure **Dividend Policy:** Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches — Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach	08
	Total	**39**

Books Recommended:

Textbooks:

1. Financial Management, Theory & Practice 8th Edition (2011), by Prasanna Chandra: Tata McGraw Hill Education Private Limited, New Delhi.
2. Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
3. Financial Management, 11th Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.

Reference Books:

1. Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
2. Analysis for Financial Management, l0th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.

Prepared by Checked by Head of the Department Principal

Program: Open Elective for all Programs	S.Y B.Tech.	Semester: IV
Course: Corporate Social Responsibility (DJS23OCOE405)		

Pre-requisite:

1. Nil

Objectives:

1. To make students understand the concept, theories and application of CSR for the Development of the Society.

Outcomes: On completion of the course, the learner will be able to:

1. Upon completion of this course, students will be able to analyse and critique the ethical dimensions of Corporate Social Responsibility initiatives, demonstrating a comprehensive understanding of CSR principles and their ethical underpinnings.
2. Upon completion of this course, students will demonstrate an understanding of the legislative frameworks shaping Corporate Social Responsibility both in India and globally, alongside recognizing the key drivers fostering CSR practices within the Indian context.
3. Upon completion of this course, students will be able to identify and discuss the significance of social responsibility and community engagement initiatives, demonstrating an understanding of their impact on both businesses and society.

Corporate Social Responsibility (DJS23OCOE405)		
Unit	**Description**	**Duration**
1	**Introduction to Corporate Social Responsibility (CSR)** - Understanding the concept of CSR - Historical evolution and development of CSR - Importance and benefits of CSR for businesses and society - Stakeholder theory and its relevance to CSR	07
2	**Ethical Foundations of CSR** - Ethical theories relevant to CSR (Utilitarianism, Deontology, Virtue Ethics) - Ethical decision-making frameworks in business - Corporate governance and ethics - Ethical issues in supply chain management	08
3	**CSR-Legislation in India and the World** Section 135 of Companies Act 2013.Scope for CSR Activities under Schedule VII, Appointment of Independent Directors on the Board, and Computation of Net Profit's Implementing Process in India	08
4	**The Drivers of CSR in India** Market based pressure and incentives, civil society pressure, the regulatory environment in India Counter trends, Review of current trends and opportunities in CSR, Review of successful corporate initiatives and challenges of CSR. Case Studies of Major CSR Initiatives Corporate Social Responsibility and Public-Private Partnership (PPP)	08

5	**Social Responsibility and Community Engagement** - Social issues and challenges in contemporary society - Corporate philanthropy and community development initiatives - Stakeholder engagement strategies - Corporate volunteering and employee engagement programs - CSR as a strategic business tool vital for sustainable development	08
	Total	**39**

Books Recommended:

Text Books:

1. Andrew Crane, Dirk Matten , "Corporate Social Responsibility: Definition, Core Issues, and Recent Developments" Oxford University Press.
2. O. C. Ferrell, John Fraedrich, Linda Ferrell , "Business Ethics: Ethical Decision Making & Cases", Cengage Learning
3. Corporate Social Responsibility in India, Sanjay K Agarwal, Sage Publications, 2008
4. Corporate Social Responsibility in India, Bidyut Chakrabarty, Routledge, New Delhi, 2015

Reference Books:

1. Corporate Social Responsibility: An Ethical Approach, Mark S. Schwartz, Broadview Press, 2011
2. Attaining Sustainable Growth through Corporate Social Responsibility, George Pohle and Jeff Hittner, IBA Global Business Services, 2008
3. Strategic Corporate Social Responsibility: Stakeholders in a Global Environment, William B. Werther Jr. and David Chandler, 2nd Edition, Sage Publications, 2011

Program: Open Elective for all Programs	S.Y B.Tech.	Semester: IV
Course: Bioinformatics (DJS23OCOE406)		

Pre-requisite:

1. Nil

Course Objectives:

1. To provide an overview of bioinformatics and its significance in modern biological research.
2. To enable students to apply bioinformatics methods in practical scenarios for biological data analysis and interpretation.

Course Outcomes: Upon successful completion of this course, students will be able to:

1. Understand the structure and function of cells, organelles, and biomolecules.
2. Understand the types of data stored in bioinformatics databases and their relevance to biological research.
3. Explore genomic databases and understand the structure and content of protein databases.
4. Understand system biology concepts and molecular evolution.
5. Apply knowledge of cellular and molecular biology concepts to analyze a biological problem.

