ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES :: TIRUPATI
(AUTONOMOUS)
DETAILED SYLLABI FOR THE COURSES OF REGULAR M.TECH (PE&ED)
(Effective for the batches admitted in AY: 2025-26)

Semester I (First year)

S.No	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	PC	25DPC9001	Advanced Finite Element Methods	3	0	0	3	40	60	100
2	PC	25DPC9002	Advanced Manufacturing Processes	3	0	0	3	40	60	100
3	PE		**Program Elective Course - I**	3	0	0	3	40	60	100
		25DPE9001	Computational Methods							
		25DPE9002	Design For Manufacturing							
		25DPE9003	Additive Manufacturing							
4	PE		**Program Elective Course - II**	3	0	0	3	40	60	100
		25DPE9004	Advanced Optimization Techniques							
		25DPE9005	Mechanical Vibrations							
		25DPE9006	Geometrical Dimensioning and Tolerances							
5	MC	25MBA0110	Research Methodology and IPR	2	0	0	2	40	60	100
6	SE	25DSE9001	Artificial Intelligence and Machine Learning for Mechanical Engineering	0	1	2	2	40	60	100
7	AC		**Audit Course – I**	2	0	0	0	40	-	40
		25DMC9901	English for Research Paper Writing							
		25DMC2001	Disaster Management							
		25DMC9902	Essence of Indian Traditional Knowledge							
PRACTICAL										
8	PC	25DPC9003	Design Simulation Laboratory	0	0	4	2	40	60	100
9	PC	25DPC9004	Advanced Manufacturing Processes & Metal Cutting Lab	0	0	4	2	40	60	100
			Total				20	360	480	840

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Semester II (First year)

S.No	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	PC	25DPC9005	Simulation of Manufacturing Systems	3	0	0	3	40	60	100
2	PC	25DPC9006	Drives and Controls for Automation	3	0	0	3	40	60	100
3	PE		**Program Elective Course - III**	3	0	0	3	40	60	100
		25DPE9007	Industrial Robotics and Expert Systems							
		25DPE9008	Automation in Manufacturing							
		25DPE9009	Material science and Technology							
4	PE		**Program Elective Course - IV**	3	0	0	3	40	60	100
		25DPE9010	Mechanics & Manufacturing Methods of Composites							
		25DPE9011	Advanced Kinematics of Mechanisms							
		25DPE9012	Advanced Metal Forming Processes							
5	MC	25DMC5801	Quantum Technologies and Applications	2	0	0	2	40	-	40
6	PC	25DPC9007	**Comprehensive Viva-Voce**	0	0	0	2	100	-	100
7	AC		**Audit Course – II**	2	0	0	0	40	-	40
		25DAC0101	Business Ethics and Corporate Governance							
		25DAC5801	System Modeling							
		25DAC9904	Stress Management By Yoga							
PRACTICAL										
8	PC	25DPC9008	Manufacturing Simulation Laboratory	0	0	4	2	40	60	100
9	PC	25DPC9009	Drives and Controls Lab	0	0	4	2	40	60	100
			Total				20	420	360	780

*__**Students must undergo an Industry Internship after I Year II Semester__*

__for duration of 6 to 8 weeks that will be evaluated in III semester.__

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Semester III (Second Year)

S.No.	Course codes	Course Name	Category	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P				
1.	**Program Elective – V**		PE	3	0	0	3	40	60	100
	25DPE9012	Design & Manufacturing of MEMS and Micro Systems								
	25DPE9013	Quality Engineering								
	25DPE9014	Smart Materials								
2.	**Open Elective-I**									
	25DOE9001	Integrated Product Design and Development	OE	3	0	0	3	40	60	100
3.	25DPR9001	Dissertation Phase – I	PR	0	0	20	10	100		100
4.	25DPR9002	Industry Internship		0	0	0	2	100		100
5.	25DPR9003	Co- Curricular Activities		0	0	0	1	-	-	-
		Total					19	280	120	400

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Semester IV (Second Year)

S.No.	Corse codes	Course Name	Category	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P				
1.	25DPR9004	Dissertation Phase – II	PR	0	0	32	16	100	100	200
Total							16	100	100	200

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Semester I (First year)

S.No	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	PC	25DPC9001	Advanced Finite Element Methods	3	0	0	3	40	60	100
2	PC	25DPC9002	Advanced Manufacturing Processes	3	0	0	3	40	60	100
3	PE		**Program Elective Course - I**	3	0	0	3	40	60	100
		25DPE9001	Computational Methods							
		25DPE9002	Design For Manufacturing							
		25DPE9003	Additive Manufacturing							
4	PE		**Program Elective Course - II**	3	0	0	3	40	60	100
		25DPE9004	Advanced Optimization Techniques							
		25DPE9005	Mechanical Vibrations							
		25DPE9006	Geometrical Dimensioning and Tolerances							
5	MC	25DMC0110	Research Methodology and IPR	2	0	0	2	40	60	100
6	SE	25DSE9001	Artificial Intelligence and Machine Learning for Mechanical Engineering	0	1	2	2	40	60	100
7	AC		**Audit Course – I**	2	0	0	0	40	-	40
		25DAC9901	English for Research Paper Writing							
		25DAC2001	Disaster Management							
		25DAC9902	Essence of Indian Traditional Knowledge							
PRACTICAL										
8	PC	25DPC9003	Design Simulation Laboratory	0	0	4	2	40	60	100
9	PC	25DPC9004	Advanced Manufacturing Processes & Metal Cutting Lab	0	0	4	2	40	60	100
			Total				20	360	480	840

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Year: I   Semester: I   Branch of Study: PEED

Subject Code	Subject Name	L	T	P	Credits
25DPC9001	Advanced Finite Element Methods	3	0	0	3

Course Outcomes: At the end of this course, student will be able to
CO1 Apply FEM formulation techniques for solving engineering problems using variational and weighted residual methods
CO2 Apply1- D FEM to bar elements, heat transfer, and temperature effects with boundary condition handling
CO3 Analyze trusses for displacements, reactions, stresses, and temperature effects using FEM
CO4 Evaluate 2-D problems and heat transfer analysis using CST, LST and ISO parametric formulations
CO5 Evaluate FEM applications in structural dynamics, eigenvalue problems, and convergence/refinement techniques for accurate solutions

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Apply	FEM formulation techniques for solving engineering problems	Variational and weighted residual methods		L3
CO2	Apply	1- DFEM to bar elements, heattransfer, and temperature effects	boundary condition handling		L3
CO3	Analyze	Trusses for displacements, reactions, stresses, and temperature effects	FEM		L4
CO4	Evaluate	2-Dproblemsandheattransfer analysis	CST, LST and ISO parametric formulations		L5
CO5	Evaluate	FEM applications in structural dynamics, eigenvalue problems, and convergence/refinement techniques	accurate solutions		L5

Unit-I

Formulation Techniques: Methodology, Engineering problems and governing differential equations, finite elements., Variational methods-potential energy method, Raleigh Ritz method, strong and weak forms, Galerkin and weighted residual methods, calculus of variations, Essential and natural boundary conditions.

