DAV UNIVERSITY

Empowering Students with 21st century Skills

ACADEMIC REGULATIONS

COURSE STRUCTURE
AND
DETAILED SYLLABUS

FOR

M. TECH

Mechanical Engineering

(Batch: 2024-25)

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DAV UNIVERSITY JALANDHAR

Course Scheme & Syllabus

For

Master of Technology In Mechanical Engineering

1st TO 4thSEMESTER Examinations
2024–2025 Session

Syllabi Applicable For Admissions in 2024

Optional Induction program (Appendix A)
[Induction program for students to be offered right at the start of the first year.]

Induction Program (0ptional)

- **Physical activity**
- **Creative Arts**
- **Universal Human Values**
- **Literary**
- **Proficiency Modules**
- **Lectures by Eminent People**
- **Visits to local Areas**
- **Familiarization to Dept. /Branch & Innovations**

PROGRAMME EDUCATIONAL OUTCOMES (PEOs)

After the successful completion of undergraduate course, Mechanical Engineering, Graduates will be able to:

PEO1: Plan, design, construct, maintain and improve mechanical engineering systems that are technically sound, economically feasible and socially acceptable.
PEO2: Apply analytical, computational and experimental techniques to address the challenges faced in mechanical and allied engineering streams.
PEO3: Communicate effectively using conventional platforms as well as innovative / online tools and demonstrate collaboration, networking & entrepreneurial skills.
PEO4: Exhibit professionalism, ethical attitude, team spirit and pursue lifelong learning to achieve career, organizational and societal goals.

PROGRAMME OUTCOMES (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECFIC OUTCOMES (PSOs)

PSO1: Apply mechanical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.
PSO2: Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.

Code	Definitions
L	Lecture
T	Tutorial
P	Practical
HS Courses	Humanities & Social Science
BS	Basic Science Courses
ES	Engineering Science Courses
PC	Program Core Courses
PE	Program Elective Courses
OE	Open Elective Courses
EEC	Employment Enhancement Courses (Project/Summer Internship/Seminar)
AEC-C	Ability Enhancement Course-Common
VAC-C	Value Added Course-Common

Mapping of PEO with PO

POs \ PEOs	PEO1	PEO2	PEO3	PEO4
PO1			Y	Y
PO2			Y	Y
PO3	Y		Y	Y
PO4			Y	Y
PO5	Y	Y	Y	Y
PO6	Y	Y	Y	Y
PO7	Y	Y	Y	Y
PO8			Y	Y
PO9			Y	Y
PO10				Y
PO11				Y
PO12	Y	Y	Y	Y

Mapping of PEO with PSO

PEOs \ PSOs	PSO1	PSO2
PEO1	Y	Y
PEO2	Y	Y
PEO3	Y	Y
PEO4	Y	Y

Scheme of Courses
M. Tech Mechanical Engineering
Semester-1

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1.	MED501	Research Methodology	3	0	0	3	PC
2.	MED502	Mathematical Methods in Engineering	3	0	0	3	PC
3.	MED503	Optimization Techniques in Design	3	0	0	3	PC
4.	MED504	Mechanics of Composite Materials	3	0	0	3	PC
5.	MED505	Research Paper Writing and Ethics/AC-I	2	0	0	2	AEC-C
6.	MED506	Mechanical Laboratory-I (Manufacturing)	0	0	4	2	PC
							Total=16CR

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of Courses
M. Tech Mechanical Engineering
Semester-2

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1.	MED551	CAD/CAM	3	0	0	3	PC
2.	MEDXXX	Specialization Course-I	3	0	0	3	PE
3.	MEDXXX	Specialization Course-II	3	0	0	3	PE
4.	MEDXXX	Specialization Course-III	3	0	0	3	PE
5.	XXX	Generic Elective -I	3	0	0	3	GE
6.	MED552	Mechanical Laboratory -II (CAD/CAM)	0	0	4	2	PC
7.	MED553	Seminar/AC-II	0	0	6	3	AEC-C
							Total=20CR

L: Lectures T: Tutorial P: Practical Cr: Credits

Note: **AC I & AC II ie Audit courses can be offered from interdisciplinary courses or from list of courses provided in* ***DAVU NEP Curricular Guidelines.***

Scheme of Courses
M. Tech Mechanical Engineering
Semester-3

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1.	MEDXXX	Specialization Course-IV	3	0	0	3	PE
2.	XXX	Generic Elective -II	3	0	0	3	GE
3.	MED601	Mechanical Laboratory -III (Specialization)	0	0	4	2	PE
4.	MED602	Dissertation Part – I*	0	0	28	14	EEC
							Total=22CR

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of Courses
M Tech Mechanical Engineering
Semester-4