Bioinformatics (DJS23OCOE406)		
Unit	**Description**	**Duration**
1	**Module 1: Foundations of Molecular and Cellular Biology** **Introduction to molecular biology:** DNA, RNA, proteins, and their roles in cellular processes **Cell structure and function:** Organelles, membrane structure, and cellular transport **Cell cycle regulation:** phases of the cell cycle, checkpoints, and cell cycle control mechanisms	08
2	**Module 2: Genetics and Genomics** **Mendelian genetics:** Inheritance patterns, Punnett squares, and genetic crosses **Chromosome structure and organization:** karyotyping, gene mapping, and genetic linkage **Introduction to genomics:** genome structure, organization, and variation Techniques in molecular genetics: PCR, DNA sequencing, and gene cloning	08
3	**Module 3: Genomic and Protein Databases** Types of genomic databases such as GenBank, Ensemble, and UCSC Genome Browser, Understand the structure and content of protein databases such as UniProt and Protein Data Bank (PDB), Searching, Retrieving, and Analysing Genomic and Protein data from online databases.	08

4	**Module 4: Systems Biology** **Introduction to Systems Biology**: Modeling biological systems and network analysis, Bioinformatics tools for systems biology and modeling complex biological processes. **Principles of molecular evolution**: Mutation, Selection, and genetic drift. **Phylogenetic analysis**: Tree construction, sequence alignment, and molecular clock.	08
5	**Module 5: Applications and Case Studies** Applications of Bioinformatics in Medicine, Agriculture, and Biotechnology, Case Studies (Integrating Cellular and Molecular Biology with Bioinformatics) and Research Examples, Ethical and Legal Issues in Bioinformatics, Future Trends and Emerging Technologies in Bioinformatics.	07
	Total	**39**

Books Recommended:

Textbooks:

1. Bioinformatics For Dummies", Jean-Michel Claverie and Cedric Notredame, For Dummies. (2019)
2. Bioinformatics Algorithms: An Active Learning Approach" by Phillip Compeau and Pavel Pevzner, Active Learning Publishers (2019)

Reference Books:

1. Introduction to Bioinformatics, Arthur Lesk, Biologist & Bioinformatics Expert, 2019
2. Introduction to Biomedical Data Science, Robert Hoyt, Informatics Education, 2019
3. Python for Biologists: A Complete Programming Course for Beginners, Martin Jones, Oxford University Press, 2013
4. An Introduction to Bioinformatics Algorithms, Neil C. Jones, and Pavel A. Pevzne, MIT Press,2004.
5. Exploring Bioinformatics: A Project-Based Approach, Caroline St. Clair, and Jonathan E. Visick, Jones & Bartlett Learning, 2014.

Program: Open Elective for all Programs	S.Y B.Tech.	Semester: IV
Course: Human Resource Management (DJS23OCOE407)		

Pre-requisite:

1. Nil

Objectives:

1. To introduce the students with basic concepts, techniques and practices of the human resource management
2. To provide opportunity of learning Human resource management (HRM) processes, related with the functions, and challenges in the emerging perspective of today's organizations
3. To familiarize the students about the importance of the labour relations in the organization.

Outcomes: On completion of the course, the learner will be able to:

1. Understand and distinguish the changing environment of the HRM and the role of the HR managers.
2. Understand and analyse the recruitment process and the application of the IT.
3. Understand and examine the importance of the training and development.
4. Understand and determine the pay plans, performance appraisal and compensation.
5. Understand and explain the importance of the labour relation, the employee security and collective bargaining.

Human Resource Management (DJS23OCOE407)		
Unit	**Description**	**Duration**
1	**Human Resource Function** Human Resource Philosophy – Changing environments of HRM – Strategic human resource management – Using HRM to attain competitive advantage – Trends in HRM – Organisation of HR departments – Line and staff functions – Role of HR Managers.	07
2	**Recruitment & Placement** Job analysis: Methods - IT and computerised skill inventory - Writing job specification - HR and the responsive organisation. Recruitment and selection process: Employment planning and forecasting - Building employee commitment: Promotion from within - Sources, Developing and Using application forms - IT and recruiting on the internet. Employee Testing & selection: Selection process, basic testing concepts, types of test, work samples & simulation, selection techniques, interview, common interviewing mistakes, Designing & conducting the effective interview, small business applications, computer aided interview.	10
3	**Training & Development** Orientation & Training: Orienting the employees, the training process, need analysis, Training techniques, special purpose training, Training via the internet.	08

	Developing Managers: Management Development - The responsive managers - On-the-job and off the-job Development techniques using HR to build a responsive organisation. Performance appraisal: Methods - Problem and solutions - MBO approach - The appraisal interviews - Performance appraisal in practice. Managing careers: Career planning and development - Managing promotions and transfers.	
4	**Compensation & Managing Quality** Establishing Pay plans: Basics of compensation - factors determining pay rate - Current trends in compensation - Job evaluation - pricing managerial and professional jobs - Computerised job evaluation. Pay for performance and Financial incentives: Money and motivation - incentives for operations employees and executives - Organisation wide incentive plans - Practices in Indian organisations. Benefits and services : Statutory benefits - non-statutory (voluntary) benefits - Insurance benefits -retirement benefits and other welfare measures to build employee commitment.	08
5	**Labour relations and employee security** Industrial relation and collective bargaining: Trade unions - Collective bargaining - future of trade unionism. Discipline administration - grievances handling - managing dismissals and separation. Labour Welfare: Importance & Implications of labour legislations - Employee health - Auditing HR functions, Future of HRM function.	06
	Total	**39**

Books Recommended:

Text Books:

1. Pattanayak, Biswajeet, Human Resource Management, 6th Ed,PHI Learning Pvt. Ltd., 1 Jul 2020
2. Gary Dessler, Human Resource Management, 16th Ed, Pearson Publications, 2020