Unit-II

One-dimensional finite element methods: Bar elements, temperature effects. Element matrices, assembling of global stiffness matrix, Application of boundary conditions, Elimination and penalty approaches, solution for displacements, reaction, stresses, temperature effects, Quadratic Element, Heat transfer problems: One-dimensional, conduction and convection problems. Examples: - one dimensional fin.

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Unit-III
Trusses: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses, temperature effects. Beams and Frames: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses.

Unit-IV
Two dimensional problems: CST, LST, four noded and eight nodded rectangular elements, Lagrange basis for triangles and rectangles, serendipity interpolation functions. Axisymmetric Problems: Axisymmetric formulations, Element matrices, boundary conditions. Heat Transfer problems: Conduction and convection, examples: - two-dimensional fin. Isoparametric formulation: Concepts, sub parametric, super parametric elements, numerical integration.

Unit-V
Finite elements in Structural Dynamics: Dynamic equations, eigen value problems, and their solution methods, simple problems. Convergence: Requirements for convergence, h-refinement and prefinement, complete and incomplete interpolation functions, pascal's triangle.

Textbooks:
1.Finite element methods by Chandraputla & Belagondu.
2.Finite element method in Heat transfer and fluid dynamics, . J.N.Reddy, CRC press,1994

Reference Books:
1. Finite Element Method, Zienckiwicz O.C. & R. L. Taylor,McGraw-Hill,1983.
2.Finite Element of Nonlinear continua, . J. N. Oden, McGraw-Hill, New York, 1971
3.Finite element procedures, . K. J. Bathe, Prentice-Hall, 1996.

Online Learning Resources:
1. nptel.ac.in/courses/112/106/112106130/
2. www.digimat.in/nptel/courses/video/112104193/L01.html

Mapping of course outcomes with program outcomes

Course Title	COs	Programmes Outcome's		
		PO1	PO2	PO3
Advanced Finite Element Methods	CO1	2	2	
	CO2	2	2	
	CO3		2	3
	CO4	2	2	
	CO5	2	3	3

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Year: I   **Semester: I**   **Branch of Study: PEED**

Subject Code	Subject Name	L	T	P	Credits
25DPC9002	Advanced Manufacturing Processes	3	0	0	3

Course Outcomes: At the end of this course, student will be able to
CO1 Apply the various surface processing operations in Manufacturing Industries
CO2 Analyze the process parameters, applications and limitations of distinct Un-Conventional Machining methods
CO3 Apply the parameters, Principles and operations of Electro-Chemical Process
CO4 Analyze the influence of LBM parameters on surface quality and major RP methods.
CO5 Analyze the working mechanisms of different Surface Processing Operations

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Apply	various surface processing operations		Manufacturing Industries	L3
CO2	Analyze	The process parameters, applications and limitations		Distinct Un-Conventional Machining methods	L4
CO3	Apply	The parameters, Principles and operations		Electro-Chemical Process	L2
CO4	Analyze	the influence		LBM parameters on surface quality and major RP methods	L4
CO5	Analyze	working mechanisms		Surface Processing Operations	L4

Unit-I
Conventional and Un-conventional Machining Methods: Introduction to conventional and un-conventional machining methods, difference between conventional and un-conventional machining methods.
Abrasive jet machining - Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent developments.
Ultrasonic machining: Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent developments.

Unit-II
Electro-Chemical Processes: Fundamentals of electro chemical machining, metal removal rate in ECM, Tool design, Surface finish and accuracy economics aspects of ECM. Wire EDM Process: General Principle and applications of Wire EDM, Mechanics of metal removal, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy

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Unit-III

Electron Beam Machining: Generation and control of electron beam for machining, theory of electron beam machining, principle, advantages, limitations, comparison of thermal and non-thermal processes. Plasma Arc Machining: Principle, machining parameters, effect of machining parameters on surface finish and metal removal rate, applications, limitations.

Unit-IV

Laser Beam Machining: Principle, effect of machining parameters on surface finish, applications, and limitations.
Rapid Prototyping: Working principle, methods-Steriolithography, Laser sintering, Fused deposition method, applications and limitations

Unit-V

Surface Processing Operations: Plating and Related Processes, Conversion Coatings, Physical Vapor Deposition, Chemical Vapor Deposition, Organic Coatings, Porcelain Enameling and other Ceramic coatings, Thermal and Mechanical Coating Processes.

Textbooks:
1. Manufacturing Technology - P. N. Rao, TMH Publishers
2. Fundamentals of Modern Manufacturing, Mikell P. Groover, John Wiley & Sons Publishers

Reference Books:
1. Production Technology - HMT
2. Manufacturing Science - Cambel
3. Welding Technology - R.S, Parmar,
4. Introduction to Nanotechnology - Poole and Owens, Wiley (2003).

Online Learning Resources:
1. https://onlinecourses.swayam2.ac.iic20_sp01/preview
2. https://onlinecourses.nptel.ac.in/noc25_me156/preview

Mapping of course outcomes with program outcomes

Course Title	COs	Programmes Outcome's		
		PO1	PO2	PO3
Advanced Manufacturing Processes	CO1	3		
	CO2	3		2
	CO3	3	2	2
	CO4	3	2	2
	CO5	3	2	2

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Program Elective Course - I

Year: I   **Semester: I**   **Branch of Study: PEED**

Subject Code	Subject Name	L	T	P	Credits
25DPE9001	Computational Methods	3	0	0	3

Course Outcomes: At the end of this course, student will be able to
CO1 Apply the numerical methods used to model and solve engineering problems.
CO2 Analyze one-dimensional and multidimensional unconstrained optimization problems.
CO3 Evaluate approximate solutions for Partial Differential Equations with different constraints.
CO4 Analyze stability and convergence of numerical schemes.
CO5 Apply least-squares methods for curve fitting and function approximation.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	Numerical methods used to modelandsolveengineeringproblems			L2
CO2	Analyze	one-dimensional and multidimensional unconstrained optimization problems			L4
CO3	Evaluate	approximate solutions for Partial Differential Equations with different constraints			L5
CO4	Analyze	stabilityand convergenceofnumerical schemes			L4
CO5	Apply	least-squares methods for curve fitting and function approximation			L3

Unit-I
Introduction to numerical methods applied to engineering problems: Examples, solving sets of equations – Matrix notation – Determinants and inversion – Iterative methods – Relaxation methods – System of non-linear equations – computer programs Numerical integration: Newton-Cotes integration formulas – Simpson's rules, Gaussian quadrature. Adaptive integration.