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	MED651	Dissertation Part – II*	0	0	44	22	EEC
							Total=22CR

L: Lectures T: Tutorial P: Practical Cr: Credits

Note: **At the end of the examination of 4th Semester based on specialization course and field of research for dissertation-I and II. The degree will be offered in: M Tech (Mechanical Engineering)-Specialization: Design Engineering, M Tech (Mechanical Engineering)-Specialization: Thermal Engineering, M Tech (Mechanical Engineering)-Specialization: Manufacturing and Automation Engineering, M Tech (Mechanical Engineering)-Specialization: Industrial Engineering*

Specialization Course -I

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	MED561	Engineering Tribology	3	0	0	3	PE-Design Engg.
2	MED562	Advanced Fluid Dynamics	3	0	0	3	PE-Thermal Engg.
3	MED563	Metal Casting and Forming	3	0	0	3	PE-Mnuf. & Automation
4	MED564	Quality Control and Reliability	3	0	0	3	PE-Industrial Engg
5	MOOC Courses		3	0	0	3	

Specialization Course -II

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	MED571	Finite Element Method	3	0	0	3	PE-Design Engg.
2	MED572	Modelling of IC Engines	3	0	0	3	PE-Thermal Engg.
3	MED573	Welding Technology	3	0	0	3	PE-Mnuf. & Automation
	MED574	Material Management	3	0	0	3	PE-Industrial Engg
4	MOOC Courses		3	0	0	3	

Specialization Course -III

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	MED581	Advance Materials	3	0	0	3	PE-Design Engg.
2	MED582	Design of solar and wind System	3	0	0	3	PE-Thermal Engg.
3	MED583	Non-Destructive Testing	3	0	0	3	PE-Mnuf. & Automation
4	MED584	Supply Chain Management	3	0	0	3	PE-Industrial Engg
5	MOOC Courses		3	0	0	3	

Specialization Course -IV

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	MED611	Design of Robotic System	3	0	0	3	PE-Design Engg.
2	MED612	Design of Heat Exchanges	3	0	0	3	PE-Thermal Engg.
3	MED613	Design for manufacturing and Assembly	3	0	0	3	PE-Mnuf. & Automation
4	MED614	Industrial and Organizational Psychology	3	0	0	3	PE-Industrial Engg
6	MOOC Courses		3	0	0	3	

Generic Elective -I

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1			3	0	0	3	GE
	MOOC Courses						

Generic Elective - II

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1			3	0	0	3	GE
	MOOC Courses						

Generic Elective I and II -Provided by other departments.

M Tech Course Structure

CBCS	Nature of Courses	Core	Elective Courses			Ability Enhancement Courses		Total Credits
Year	Course Structure	Core	Dissertation/ Project(EEC)	Open Elective/ MOOC Courses	Program Elective/ MOOC Courses	Ability Enhancement Compulsory Courses	Value Added Courses	
2024	M.TECH	19	36	6	14	5	0	80

Course Code	MED501						
Course Title	**Research Methodology**						
Course Outcomes	CO1: To provide basic knowledge about research. CO2: To learn about different methods of data collection. CO3: To learn about various data analysis techniques. CO4: To provide basic knowledge of report writing.						
Examination Mode	**Theory**						
Assessment Tools	**Written Quiz**	**Assignment/ Project Work**	**MSE**	**MTP**	**ESE**	**EPR**	**ABL/PBL**
Weightage	10%	10%	25%		50%		5%
Syllabus							**CO Mapping**
Unit 1							
	Introduction to Research: Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. **Defining the Research Problem**: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem **Research Design**: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, factors affecting RDs, Relation among RDs, Developing a Research Plan.						CO1
Unit 2							
	Sampling design and Procedures: Sample or Census, The Sampling Design Process, A Classification of Sampling Techniques, Choosing Nonprobability Versus Probability Sampling, Uses of Non-probability Versus Probability Sampling **Measurement and Scaling**: Non-comparative Scaling Techniques, Continuous Rating Scale, Itemized Rating Scale, Non-comparative Itemized Rating Scale Decisions, Multi-item Scales, Scale Evaluation, Choosing a Scaling Technique **Methods of Data Collection:** Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Some Other Methods of Data Collection, Collection of Secondary Data, Selection of Appropriate Method for Data Collection.						CO2
Unit 3							
	Questionnaire & form design: questionnaire & observation forms, questionnaire design process. **Data preparation:** editing, coding, transcribing **Data analysis**: tests of significance based on t, f, and z distribution and chi-square test; cross-tabulation **Multiple Regressio**n: Overview of Multiple Regression, Statistics Associated with Multiple Regression, Conducting Multiple Regression, Stepwise Regression, Multicollinearity						CO3

Unit 4		
	Research Report Writing: Contents of Report, Executive Summary, Bibliography format. Presentation of Report Plagiarism identification, research ethics.	CO4
Text Books	**1)** Kothari, C.R. Research Methodology, New Age Publishers. Print.	
Reference Books	**2)** Bajpai Naval, Business Research Methods, Pearson Publications. Print. **3)** Malhotra, Naresh K. Marketing Research: An Applied Orientation, 5th Edition. Pearson/Prentice-Hall, 2007. Print. **4)** Proctor Tony, Essentials of Marketing Research, Prentice Hall, 4th Edition. Print. **5)** Beri, G. C. Marketing research, McGraw-Hill, 4th Edition. Print.	