Reference Books:

1. Stephen Robbins, Organizational Behavior, 16th Ed, 2013
2. Aswathapa, Human resource management: Text & cases, 6th edition, 2011
3. C. B. Mamoria and S V Gankar, Dynamics of Industrial Relations in India, 15th Ed, 2015, Himalaya Publishing, 15thedition, 2015
4. P. Subba Rao, Essentials of Human Resource management and Industrial relations, 5th Ed, 2013, Himalaya Publishing
5. Laurie Mullins, Management & Organizational Behavior, Latest Ed, 2016, Pearson Publications
6. Raymond J. Stone, Anne Cox, Mihajla Gavin, Human Resource Management, 10th Ed,John Wiley & Sons, 14 Dec 2020.
7. V S P Rao, Human Resource Management, 3rd Ed, 2010, Excel publishing.

Prepared by Checked by Head of the Department Principal

Program: Open Elective for all Programs	S.Y B.Tech.	Semester: IV
Course: Digital Marketing Management (DJS23OCOE408)		

Pre-requisite:

1. Nil

Objectives:

1. Explain the evolution and technology of digital marketing, including underlying frameworks.
2. Understand digital business strategy and emerging business structures.
3. Cover digital marketing planning, operations setup, and implementation of search campaigns, alongside emerging concepts like Big Data, IoT, SMB, B2B marketing, and SoLoMo.

Outcomes: On completion of the course, the learner will be able to:

1. Understand the digital marketing framework & model and consumer behaviour.
2. Develop digital marketing strategy roadmap.
3. Explain the terminology and concepts for developing web-specific media plans.
4. Understand concepts related to digital campaign management and revenue generation models.
5. Get a perspective on global digital marketing technology/tools and future trends.

Digital Marketing Management (DJS23OCOE408)		
Unit	**Description**	**Duration**
1	**Introduction to Digital Marketing** Emergence of Digital Marketing as a tool, media consumption drivers for new marketing environment, applications and benefits of digital marketing. **Digital Marketing Framework** Delivering enhanced customer value, market opportunity analysis and digital services development, ASCOR framework **Digital Marketing Models Creation** Factors impacting digital marketplace, value chain digitization, business models. **The Consumer for Digital Marketing** • Consumer behavior on the internet, evolution of consumer behavior models, managing consumer demand, integrated marketing communications (IMC)	**06**
2	**Digital marketing Strategy Development** Elements of assessment phase, macro-micro environmental analysis, marketing situation analysis. **Digital Marketing Internal Assessment and Objectives Planning** Analyzing present offerings mix, marketing mix, core competencies analysis and internal resource mapping. Digital presence analysis, digital marketing objectives development and review. **Digital Marketing Strategy Definition**	**12**

	Understanding digital business strategy and structures, consumer development strategy, offering mix for Digital, digital pricing models, managing promotional channels and developing the extended Ps- People, process, programs and performance. **Digital marketing Strategy Roadmap** Developing digital marketing strategy roadmap, the 6s digital marketing implementation strategy, marketing across the product life cycle.	
3	**Digital Marketing Planning and Setup** Understanding digital media planning terminology and stages, steps to creating marketing communications strategy, introduction to search marketing, display marketing, social media marketing. **Digital Marketing Operations Setup** Basics of lead generation and conversion marketing, website content development and management, elements of user experience, web usability and evaluation.	**08**
4	**Digital marketing Execution** Basic elements of digital campaign management, search execution, display execution, social media execution, content marketing. **Digital marketing Execution Elements** Digital revenue generation models, managing service delivery and payments, managing digital implementation challenges like e commerce, internal & external and consumer specific challenges.	**08**
5	**Digital Business – Present and Future** Digital Marketing – Global Landscape, digital marketing overview – global spend, advertising spend, and technology/tools landscape. Data technologies (Big data and IOT) impacting marketing, segment based digital marketing and SoLoMo – the next level of hyperlocal marketing.	**05**
	Total	**39**

Books Recommended:

Text Books:

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia, Pearson Education Limited,2017
2. Digital Marketing by Seema Gupta- McGraw Hill Education, 2022

Reference Books:

1. Digital Marketing Excellence: Planning, Optimizing and Integrating Online Marketing by Dave Chaffey and P. R. Smith, 5 th edition, Taylor & Francis, 2017
2. Digital Marketing: Strategy, Implementation and Practice- 6 th edition by Dave Chaffey Fiona Ellis-Chadwick, Pearson Education Limited,2019
3. Digital marketing by Vandana Ahuja, Oxford University Press, 2015
4. The Art of Digital Marketing by Ian Dodson, John Wiley & Sons, 2016

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Program: Open Elective for all Programs	S.Y B.Tech.	Semester: IV
Course: Logistics and Supply Chain Management (DJS23OCOE409)		

Pre-requisite:

1. Latest trend of information technology in retail industry and logistic applications.

Objectives:

1. To develop advanced strategic thinking skills in supply chain management and logistics to effectively analyse and optimize supply networks.
2. To attain proficiency in leveraging cutting-edge tools and technologies to enhance supply chain efficiency and supply chain transformation.
3. Design and implement collaborative supply chain and sourcing strategies to promote information sharing and optimise coordination.