Unit-II
Optimization: One dimensional unconstrained optimization, multidimensional unconstrained optimization –direct methods and gradient search methods, constrained optimization Boundary value problems and characteristic value problems: Shooting method – Solution through a set of equations – Derivative boundary conditions – Rayleigh – Ritz method – Characteristic value problems.

Unit-III
Numerical solutions of partial differential equations: Laplace's equations – Representations as a difference equation – Iterative methods for Laplace's equations – poisson equation – Examples – Derivative boundary conditions – Irregular and non – rectangular grids – Matrix patterns, sparseness – ADI method – Finite element method.

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Unit-IV

Parabolic partial differential equations: Explicit method – Crank-Nickelson method – Derivative boundary condition – Stability and convergence criteria – Finite element for heat flow – computer programs. Hyperbolic partial differential equations: Solving wave equation by finite differences-stability of numerical method –method of characteristics-wave equation in two space dimensions computer programs.

Unit-V

Curve fitting and approximation of functions: Least square approximation fitting of nonlinear curves by least squares –regression analysis- multiple linear regression, non linear regression - computer programs.

Textbooks:

1. Numerical Methods for Engineers, Steven C.Chapra, Raymond P.Canale Tata Mc-Graw hill
2. Applied numerical analysis", Curtis F.Gerald, partick.O.WheatlyAddison-wesley,1989
3. Numerical methods", Douglas J..Faires,Riched BurdenBrooks/cole publishing company,1998.Second edition.

Reference Books:

1. Numerical mathematics and computing", Ward cheney &David Kincaid Brooks/Cole publishing company1999,fourth edition.
2. Mathematical methods for physics and engineering"Riley K.F.M.P.Hobson.&.Bence S.J.Cambridge university press,1999.

Online Learning Resources:

1. nptel.ac.in/noc/courses/noc15/SEM1/noc15-ch04/
2. https://www.nature.com/subjects/computational-methods#:~:text=Computational%20models%20are%20mathematical%20models,means%20of%20a%20computer%20simulation.
3. https://www.sciencedirect.com/topics/computer-science/computational-method

Course Title	COs	Programmes Outcome's		
		PO1	PO2	PO3
Computational Methods	CO1	3		2
	CO2	3		2
	CO3	3		2
	CO4	3		2
	CO5	3		2

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Program Elective Course - I

Year: I **Semester: I** **Branch of Study: PEED**

Subject Code	Subject Name	L	T	P	Credits
25DPE9002	Design For Manufacturing	3	0	0	3

Course Outcomes: At the end of this course, student will be able to
CO1 Apply design principles for economic production and Material Selection Principles.
CO2 Apply general design rules for machining and redesign Components for Machining.
CO3 Apply the product design rules for Metal casting process.
CO4 Analyze the factors to influence weldment design.
CO5 Apply the design guide lines for Forging and Sheet Metal Work.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Apply	design principles for economic production and Material Selection Principles			L3
CO2	Apply	General design rules for machining and redesign Components for Machining			L3
CO3	Apply	the product design rules for Metal casting process			L3
CO4	Analyze	the factors that influence weldment design			L4
CO5	Apply	the design guide lines for Forging and Sheet Metal Work			L3

Unit-I
Introduction: Design philosophy - steps in design process - general design rules for manufacturability - basic principles of designing for economical production - creativity in design.
Materials: Selection of materials for design - developments in material technology -criteria for material selection - material selection interrelationship with process selection -process selection charts.

Unit-II
Machining techniques: Overview of various machining processes-general design rules for machining - dimensional tolerance and surface roughness - Design for machining - ease - redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

Unit-III
Metal casting: Appraisal of various casting processes, selection of casting process- general design considerations for casting - casting tolerance - use of solidification, simulation in casting design - product design rules for sand casting.

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Unit-IV
Metal joining: Appraisal of various welding processes, factors in design of weldments - general design guidelines - pre and post treatment of welds - effects of thermal stresses in weld joints design of brazed joints.

Unit-V
Forging: Design factors for forging - closed die forging design - parting lines of dies - drop forging die design - general design recommendations.
Extrusion & Sheet metal work: Design guide lines extruded sections - design principles for punching, blanking, bending, deep drawing - Keeler Goodman forging line diagram - component design for blanking.

TEXT BOOKS:
1. Design for Manufacture, John cobert, Adisson Wesley. 1995
2. Design for Manufacture by Boothroyd,

REFERENCES:
1. ASM Hand book Vol.20
2. Engineering Design - Material & Processing Approach/ George E. Deiter/McGraw Hill Intl.2nd Ed. 2000.
3. Product Design for Manufacturing and Assembly/ Geoffrey Boothroyd, Peter Dewhurst & Winston A. Knight/CRC Press/2011.

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3
CO1	3		
CO2	3		
CO3	3	2	2
CO4	3	2	2
CO5	3	2	2

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Program Elective Course - I

Year: I   Semester: I   Branch of Study: PEED

Subject Code	Subject Name	L	T	P	Credits
25DPE9003	Additive Manufacturing	3	0	0	3

Course Outcomes: At the end of this course, student will be able to
CO1 Understand the Fundamental Concepts of Additive Manufacturing.
CO2 Analyze the operational principles and elements of Fused Deposition Modeling.
CO3 Analyze the operational principle and process details of Laminated Object Manufacturing.
CO4 Analyze the principles and applications of Laser Engineering Net Shaping.
CO5 Evaluate the critical factors influencing the accuracy of parts produced by rapid manufacturing processes.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	The Fundamental Concepts of Additive Manufacturing			L2
CO2	Analyze	the operational principles and elements of Fused Deposition Modeling			L4
CO3	Analyze	the operational principle and process details of Laminated Object Manufacturing			L4
CO4	Analyze	the principles and applications of Laser Engineering Net Shaping			L4
CO5	Evaluate	the critical factors influencing the accuracy of parts produced by rapid manufacturing processes.			L5

Unit-I
Introduction: Need for the compression in product development, History of RP system, Survey of applications, Growth of RP industry and classification of RP system. Stereo Lithography, Selective Laser Sintering and Selective Laser Melting Systems: Principle, Process parameter, Process details, Data preparation, Data files and machine details, Applications.

Unit-II
Fusion Decomposition Modeling: Principle, process parameter, Path generation, Applications. Solid ground curing: Principle of operation, Machine details, Applications.

Unit-III
Laminated Object Manufacturing: Principle of Operation, LOM materials, Process details, Applications. Concepts Modelers: Principle, Thermal jet printer, Sander's model market, 3-D printer, Genesis Xs printer HP system 5, Object Quadra system.