Outcomes: On completion of the course, learner will be able to:

1. Develop a sound understanding of the important role of supply chain management in today's business environment.
2. Develop criteria and standards to achieve improved business performance by integrating and optimizing the total logistics and supply-chain process.
3. Summarize the value of focusing on information business logistics systems which drives improved accuracy and decision-making at all levels of management.
4. Become familiar with current supply chain information technology management trends.
5. Use available technologies to enhance work performance and support supply chain functions, processes, transactions, and communications.

Logistics and Supply Chain Management (DJS23OCOE409)		
Module	**Description**	**Hours**
1	**Introduction** What Is Supply Chain Management? The Development Chain, Global Optimization, Managing Uncertainty and Risk, The Complexity in Supply Chain Management, Key Issues in Supply Chain Management.	05
2	**Network planning** Introduction, Network Design- Data Collection, Data Aggregation, Transportation Rates, Mileage Estimation, Warehouse Costs, Warehouse Capacities, Potential Warehouse Locations, Service Level Requirements, Future Demand, Model and Data Validation, Solution Techniques, Key Features of a Network Configuration Supply Chain Planning; Inventory Positioning and Logistics Coordination -Strategic Safety Stock.	06
3	**THE VALUE OF INFORMATION** Introduction, The Bullwhip Effect-Quantifying the Bullwhip Effect, The Impact of Centralized Information on the Bullwhip Effect, Methods for Coping with the Bullwhip Effect, Information Sharing and Incentives, Effective Forecasts, Information for the Coordination of Systems, Locating Desired Products, Lead-	08

	Time Reduction, Information and Supply Chain Trade-offs-Conflicting Objectives in the Supply Chain, Designing the Supply Chain for Conflicting Goals ,Decreasing Marginal Value of Information.	
4	**Supply chain integration** Introduction, Push, Pull, and Push-Pull Systems-Push-Based Supply Chain, Pull-Based Supply Chain, Push-Pull Supply Chain ,Identifying the Appropriate Supply Chain Strategy, Implementing a Push-Pull Strategy The Impact of Lead Time Demand-Driven Strategies The Impact of the Internet on Supply Chain Strategies-what is E-Business, the Grocery Industry , the Book Industry , the Retail Industry and Impact on Transportation and Fulfillment.	08
5	**Information Technology and Business Process** Introduction, The Importance of Business Processes, Goals of Supply Chain IT Supply Chain Management System Components, Decision-Support Systems IT for Supply Chain Excellence, Sales and Operations Planning Integrating Supply Chain Information Technology. Implementation of ERP and Decision Support System.	06
6	**Technology standards** Introduction, IT Standards, Information Technology Infrastructure-Interface Devices, System Architecture and Electronic Commerce. Service-Oriented Architecture (SOA)-Technology Base: IBM and Microsoft and ERP Vendor Platform: SAP and Oracle. Radio Frequency Identification (RFID)- applications, point of sale data , business benefits and supply chain efficiency.	06
	Total	**39**

Books Recommended:

Text Books:

1. Sunil Chopra, Peter Meindl "Supply Chain Management-Strategy, Planning, and Operation", Pearson Publications 2016
2. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, "Designing and Managing the Supply Chain-Concepts, Strategies, and Case Studies", McGraw-Hill/Irwin 2008

Reference Books:

1. Ian Sadler, "Logistics and Supply Chain Integration", SAGE Publications, 2007
2. Donald Waters, "Supply Chain Management - An Introduction to Logistics", Bloomsbury Publishing, 2019
3. Dimitris Folinas, "E-Logistics and E-Supply Chain Management-Applications for Evolving Business, IGI Global publications, 2013
4. Martin Christopher, "Logistics & Supply Chain Management", Pearson Education publications, 2016

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Program: Common to all Programs.	Group A / B	S.Y B. Tech.	Semester: IV
Course: Design Thinking Laboratory (DJS23ILHSX06)			

Pre-requisite:

1. Basic understanding with the development life cycle of products, processes, software, or services.
2. Basic knowledge of iterative frameworks (not mandatory).

Course Objectives:

1. To introduce students to the fundamentals, history, and importance of design thinking and its role in solving complex, real-world problems.
2. To develop students' empathy and user-research skills by teaching them how to gather insights, create personas, and map user journeys.
3. To equip students with the skills to define and reframe problem statements effectively, identifying opportunity areas and stakeholder touchpoints.
4. To foster creative ideation, prototyping, and testing skills through hands-on exercises that incorporate strategic innovation and rapid prototyping techniques.

Course Outcomes: On completion of the course, the learner will be able to:

1. Understand and apply the design thinking process to analyze and solve real-world problems.
2. Develop the ability to empathize with users, create user personas, and design empathy and journey maps tailored to specific challenges.
3. Demonstrate proficiency in defining clear and actionable problem statements that uncover areas of opportunity.
4. Generate diverse ideas using ideation techniques, such as brainstorming and SCAMPER, to approach problem-solving creatively and collaboratively.
5. Create and test prototypes, iterating based on feedback and validating solutions through digital platforms and peer review.

Design Thinking Laboratory (DJS23ILHSX06)		
Unit	**Syllabus Content**	**Duration**
1	**Introduction to Design Thinking and Strategic Innovation** • Understanding the fundamentals of design thinking. • Exploring the history and evolution of design thinking. • The importance of empathy in the design thinking process. • Conduct market & industry research by observing and contextualizing various macro & micro trends. • Case Study - conduct their research on how Design Thinking helped solve some of the biggest and most critical problems of our time. **Design Thinking for Strategic Innovation**: • Types of innovations, strategic innovation. • Features of strategic innovation. • Design thinking and strategic innovation. • Practices of integrating design thinking in strategic innovation.	**08**

2	**Empathize Phase** • Techniques for conducting user research and gathering insights. • Creating user personas and empathy maps. • Practicing active listening and observation skills. • To apply various empathizing techniques to the problem statement selected. • Use walk-a-mile immersion and heuristic reviews to first empathize with end users and then to build an empathy map and customer journey map.	**04**
3	**Define Phase** • Defining problem statements and reframing challenges. • Tools for synthesizing research findings. • Developing a clear and actionable problem statement. • Start building from Persona map and conduct interviews/ Gemba walk to plot user's journeys from start to end. • Define the problem space using the HMW statement. Now highlight areas of opportunities in the journey map and enlist potential channels/touchpoints as well as stakeholders for proposed solution interventions.	**04**
4	**Ideate Phase** • Generating creative ideas through brainstorming sessions. • Techniques for divergent and convergent thinking. • Prototyping and experimenting with ideas. • Apply suitable ideation techniques to quickly generate diverse ideas that could be applied to target problem space – either partially or in full. • Brain Writing – Build on each other's ideas and constructively & creatively develop better ideas using SCAMPER technique. • Evaluation of ideas	**04**
5	**Prototype and Validation** • Introduction to prototyping tools and techniques. • Rapid prototyping methods. • Testing prototypes with users and gathering feedback. • Refining solutions based on user insights. • Develop user storyboard to layout solution proposition in visual and easily explainable form. Run a quick peer validation. • peer-validated the storyboard. • Build an interactive digital prototype using any digital rapid prototyping platform and seek user validation.	**06**
	Total	**26**

List of Experiments:

- Below is a list of assignments/ activities/ experiments that would be carried out by students as a mini project in groups consisting of 3-4 students.
- Problem statement for these assignments/ activities/ experiments will be provided by facilitator/ instructor/ faculty to the groups/ teams/ batches within each class.

- This list of experiments will help students learn various design thinking methods and practice the corresponding tools available.

Sr. No.	Name of the Experiment
1	To conduct market and industry research and analyze case studies demonstrating the application of design thinking.
2	To exercise empathizing techniques to understand the needs and pain points of a target audience.
3	Developing empathy maps and customer journey maps based on collected insights.
4	To exercise different tools and techniques (such as affinity diagrams, journey mapping, and user story mapping) for synthesizing research findings.
5	Develop user personas to represent different user archetypes and their needs concerning the problem at hand.
6	To practice the SCAMPER technique, Brainstorming, and brain-writing as a collaborative ideation technique to create multiple creative ideas/ solutions for the problem at hand.
7	Create a mind map to generate a wide range of solutions to a problem at hand.
8	To explore different prototyping tools and platforms, such as Adobe XD, Figma, Sketch, and In Vision.
9	To Conduct rapid prototyping sessions to build low fidelity / High fidelity prototypes based on the ideas generated in the Ideation phase and iterate based on feedback received.
10	Develop a plan for implementing the final solution, considering factors like scalability and feasibility.
11	Conduct usability testing to gather feedback on prototypes. Use A/B testing to compare different versions of a solution and determine which performs better.

***Note** – A minimum of five experiments from the above-suggested list or any other assignment based on the syllabus will be included, which would help the learner to apply the concept. The mini-project is mandatory.*

Books Recommended

Textbooks:

- I. Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", Wiley, 2013.
- M. Lewrick, P. Link, and L. Leifer, "The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems", Wiley, 2018.
- T. Lockwood, "Design Thinking: Integrating Innovation, Customer Experience, and Brand Value", Allworth Press, 2010.
- K. T. Ulrich and S. D. Eppinger, "Product Design and Development", McGraw-Hill Hill Education, 6th Edition, 2016.
- C. J. Meadows and C. Parikh, "The Design Thinking Workbook: Essential Skills for Creativity and Business Growth", Emerald Publishing, 2022.

Reference books:

- T. Kelley and D. Kelley, "Creative Confidence: Unleashing the Creative Potential Within Us All", HarperCollins Publisher, 2013.
- T. Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", HarperCollins, 2013.

- J. Knapp, J. Zeratsky, and B. Kowitz, "Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days", Simon & Schuster, 2016.
- Chakrabarti, "Engineering Design Synthesis: Understanding, Approaches and Tools", Springer, 2002.
- K. Otto, and K. Wood, "Product Design", Prentice Hall, 2000.