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Unit-IV
LASER ENGINEERING NET SHAPING (LENS) Rapid Tooling: Indirect Rapid tooling-Silicon rubber tooling- Aluminum filled epoxy tooling Spray metal tooling, Cast kriksite, 3Q keltool, etc, Direct Rapid Tooling Direct. AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft, Tooling vs. hard tooling. Software for RP: STL files, Overview of Solid view, magics, imics, magic communication, etc. Internet based software, Collaboration tools.

Unit-V
Rapid Manufacturing Process Optimization: Factors influencing accuracy, Data preparation error, Part building error, Error in finishing, Influence of build orientation.

Textbooks:
1. " Stereo lithography and other RP & M Technologies", Paul F.Jacobs, SME, NY 1996
2. " Rapid Manufacturing ", Flham D.T & Dinjoy S.S, Verlog London 2001
3. "Rapid automated", Lament wood, Indus Press New York.

Reference Books:
Textbook of Rapid Prototyping Ramesh S

Online Learning Resources:
1.https://onlinecourses.nptel.ac.in/noc20_me50/preview
2.nptel.ac.in/noc/courses/noc19/SEM1/noc19-me24/

	PO1	PO2	PO3
CO1	3		2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	2	3	2

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Program Elective Course - II

Year: I   **Semester: I**   **Branch of Study: PEED**

Subject Code	Subject Name	L	T	P	Credits
25DPE9004	Advanced Optimization Techniques	3	0	0	3

Course Outcomes: At the end of this course, student will be able to
CO1 Apply classical optimization techniques for single and multi-variable problems.
CO2 Apply geometric programming to perform constrained and unconstrained minimization.
CO3 Apply Genetic Programming to function modeling and solving differential equations.
CO4 Apply multi-objective optimization concepts such as non-dominated fronts and NSGA methods.
CO5 Apply general optimization models for real engineering applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Apply	classical optimization techniques for single and multi-variable problems			L2
CO2	Apply	Geometric programming to perform constrained and unconstrained minimization			L3
CO3	Apply	Genetic Programming to function modeling and solving differential equations			L3
CO4	Apply	multi-objective optimization concepts such as non-dominated fronts and NSGA methods			L3
CO5	Apply	General optimization models for real engineering applications			L3

Unit-I
Classical optimization techniques: Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions.
Numerical methods for optimization: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method.

Unit-II
Integer programming: cutting plane method and branch and bound technique. Geometric Programming: Unconstrained & Constrained Minimization

Unit-III
Genetic algorithm (GA) : Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA,
Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, solving differential equations using GP.

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Unit-IV

Multi-Objective Optimization : Introduction to goal programming , Non-dominated front, multi – objective GA, Non-dominated sorted GA, convergence criterion, applications of multi-objective problems . Introduction to Analytical hierarchical process, analytical network process.

Unit-V

Applications of Optimization in Design and Manufacturing systems: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, optimization of springs and gears, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

Textbooks:

1. Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers

2. Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers

3. Engineering Optimization – S.S.Rao, New Age Publishers

4. Operation Research by Hamdy A. Taha, Pearson publications

Reference Books:

1.Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers

2.Genetic Programming- Koza

3.Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers

4.Fundamentals of Metal cutting and Machine tools , B.L.Juneja, G. S. Sekhom and Nitin Seth , New Age International publishers

5.Tool Engineering, G.R.Nagpal, Khanna Publishers

Online Learning Resources:

1.https://www.youtube.com/watch?v=eo2tOPV3AoE

2.https://www.youtube.com/watch?v=4t3z8y4CAcs

3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/lecture-videos/lecture-1-introduction-and-optimization-problems/

4. https://ocw.mit.edu/courses/sloan-school-of-management/15-093j-optimization-methods-fall-2009/lecture-notes/

5.https://web.eng.fiu.edu/arleon/courses/Optimization/Lectures/Classical_Optimization.pdf

6. https://nptel.ac.in/content/storage2/courses/105108127/pdf/Module_1/M1L4_LN.pdf

7.https://www.iare.ac.in/sites/default/files/OT%20Complete%20Notes_1.pdf

Course Title	COs	Programmes Outcome's		
		PO1	PO2	PO3
Advanced Optimization Techniques	CO1	3	2	2
	CO2	3	2	2
	CO3	3	2	2
	CO4	3	2	2
	CO5	3	2	2

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Program Elective Course - II

Year: I   Semester: I   Branch of Study: PEED

Subject Code	Subject Name	L	T	P	Credits
25DPE9005	Mechanical Vibrations	3	0	0	3

Course Outcomes: At the end of this course, student will be able to
CO1 Analyze the free and forced vibration response of Single Degree-of-Freedom systems.
CO2 Evaluate the operation and application of vibration measuring instruments.
CO3 Analyze the motion for Multi Degree-of-Freedom systems using matrix methods.
CO4 Apply the numerical and approximate methods to solve complex vibration problems.
CO5 Analyze the free vibration of Continuous Systems and critical speeds.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	the free and forced vibration response of Single Degree-of-Freedom systems			L4
CO2	Evaluate	the operation and application of vibration measuring instruments			L5
CO3	Analyze	the motion for Multi Degree-of-Freedom systems using matrix methods			L4
CO4	Apply	the numerical and approximate methods to solve complex vibration problems			L3
CO5	Analyze	the free vibration of Continuous Systems and critical speeds			L4

Unit-I
Single degree of Freedom systems: Undamped and damped free vibrations: forced vibrations; coulomb damping; Response to harmonic excitation; rotating unbalance and support excitation; Vibration isolation and transmissibility.

Response to Non Periodic Excitations: unit Impulse, unit step and unit Ramp functions; response to arbitrary excitations, The Convolution Integral; shock spectrum; System response by the Laplace Transformation method.

Unit-II
Vibration measuring instruments : Vibrometers, velocity meters & accelerometers
Two degree freedom systems: Principal modes – undamped and damped free and forced vibrations; undamped vibration absorbers

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Unit-III
Multi degree freedom systems: Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi – rotor systems and geared systems; Discrete-Time systems.

Unit-IV
Numerical Methods: Rayliegh's, stodola's, Matrix iteration, Rayleigh-Ritz Method and Holzer's methods.

Unit-V
Continuous systems: Free vibration of strings – longitudinal oscillations of bars-traverse vibrations of beams- Torsional vibrations of shafts.

 Critical speeds of shafts: Critical speeds without and with damping, secondary critical speed.

 Textbooks:
 1. Elements of Vibration Analysis by Meirovitch.
 2. Mechanical Vibrations by G.K. Groover.