***Web Resources*:**

1. **Design and Innovation:**
   a. https://openstax.org/books/entrepreneurship/pages/4-suggested-resources
2. **Overview of Design Thinking:**
   a. https://www.interaction-design.org/literature/topics/design-thinking
   b. 10 Models for Design Thinking. In 2004, business consultants Hasso… | by Libby Hoffman | Medium
   c. https://www.tcgen.com/design-thinking/#What_is_Design_Thinking_and_How_Does_it_Relate_to_Product_Development
3. **Understand, observe and define the problem:**
   a. https://www.nngroup.com/articles/empathy-mapping/
   b. https://uxdesign.cc/the-purpose-of-a-journey-map-and-how-can-it-galvanize-action-9a628b7ae6e
4. **Ideation and prototyping**:
   a. https://www.interaction-design.org/literature/topics/prototyping
   b. https://www.uxmatters.com/mt/archives/2019/01/prototyping-user-experience.php
5. **Testing and implementation:**
   a. https://www.nngroup.com/articles/usability-testing-101/
   b. https://www.interaction-design.org/literature/article/test-your-prototypes-how-to-gather-feedback-and-maximise-learning
6. **Design thinking in various sectors:**
   a. https://www.tutorialspoint.com/design_thinking/design_thinking_quick_guide.htm

Swayam Courses:

1. Creative Engineering Design (https://nptel.ac.in/courses/107108010)
2. Understanding Creativity and Creative Writing (https://nptel.ac.in/courses/109101017)
3. Understanding Design Thinking & People Centred Design (https://nptel.ac.in/courses/109104109)
4. Design Thinking - A Primer (https://nptel.ac.in/courses/110106124)
5. Product Engineering and Design Thinking (https://nptel.ac.in/courses/112105316)

Laboratory: (Term work)

The distribution of marks for term work shall be as follows:

Laboratory work (Performance of Experiments, Write-up): 15Marks

Mini Project (Report and Presentation): 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

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Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

Program: Mechanical Engineering	**S.Y. B. Tech.**	**Semester: IV**
Course: Computer Aided Machine Drawing Laboratory (DJS23MLSC401)		

Objectives:

1. To study conventional representation of various machining and mechanical details.
2. To impart knowledge and skills of CAD modelling software.
3. To become conversant with 3D drafting of machine components from the given assembly/detail drawing.

Outcomes: Learner will be able to…

1. Visualize and interpret the machine components from the given assembly/detail drawing.
2. Using CAD software, prepare 3D models of the machine components from the given assembly/detail drawing.
3. Conversion of detailed drawings to assembly drawings and assembly drawings to detailed drawings.

Unit	Description	Duration
1	**Introduction**: Introduction of CAD Softwares, Review of graphic interface, various tools and settings for preparation of graphics workspace. Introduction of basic sketching commands (Line, circle, arc, rectangle, slot, spline, fillet, polygon, text, dimensioning, etc.) modify commands (move, trim, copy, replace, extend, split, offset, etc.), feature commands (extrude, revolve, loft, sweep, rib, coil, emboss, etc.) and navigational commands (Pan, zoom in, zoom out, orientation, etc.). Types of drawing sheets and its sizes, Drawing units, grid and snap, title block. Conversion of 3D views into orthographic projections of simple machine parts like (nuts, bolts, keys, screws, springs, etc.), Editing, Hidden line view, shaded view, render view, presentation of various views along with different orientations.	**8**
2	**Details and assembly drawings**: Types of assembly drawings, part drawings, drawings for catalogues and instruction manuals, patent drawings, drawing standards, Introduction to unit assembly drawing, steps involved in preparing assembly drawing from details and vice-versa. **Geometric Dimensions and Tolerances (GD&T):** Introduction of Limits, fits, deviations, and tolerances with their applications, dimensioning with tolerances indicating various types of fits in details and assembly. **Threaded Fasteners**: Types of threads, thread designation, Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW (Internal & External), Square, Acme and American Standard thread, Conventional representation of threaded parts.	**6**

3	**Preparation of details/assembly drawings of Machinery parts, Joints, Keys and Couplings:** **Machinery parts:** Clapper block, Single tool post, Lathe and Milling tail stock, jigs and fixtures. **Joints and Keys:** Cotter joints, knuckle joints, taper key, feather key, woodruff key, etc. **Couplings:** Muff coupling, flanged coupling, Protected type flange coupling, Pin type flexible coupling, Oldham's coupling and Universal Coupling.	**12**
4	**Preparation of details / assembly drawings of Bearings** Solid bearing, Bushed bearing, Pedestal bearing/Plummer block and footstep bearing. **Preparation of details / assembly drawings of pulleys, Pipe joints: Pulleys:** Flat belt pulleys, V-belt pulleys, rope pulleys, Fast and loose pulleys. **Pipe joints:** Flanged joints, Socket and spigot joint, Gland and stuffing box expansion joint and Union joint.	**12**
5	**Preparation of details / assembly drawings of Valves:** Air cock, blow off cock, Steam stop valve, Gate valve, Globe valve and Non-Return Valve. **Preparation of details / assembly drawings of I.C. Engine parts:** Piston, Connecting rod, Crankshaft, Carburetor, Injector and Spark plug. **Introduction to Reverse Engineering: Historical** Background, scope and task of Reverse Engineering in Modern Industries.	**14**
	TOTAL	**52**

List of Laboratory Experiments (Any Six):

1. General machine elements - nuts, bolts, keys, cotter, screws, springs, etc. (any one)
2. Details/Assembly of Clapper block, Single tool post, Lathe and Milling tail stock, jigs and fixtures. (any one)
3. Details/Assembly of coupling - simple, muff, flanged Protected flange coupling, Oldham's coupling, Universal coupling. (any one)
4. Details/Assembly of ball and roller bearing, Pedestal bearing, footstep bearing. (any one)
5. Details/Assembly of different types of pulleys. (any one)
6. Details/Assembly of pipe joints - Flanged joints, Socket and spigot joint, Gland and stuffing box, expansion joint. (any one)
7. Details/Assembly of Air cock; Blow off cock, Steam stop valve, Gate valve, Globe valve, Non return Valve. (any one)
8. Details/Assembly of Piston, Connecting rod, Cross head, Crankshaft, Carburetor, Fuel pump, injector, and Spark plug. (any one)

Term work

Printouts / plots of the problems solved in practical class from the practical part of each module. Problems from practical parts of each module should be solved using any standard CAD packages like Autodesk Inventor, Fusion 360, PRO-E, CATIA, Solid Works, etc.

The distribution of marks for Term work shall be as follows:

- Printouts/Plots… ..... 40 marks
- Attendance & participation … 10 marks

End Semester Practical & Oral examination:

To be conducted by pair of Internal and External Examiner

1. Practical examination duration is **three hours**, based on the Term work, and should contain two sessions as follows:
   Session-I: Preparation of minimum five detailed 3-D part drawings from given assembly drawing**.**
   Session-II: Preparation of 3-D models of parts, assembling parts and preparing views of assembly from given detailed drawing.

   Oral examination should also be conducted to check the knowledge of conventional and CAD drawing.

2. Questions provided for practical examination should contain a minimum of five and not more than ten parts.

3. The distribution of marks for practical examination shall be as follows:
   - **Session-I .....** 20 marks
   - **Session-II.....**20 marks
   - **Oral.....** 10 marks
4. Evaluation of practical examination to be done based on the printout of student's work.

Books Recommended:

Reference Books:

- N.D. Bhatt, Machine Drawing, N.D. Bhatt, Charotar Publishing Home Pvt. Ltd, 51st Edition, 2022.
- K.I. Narayana, P. Kannaiah and K. Venkata Reddy, Machine Drawing, New Age International (P) Limited, Publishers. 5th Edition, 2016,
- K. C. John, Textbook of Machine Drawing 2010, PHI Learning Pvt. Ltd. New Delhi,2010.
- M. B. Shah, Engineering Drawing Pearson Education India. 2nd Edition, 2009
- Laxminarayan and M.L.Mathur, A textbook of Machine Drawing, 3rd Edition, Jain Brothers Delhi. 2017,
- R.B.Gupta, A textbook of Machine Drawing Satyaprakashan, Tech. Publication. 10th Edition, 2019,
- R. K. Dhawan, A textbook of Machine Drawing, S. Chand Publication ,2006.

Program: Mechanical Engineering	**S. Y B.Tech**	**Semester: IV**
Course: Advanced Manufacturing Process Laboratory (DJS23MLSC402)		

Pre-requisite:

1. Knowledge of fundamental machining techniques and various manufacturing processes.

Objectives:

1. To apply safety precautions and adhere to norms while demonstrating effective interpersonal skills for successful teamwork and hands-on learning.
2. To evaluate the effects of process parameters on various responses in non-conventional machining processes.
3. To fabricate a simple component using 3D printing techniques, and to fabricate and assemble mechanical components by applying various manufacturing techniques. To demonstrate expertise in CNC control systems by determining parameters and executing CNC programs for a range of machining operations.

Outcomes: On completion of the course, the learner will be able to:

1. Demonstrate lifelong learning with a commitment to professional, safety, environmental, and social responsibilities for career excellence.
2. Fabricate and assemble mechanical components using diverse manufacturing techniques.
3. Assess the effects of process parameters on MRR, TWR in EDM of mild steel, and DOP, HOC in ECDM of glass.
4. Apply engineering expertise in additive manufacturing for the creation of functional 3D printed models.
5. Exhibit CNC control systems, compute technological parameters, and develop, simulate, and execute CNC programs for various machining operations.

Advanced Manufacturing Process Laboratory (DJS23MLSC402)		
Exp.	**Experiment**	**Duration**
1	To fabricate and assemble mechanical components through the application of conventional, non-conventional, and advanced manufacturing techniques.	16
2	To analyze the influence of process parameters on the EDM process and determine the material removal rate (MRR), tool wear rate (TWR), and surface roughness of mild steel (M.S) using a copper electrode.	04
3	To examine the effects of process parameters on ECDM and determine the depth of penetration (DOP) and hole overcut (HOC) in glass using a tungsten carbide electrode	04
4	To fabricate a simple component using one of the 3D Printing techniques below 1) Selective laser printing (SLS) 2) Stereolithography (SLA) 3) Fused deposition modelling (FDM).	12
5	To program, simulate, and fabricate a component on a CNC Vertical Machining Center, involving part programming, interpolation, contour motion, pocket milling (circular and rectangular), and mirror commands etc.	16
	Total	**52**