 Reference Books:
 1. Vibrations by W.T. Thomson
 2. Mechanical Vibrations – Schaum series.
 3. Vibration problems in Engineering by S.P. Timoshenko.
 4. Mechanical Viabrations – V.Ram Murthy

 Online Learning Resources:
 https://nptel.ac.in/courses/112/103/112103112/
 https://youtu.be/NqiGVeOn9cY
 https://youtu.be/KcWCkNdEQfs
 https://youtu.be/s287PPKRXBU
 https://youtu.be/LaxkM1B3Lm4
 https://www.youtube.com/watch?v=bn8Ztp3kTq8

 Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3
CO1	2	2	
CO2	3	3	2
CO3			2
CO4	2		
CO5	2	1	

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Program Elective Course - II

Year: I   Semester: I   Branch of Study: PEED

Subject Code	Subject Name	L	T	P	Credits
25DPE9006	Geometrical Dimensioning and Tolerances	3	0	0	3

Course Outcomes: At the end of this course, student will be able to
CO1 Apply dimensioning principles, limits, fits, and GD&T standards to inspect dimensional sizes and geometrical deviations accurately.
CO2 Analyze and interpret the tolerances with proper specifications to measure straightness, flatness, roundness, and orientation deviations.
CO3 Analyze the tolerance type in profile of lines, run out, angle, and cone and interpret their location with geometric design specifications.
CO4 Apply filtering techniques to measure various two-dimensional and areal parameters for surface texture analysis.
CO5 Analyze dimensional chains, uncertainty, vectorial and statistical tolerancing to verify assemblies using conventional and CMM inspection.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Apply	dimensioning principles, limits, fits, and GD&T standards	to inspect dimensional sizes and geometrical deviations	accurately	L3 (Apply)
CO2	Analyze	the tolerances with proper specifications	to measure straightness, flatness, roundness, and orientation deviations		L4 (Analyze)
CO3	Analyze	tolerance types in profile of lines, runout, angle, and cone	and interpret their location with geometric design specifications		L2 (Understand)
CO4	Apply	filtering techniques	to measure various two-dimensional and areal parameters for surface texture analysis		L3 (Apply)
CO5	Analyze	dimensional chains, uncertainty, vectorial and statistical tolerancing	to verify assemblies using conventional and CMM inspection		L4 (Analyze)

Unit-I
Basic Concepts:
General terms and definitions of geometrical features - General principle of sizes - System of limits and fits - Principles of dimensioning - Introduction to geometric dimensioning and tolerancing (GD&T) - Inspection of dimensional and geometrical deviations - Datums and datum systems. Rule #1 and Rule #2- Boundary principle.

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Unit-II
Form and Orientation Tolerances:
Form tolerances: types, specifications and interpretations - measurement and evaluation of straightness, flatness and roundness - Orientation tolerances: types, specifications and interpretations, and verification of orientation tolerances. Exercises on each group.

Unit-III
Location, Runout and Profile Tolerances :
Tolerances of location: types, specifications and interpretations - verification techniques - Tolerances of profiles of lines and surfaces with or without datums - Tolerances of runout -Tolerancing of angles and cones. Exercises on each group.

Unit-IV
Surface Roughness :
Various parameters and their measurements in two dimensions - filtering and filtering techniques - areal parameters. Problems on Centre Line Average (CLA) and Roughness Average (RA).

Unit-V
Related Topics :
Vectorial dimensioning and tolerancing - Statistical tolerancing of mechanical assemblies -Dimensional chains - Measurement uncertainty - Computer-aided tolerancing and verification. Inspection techniques-conventional and CMM.

Textbooks:

1. Drake, P. J., Dimensioning and Tolerance Handbook, McGraw-Hill, Inc., New York.

2. Meadows, J. D., Geometric Dimensioning and Tolerancing Applications and Techniques for use in Design, Manufacturing and Inspection, Marcel Dekker, Inc.,New York.

3. Gill, P. S., Geometric Dimensioning and Tolerancing, S. K. Kataria & Sons, New Delhi.

Reference Books:

1. Gupta, I. C., A Textbook of Engineering Metrology, Dhanpat Rai Publications, New Delhi.

2. Galyer, J. F. W. and C. R. Shotbolt, Metrology for Engineers, Cassell Publishers, London.

3. Henzold, G., Handbook of Geometrical Tolerancing Design, Manufacturing and Inspection, John Wiley & Sons, Chichester.

4. Muralikrishnan, B. and J. Raja, Computational Surface and Roundness Metrology, Springer, USA.

5. Relevant Indian and International Standards.

6. Whitehouse, D. J., Surfaces and their Measurement, Hermes Penton Science, London

Online Learning Resources:

1.http://www.pages.drexel.edu/~rcc34/Files/Teaching/MEM201%20L6-Tolerance_RC.pdf
2.https://www.youtube.com/watch?v=aS9OgYadjpY
3.https://www.youtube.com/watch?v=X_VepJhq_vk

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Mapping of course outcomes with program outcomes

	PO1	PO2	PO3
CO1	2	2	
CO2	3	3	
CO3	3		2
CO4	3	3	
CO5	2	2	

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Year: I **Semester: I** **Branch of Study: PEED**

Subject Code	Subject Name	L	T	P	Credits
25MBA0110	Research Methodology and IPR	2	0	0	2

Course Outcomes: At the end of this course, student will be able to
CO1 Understand various research approaches for different research goals to identify suitable methodologies.
CO2 Analyze various sources and tools and technologies to collect the data.
CO3 Apply statistical methods for analysing data and understand the guidelines for report writing.
CO4 Analyze the safeguarding of business secrets by using various types of Intellectual Property Rights
CO5 Understand the procedure for filling and grant of patent to protect the innovative ideas of the business.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	various research approaches for different research goals.		to identify suitable methodologies	L2
CO2	Analyze	various sources and tools and technologies		to collect the data	L4
CO3	Apply Understand	statistical methods for analysing data the guidelines for report writing			L3 L2
CO4	Analyze	the safeguarding of business secrets	by using various types of Intellectual Property Rights		L4
CO5	Understand	the procedure for filling and grant of patent		to protect the innovative ideas of the business	L2

Unit-I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, scope, and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit-II

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Unit-III

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

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Unit-IV

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit-V

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Textbooks:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"

2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

Reference Books:

1. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"

2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.