Prepared by Checked by Head of the Department Principal

Program: Mechanical Engineering	S.Y B.Tech	Semester: IV
Course: Innovative Product Development II (DJS23IPSCX02)		

Objectives:

1. To acquaint the students with the process of identifying the need (considering a societal requirement) and ensuring that a solution is found out to address the same by designing and developing an innovative product.
2. To familiarize the students with the process of designing and developing a product, while they work as part of a team.
3. To acquaint the students with the process of applying basic engineering fundamentals, so as to attempt at the design and development of a successful value-added product.
4. To inculcate the basic concepts of entrepreneurship and the process of self-learning and research required to conceptualize and create a successful product.

Outcomes: On completion of the course, the learner will be able to:

1. Identify the requirement for a product based on societal/research needs.
2. Apply knowledge and skills required to solve a societal need by conceptualizing a product, especially while working in a team.
3. Use standard norms of engineering concepts/practices in the design and development of an innovative product.
4. Draw proper inferences through theoretical/ experimental/simulations and analyze the impact of the proposed design and development of the product.
5. Develop product/project management skills, interpersonal skills, self-learning and effective communication eventually preparing them to be successful entrepreneurs.

Guidelines for the proposed product design and development:

- Students shall form a team of 3 to 4 students (max allowed: 5-6 in extraordinary cases, subject to the approval of the department review committee and the Head of the department).
- Students should carry out a survey and identify the need, which shall be converted into conceptualization of a product, in consultation with the faculty supervisor/head of department/internal committee of faculty members.
- Students should recognize the essential requirements for product development and choose the most suitable design in consultation with the faculty supervisor.
- Students shall transform the most appropriate design solution into a functional model, incorporating components from their specific domain and related interdisciplinary fields.
- Throughout the two-semester duration of the activity, faculty supervisors will provide guidance to students, with a primary emphasis on self-directed learning.
- Each team is required to maintain an activity log-book, where they can document their weekly progress. The guide or supervisor should review the recorded notes and comments and provide approval on a weekly basis.
- Students should validate the design solution with appropriate justifications and compile a report in a standard format for submission to the department. Additionally, students are encouraged to make efforts to publish a technical paper, either in the institute journal ‘Techno Focus: Journal for Budding

Engineers' or in a suitable publication approved by the department's research committee or the Head of the department.

- The focus should be on self-learning, capability to design and innovate new products as well as on developing the ability to address societal problems. Advancement of entrepreneurial capabilities and quality development of the students through the year long course should ensure that the design and development of a product of appropriate level and quality is carried out, spread over two semesters, i.e. during the semesters III and IV.

Guidelines for Assessment of the work:

- The review/ progress monitoring committee shall be constituted by the Head of the Department. The progress of design and development of the product is to be evaluated on a continuous basis, holding a minimum of two reviews in each semester.
- In the continuous assessment, focus shall also be on each individual student's contribution to the team activity, their understanding and involvement as well as responses to the questions being raised at all points in time.
- Distribution of marks individually for the both reviews as well as for the first review during the subsequent semester shall be as given below:
    - Marks awarded by the supervisor based on log-book: 10
    - Marks awarded by review committee: 10
    - Quality of the write-up: 05

- A candidate needs to secure a minimum of 50% marks.

Review/progress monitoring committee may consider the following points during the assessment.

- In the semester III, the entire design proposal shall be ready, including components/system selection as well as the cost analysis. Two reviews will be conducted based on the presentation given by the student's team.
    - First shall be for finalization of the product selected.
    - Second shall be on finalization of the proposed design of the product.
- In the semester IV, the expected work shall be procurement of components/systems, building of the working prototype, testing and validation of the results based on work completed in semester III.
    - First review is based on readiness of building the working prototype.
    - Second review shall be based on a presentation as well as the demonstration of the working model, during the last month of semester IV. This review will also look at the readiness of the proposed technical paper presentation of the team.

The overall work done by the team shall be assessed based on the following criteria;

1. Quality of survey/ need identification of the product.
2. Clarity of Problem definition (design and development) based on need.
3. Innovativeness in the proposed design.
4. Feasibility of the proposed design and selection of the best solution.
5. Cost effectiveness of the product.
6. Societal impact of the product.

7. Functioning of the working model as per stated requirements.
8. Effective use of standard engineering norms.
9. Contribution of each individual as a member or the team leader.
10. Clarity on the write-up and the technical paper prepared.

- The semester reviews (III and IV) may be based on relevant points listed above, as applicable.

Guidelines for Assessment of Semester Reviews:

- The write-up should be prepared as per the guidelines given by the department.
- The evaluation of the product's design and development will involve a presentation and demonstration of the working model by the student team. This assessment will be conducted before a panel of Internal and External Examiners, preferably with more than five years of experience in industry or research organizations. The Head of the Institution approves the selection of these examiners. The presence of an external examiner is desirable only for the second presentation during semester IV. Additionally, students are required to present an outline of the technical paper they have prepared during the final review in semester IV.