3. Mayall, "Industrial Design", McGraw Hill, 1992.

4. Niebel, "Product Design", McGraw Hill, 1974.

5. Asimov, "Introduction to Design", Prentice Hall, 1962.

6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

CO	PO1	PO2	PO3
CO1	2		
CO2	3		
CO3	2	2	
CO4	3		
CO5	2		

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Year: I   **Semester: I**   **Branch of Study: PEED**

Subject Code	Subject Name	L	T	P	Credits
25DSE9001	Artificial Intelligence and Machine Learning for Mechanical Engineering	0	1	2	2

Course Outcomes: At the end of this course, student will be able to
CO1 Understand the concepts, history and branches of Artificial Intelligence with relevance to Mechanical engineering applications
CO2 Apply machine learning models and algorithms to solve Mechanical engineering problems
CO3 Apply artificial neural network and deep learning models for Optimization techniques in engineering applications
CO4 Understand fuzzy logic and expert systems to handle uncertainty in engineering decision-making
CO5 Understand prompt engineering techniques to effectively use AI tools in Mechanical engineering

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the concepts, history and branches of Artificial Intelligence	with relevance to Mechanical engineering applications		L2 (Understand)
CO2	Apply	machine learning models and algorithms	to solve Mechanical engineering problems		L3 (Apply)
CO3	Apply	artificial neural network and deep learning models	for Optimization techniques in engineering applications		L3 (Apply)
CO4	Understand	fuzzy logic and expert systems	to handle uncertainty in engineering decision-making		L2 (Understand)
CO5	Understand	prompt engineering techniques	to effectively use AI tools in Mechanical engineering		L2 (Understand)

Unit-I
Introduction to Artificial Intelligence and Problem-Solving Agent: Problems of AI, AI technique, Tic – Tac – Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents. Defining the problem as state space search, production system, problem characteristics, and issues in the design of search programs
Unit-II
Search Techniques: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best -first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search

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Unit-III

Constraint Satisfaction Problems and Game Theory: Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening

Unit-IV

Knowledge & Reasoning: Statistical Reasoning: Probability and Bays' Theorem, Certainty Factors and Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic. AI for knowledge representation, rule-based knowledge representation, procedural and declarative knowledge, Logic programming, Forward and backward reasoning.

Unit-V

Introduction to Machine Learning: Exploring sub-discipline of AI: Machine Learning, Supervised learning, Unsupervised learning, Reinforcement learning, Classification problems, Regression problems, Clustering problems, Introduction to neural networks and deep learning**.**

Textbooks:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2015.
2. Nils J. Nilsson, "Artificial Intelligence: A New Synthesis", 1st Edition, Morgan-Kaufmann, 1998.

Reference Books:

1. Elaine Rich, Kevin Knight, & Shivashankar B Nair, "Artificial Intelligence", McGraw Hill, 3rd ed.,2017.
2. Patterson, "Introduction to Artificial Intelligence & Expert Systems", Pearson, 1st ed. 2015.
3. Saroj Kaushik, "Logic & Prolog Programming", New Age International, Ist edition, 2002.
4. Joseph C. Giarratano,Gary D. Riley, "Expert Systems: Principles and Programming", 4th Edition, 2007.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3
CO1	3	2	2
CO2	2	3	2
CO3	2	3	2
CO4	3	2	2
CO5	2	2	3

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Audit Course - I

Year: I   Semester: I   Branch of Study: PEED

Subject Code	Subject Name	L	T	P	Credits
25DMC9901	English for Research Paper Writing	2	0	0	0

Course Outcomes: At the end of this course, student will be able to
CO1 Understand the key language aspects and structural elements of academic writing in research papers.
CO2 Apply note-making techniques to organize information from academic and research texts.
CO3 Apply correct use of voice, subject–verb agreement, and modifiers to improve sentence accuracy
CO4 Apply editing strategies to improve clarity, coherence, structure, grammar, and spelling in academic writing
CO5 Analyze plagiarism, ethical issues, and fair-use practices using digital tools and awareness strategies.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	The key language aspects and structural elements of academic writing	in research papers		L2
2	Apply	Note-making techniques to organize information		From academic and research texts	L3
3	Apply	Correct use of voice, subject–verb agreement, and modifiers to improve sentence accuracy			L3
4	Apply	Editing strategies to improve clarity, coherence, structure, grammar, and spelling	in academic writing		L3
5	Analyze	Plagiarism, ethical issues, and fair-use practices.		Using digital tools and awareness strategies	L4

UNIT - I	Fundamentals of Academic English	Lecture Hrs: 9

Academic English - MAP (Message-Audience-Purpose) - Language Proficiency for Writing - Key Language Aspects - Clarity and Precision - Objectivity - Formal Tone - Integrating References - Word order - Sentences and Paragraphs - Link Words for Cohesion - Avoiding Redundancy / Repetition - Breaking up long sentences - Structuring Paragraphs -
Paraphrasing Skills – Framing Title and Sub-headings

UNIT - II	Reading Skills for Researchers	Lecture Hrs:9

Reading Academic Texts - Critical Reading Strategies - Skimming and Scanning - Primary Research Article vs. Review Article - Reading an Abstract - Analyzing Research Articles - Identifying Arguments - Classifying Methodologies -
Evaluating Findings - Making Notes

UNIT - III	Grammar Refinement for Research Writing	Lecture Hrs:9

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Advanced Punctuation Usage - Grammar for Clarity - Complex Sentence Structures - Active- Passive Voice - Subject- Verb Agreement - Proper Use of Modifiers - Avoiding Ambiguous Pronoun References - Verb Tense Consistency -
Conditional Sentences

UNIT - IV	Mastery in Refining Written Content/Editing Skills	Lecture Hrs:9

Effective Revisions - Restructuring Paragraph - Editing vs Proofreading, Editing for Clarity and Coherence - Rectifying Sentence Structure Issues - Proofreading for Grammatical Precision – Spellings - Tips for Correspondence with Editors
- Critical and Creative Phases of Writing

UNIT - V	Technology and Language for Research	Lecture Hrs:9

Digital Literacy and Critical Evaluation of Online Content - Technology and Role of AI in Research Writing – Assistance in Generating Citations and References - Plagiarism and Ethical Considerations – Tools and Awareness –
Fair Practices

Textbooks:

1. Bailey. S. A*cademic Writing: A Handbook for International Students.* London and New York: Routledge,2015.
2. Adrian Wallwork, *English for Writing Research Papers*, Springer New York Dordrecht Heidelberg London, 2011.

Reference Books:

1. Craswell, G. *Writing for Academic Success,* Sage Publications, 2004.
2. Peter Elbow, *Writing With Power, E-book*, Oxford University Press, 2007
3. Oshima, A. & Hogue, A. *Writing Academic English*, Addison-Wesley, New York, 2005
4. Swales, J. & C. Feak, Academic Writing for Graduate Students: Essential Skills
5. and Tasks. Michigan University Press, 2012.
6. 5.Goldbort R.*Writing for Science*, Yale University Press (available on Google Books), 2006
7. 6. Day R.*How to Write and Publish a Scientific Paper*, Cambridge University Press, 2006

Online References:

1. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ge04/
2. https://onlinecourses.swayam2.ac.in/ntr24_ed15/preview
3. 3.. "Writing in the Sciences" – Stanford University (MOOC on Coursera) https://www.coursera.org/learn/sciwrite
4. Academic Phrasebank – University of Manchester
5. http://www.phrasebank.manchester.ac.uk
6. 5. OWL (Online Writing Lab) – Purdue University,   https://owl.purdue.edu
7. *(Resources on APA/MLA formats, grammar, structure, paraphrasing)*
8. Zotero or Mendeley (Reference Management Tools) – Useful for managing citations and sources

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	3	3	
CO2	3	3	
CO3	2	3	
CO4	2	3	
CO5	2	3	

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Audit Course - I

Year: I   Semester: I   Branch of Study: PEED

Subject Code	Subject Name	L	T	P	Credits
25DMC2001	Disaster Management	2	0	0	0

Course Outcomes: At the end of this course, student will be able to
CO1 Understand the key language aspects and structural elements of academic writing in research papers.
CO2 Analyze research articles and identify the strengths and limitations of different methodologies.
CO3 Apply critical reading strategies and advanced grammar skills to analyze and write research papers.
CO4 Evaluate research papers to check for plagiarism, structure, clarity, and language accuracy and develop a well-structured research paper that effectively communicates complex ideas.
CO5 Evaluate the effectiveness of different language and technology tools in research writing, including AI-assisted tools and plagiarism detection software.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	the key language aspects and structural elements of academic writing in research papers.	elements of academic writing in research papers.		L2
2	Analyze	research articles and identify the strengths and limitations of different methodologies.	the strengths and limitations of different methodologies.		L4
3	Apply	critical reading strategies and advanced grammar skills to analyze and write research papers.	to analyze and write research papers.		L3
4	Evaluate	research papers to check for plagiarism, structure, clarity, and language accuracy and develop a well-structured research paper that effectively communicates complex ideas.	to check for plagiarism, structure, clarity, and language accuracy	a well-structured research paper that effectively communicates complex ideas.	L5
5	Evaluate	the effectiveness of different language and technology tools in research writing, including AI-assisted tools and plagiarism detection software.	technology tools in research writing	AI-assisted tools and plagiarism detection software.	L5

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UNIT – I	Introduction	9 Hrs

Disaster - Definition, Factors and Significance - Difference Between Hazard and Disaster - Natural and Man- made Disasters - Difference, Nature, Types and Magnitude -
Disaster Prone Areas in India - Study of Seismic Zones - Areas Prone to Floods and Droughts, Landslides and Avalanches - Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami - Post-Disaster Diseases and Epidemics.

UNIT – II	Repercussions of Disasters and Hazards	9 Hrs

Economic Damage - Loss of Human and Animal Life - Destruction of Ecosystem - Natural Disasters - Earthquakes, Volcanism, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches,
Man-made disaster - Nuclear Reactor Meltdown - Industrial Accidents - Oil Slick sand Spills - Outbreaks of Disease and Epidemics War and Conflicts

UNIT – III	Disaster Preparedness and Management	9 Hrs

Preparedness - Monitoring of Phenomena - Triggering a Disasteror Hazard - Evaluation of Risk- Application
of Remote Sensing - Data from Meteorological and Other Agencies - Media Reports- Governmental and Community Preparedness

UNIT – IV	Risk Assessment	9 Hrs

Disaster Risk -Concept and Elements, Disaster Risk Reduction - Global and National Disaster Risk Situation - Techniques of Risk Assessment – Global Co-Operation in Risk Assessment and Warning - People's
participation in Risk Assessment – Strategies for Survival

UNIT – V	Disaster Mitigation	9 Hrs

Meaning, Concept and Strategies of Disaster Mitigation - EmergingTrends in Mitigation - Structural
Mitigation and Non- Structural Mitigation - Programs of Disaster Mitigation in India

Textbooks:

1. Gupta, H. K. *Disaster Management*. Universities Press, 2003
2. Singh, R. B. *Natural Hazards and Disaster Management*. Rawat Publications, 2006.

Reference Books:

1. Coppola, D. P. (2020). *Introduction to International Disaster Management* (4th ed.). Elsevier.
2. Shaw, R., & Izumi, T. (2022). *Science and Technology in Disaster Risk Reduction in Asia*. Springer.
3. Wisner, B., Gaillard, J. C., & Kelman, I. (2021). *Handbook of Hazards and Disaster Risk Reduction and Management* (2nd ed.). Routledge.
4. Saini, V. K. (2021). *Disaster Management in India: Policy, Issues and Perspectives*. Sage India.
5. Kelman, I. *Disaster by Choice: How Our Actions Turn Natural Hazards into Catastrophes,* Oxford University Press, 2022
6. 6. Sahni, P. & Dhameja, A. *Disaster Mitigation: Experiences and Reflections*. Prentice Hall of India, 2004.

Online References:

- 1 **National Disaster Management Authority (NDMA), India**:
  https://ndma.gov.in – official guidelines, reports, and policy frameworks.
- **United Nations Office for Disaster Risk Reduction (UNDRR)**:
  https://www.undrr.org – Sendai Framework, global risk reduction strategies.
- **Global Disaster Alert and Coordination System (GDACS)**: https://www.gdacs.org
  – real-time disaster alerts.
  World Health Organization (WHO) – https://www.who.int/emergencies – disaster- related health guidelines

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Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	1		
CO2	3		
CO3		2	
CO4			3
CO5			3

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Audit Course - I

Year: I   **Semester: I**   **Branch of Study: PEED**

Subject Code	Subject Name	L	T	P	Credits
25DMC9902	Essence of Indian Traditional Knowledge	2	0	0	0

Course Outcomes: At the end of this course, student will be able to
CO1 Understand the concept of traditional knowledge, its nature, characteristics, and scope
CO2 Understand the need for protecting traditional knowledge and its significance in the global economy
CO3 Analyze the legal framework and policies related to traditional knowledge protection
CO4 Apply traditional knowledge in different sectors, such as engineering, medicine, agriculture, and biotechnology
CO5 Analyze the relationship between traditional knowledge and intellectual property rights, including patents and non-IPR mechanisms

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	The concept of traditional knowledge, its nature, characteristics, and scope			L2
CO2	Understand	The need for protecting traditional knowledge and its significance		In the global economy	L2
CO3	Analyze	The legal framework and policies	Related to traditional knowledge protection		L4
CO4	Apply	Traditional knowledge in different sectors	Such as engineering, medicine, agriculture, and biotechnology		L3
CO5	Analyze	the relationship between traditional knowledge and intellectual property rights, including patents and non-IPR mechanisms			L4

UNIT – I		9 Hrs

Introduction to traditional knowledge - Definition, Nature and characteristics, scope and importance - Kinds of traditional knowledge - Physical and social contexts in which traditional knowledge develop - Historical impact of social change on traditional knowledge systems - Indigenous Knowledge (IK) – Characteristics -
traditional knowledge vis-à-vis indigenous knowledge -Traditional knowledge Vs western knowledge, traditional knowledge vis-à-vis formal knowledge

UNIT – II		9 Hrs

Protection of traditional knowledge- Need for protecting traditional knowledge - Significance of TK Protection
- Value of TK in global economy - Role of Government to harness TK.

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UNIT – III		9 Hrs

Legal frame work and TK - A)The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 - Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act) – B)The Biological Diversity Act 2002 and Rules 2004 - the protection of traditional knowledge bill, 2016 - Geographical Indicators Act 2003.

UNIT – IV		9 Hrs

Traditional knowledge and Intellectual property - Systems of traditional knowledge protection - Legal concepts for the protection of traditional knowledge - Certain non-IPR mechanisms of traditional knowledge protection - Patents and traditional knowledge - Strategies to increase protection of traditional knowledge -Global legal FORA for increasing protection of Indian Traditional Knowledge.

UNIT – V		9 Hrs

Traditional knowledge in different sectors - Traditional knowledge and Engineering - Traditional medicine system - TK and Biotechnology - TK in Agriculture - Traditional societies depend on it for their food and healthcare needs - Importance of conservation and sustainable development of environment - Management of biodiversity, Food security of the country and protection of TK

Textbooks:

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. *Introduction to Indian Knowledge System: Concepts and Applications*, PHI Learning Pvt.Ltd. Delhi, 2022.
2. 2.Basanta Kumar Mohanta and Vipin Kumar Singh,*Traditional Knowledge System and Technology in India,* PratibhaPrakashan 2012.

Reference Books:

1. Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati, New Delhi.
2. Kak, S.C. "On Astronomy in Ancient India", Indian Journal of History of Science, 22(3), 1987
3. Subbarayappa, B.V. and Sarma, K.V. *Indian Astronomy: A Source Book*, Nehru Centre, Mumbai, 1985.
4. Bag, A.K. *History of Technology in India*, Vol. I, Indian National Science Academy, New Delhi, 1997.
5. Acarya, P.K. *Indian Architecture*, Munshiram Manoharlal Publishers, New Delhi, 1996.
6. Banerjea, P. *Public Administration in Ancient India,* Macmillan, London, 1961.
7. Kapoor Kapil, Singh Avadhesh,*Indian Knowledge Systems Vol – I & II,* Indian Institute of Advanced Study, Shimla, H.P., 2022

Online References:

- https://www.youtube.com/watch?v=LZP1StpYEPM 2.http://nptel.ac.in/courses/121106003/

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	3	–	–
CO2	2	–	–
CO3	2	–	–
CO4	2	2	3
CO5	–	3	2

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Year: I   **Semester: I**   **Branch of Study: PEED**

Subject Code	Subject Name	L	T	P	Credits
25DPC9003	Design Simulation Laboratory	0	0	4	2

Course Outcomes: At the end of this course, student will be able to
CO1 Apply the CAD Techniques for Component Representation.
CO2 Apply Finite Element Discretization Methods to validate computational analysis.
CO3 Analyze Static and Stability Analysis on Mechanical Components.
CO4 Analyze Dynamic and Vibrational Analysis of Structures.
CO5 Analyze Advanced Materials and Failure Mechanisms.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Apply	the CAD Techniques for Component Representation			L3 (Apply)
CO2	Apply	Finite Element Discretization Methods to validate computational analysis			L3 (Apply)
CO3	Analyze	Static and Stability Analysis on Mechanical Components			L4 (Analyze)
CO4	Analyze	Dynamic and Vibrational Analysis of Structures			L4 (Analyze)
CO5	Analyze	Advanced Materials and Failure Mechanisms			L4 (Analyze)

List of Experiments
I Modeling
    1. Surface modelling (CO1)
    2. Solid modeling (CO1)
    3. Drafting (CO1)
    4. Assembling (CO1)
II Structural Analysis using any FEA Package for different structures that can be discretised with 1-D,2-D & 3-D elements
    1. Static Analysis (CO2,CO3)
    2. Modal Analysis (CO2,CO4)
    3. Harmonic Analysis (CO2,CO4)
    4. Spectrum Analysis (CO2,CO4)
    5. Buckling Analysis (CO2,CO3)
    6. Analysis of Composites (CO2,CO5)
    7. Fracture mechanics (CO2,CO5)

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References:

User manuals of ANSYS package Version 10.0 PRO/E, I-
DEAS Package / UNIGRAPHICS, CATIA

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	3	3	3
CO2	3	2	2
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

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Year: I   **Semester: I**   **Branch of Study: PEED**

Subject Code	Subject Name	L	T	P	Credits
25DPC9004	Advanced Manufacturing Processes & Metal Cutting Lab	0	0	4	2

Course Outcomes: At the end of this course, student will be able to
CO1 Analyze the Mechanics of Chip Formation in Traditional Machining.
CO2 Analyze the characteristic features and quality of parts produced by forming processes.
CO3 Analyze the Operation and Application of Precision Grinding Machines.
CO4 Analyze the Process Parameters of Advanced Non-Traditional Machining Methods.
CO5 Understand the operation and capabilities of 3D Printing.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	the Mechanics of Chip Formation in Traditional Machining			L4
CO2	Analyze	the characteristic features and quality of parts produced by forming processes			L2
CO3	Analyze	the Operation and Application of Precision Grinding Machines			L4
CO4	Analyze	the Process Parameters of Advanced Non-Traditional Machining Methods			L3
CO5	Understand	the operation and capabilities of 3D Printing			L3

List of Experiments

1 Influence of Work Material, Machining Process, and Tool Geometry on Chip Morphology and Chip Flow Direction under Simulated Orthogonal Cutting. (CO1)

2 Effect of Material Properties, Tool Geometry, and Cutting Parameters on Chip Formation, Tool Temperature, and Surface Quality in Simulated Orthogonal Cutting. (CO1)

3 Extrusion of cylindrical billets through dies of different included angles and exit diameters and their effect on extrusion pressure. (CO2)

4. Practice and study of blanking and punching process and their characteristic features on mechanical press with existing dies. (CO2)

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  5 Study of operation of tool and cutter grinder, twist drill grinder, Centreless grinder. (CO3)
  6 Determination of cutting forces in turning. (CO1)
  7 Inspection of parts using tool makers microscope, roughness and form tester. (CO5)
  8 Experimental Study of MRR, TWR and Surface Roughness on EDM. (CO4)
  9 Experimental Study on ECM. (CO4)
10 Experimental Studyon3DPrinting. (CO5)
 Note: Conduct any Eight exercises from the list given above

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3
CO1	3		3
CO2	3		3
CO3	2	2	
CO4	3		3
CO5	2	2	