Course Code	MED503						
Course Title	**Optimization Techniques in Design**						
Course Outcomes	On the completion of the course the student will be able to: CO1: Comprehend the techniques and applications of Engineering optimization. CO2: Apply basic concepts of mathematics to formulate an optimization problem CO3: Analyze various methods of solving the unconstrained minimization problem CO4: Analyze and appreciate variety of performance measures for various optimization problems						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Introduction to optimization***						
	Introduction to Classical Methods & Linear Programming Problems Terminology, Design Variables, Constraints, Objective Function, Problem Formulation. Calculus method, Kuhn Tucker conditions, Method of Multipliers. Linear Programming Problem, Simplex method, Two-phase method, Big-M method, duality, Integer linear Programming, Dynamic Programming, Sensitivity analysis.						CO1
Unit 2	***Single Variable Optimization Problems***						
	Optimality Criterion, Bracketing Methods, Region Elimination Methods, Interval Halving Method, Fibonacci Search Method, Golden Section Method. Gradient Based Methods: Newton-Raphson Method, Bisection Method, Secant Method, Cubic search method.						CO2
Unit 3	**Multivariable and Constrained Optimization Techniques**						
	Multi Variable and Constrained Optimization Technique, Optimality criteria, Direct search Method, Simplex search methods, Hooke-Jeeve's pattern search method, Powell's conjugate direction method, Gradient based method, Cauchy's Steepest descent method, Newton's method, Conjugate gradient method. Kuhn - Tucker conditions, Penalty Function, Concept of Lagrangian multiplier, Complex search method, Random search method.						CO3
Unit 4	**Intelligent Optimization Techniques**						
	Introduction to Intelligent Optimization, Genetic Algorithm: Types of reproduction operators, crossover & mutation, Simulated Annealing Algorithm, Particle Swarm Optimization (PSO), Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.						CO4
Text Books	1. S. S. Rao, Engineering Optimization: Theory and Practice, Wiley, 2008. 2. K. Deb, Optimization for Engineering design algorithms and Examples , Prentice Hall, 2nd edition 2012.						
Reference Books	1. C.J. Ray, Optimum Design of Mechanical Elements, Wiley, 2007. 2. R. Saravanan, Manufacturing Optimization through Intelligent Techniques, Taylor & Francis Publications, 2006. 3. D. E. Goldberg, Genetic algorithms in Search, Optimization, and Machine Learning , Addison-Wesley Longman Publishing, 1989.						

Course Code	MED504						
Course Title	**Mechanics of Composite Materials**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To understand the basic concepts and difference between composite materials with conventional materials. CO2: To understand role of constituent materials in defining the average properties and response of composite materials on macroscopic level. CO3: To apply knowledge for finding failure envelopes and stress-strain plots of laminates. CO4: To develop a clear understanding to utilize subject knowledge using computer programs to solve problems at structural level.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Introduction**						
	Definition and characteristics, Overview of advantage and limitations of composite materials, Significance and objectives of composite materials, Science and technology, current status and future prospectus. **Basic Concepts and Characteristics** Structural performance of conventional material, Geometric and physical definition, Material response, Classification of composite materials, Scale of analysis; Micromechanics, Basic lamina properties, Constituent materials and properties, Properties of typical composite materials.						CO1
Unit 2	**Unidirectional Lamina**						
	Elastic Behavior Stress-strain relations, Relation between mathematical and engineering constants, transformation of stress, strain and elastic parameters. **Strength** Micromechanics of failure; failure mechanisms, Macro-mechanical strength parameters, Macromechanical failure theories, Applicability of various failure theories.						CO2
Unit 3	**Elastic Behavior of Laminates**						
	Basic assumptions, Strain-displacement relations, Stress-strain relation of layer within a laminate, Force and moment resultant, General load–deformation relations, Analysis of different types of laminates.						CO3
Unit 4	**Stress and Failure Analysis of Laminates**						
	Types of failures, Stress analysis and safety factors for first ply failure of symmetric laminates, Micromechanics of progressive failure; Progressive and ultimate laminate failure, Design methodology for structural composite materials.						CO4
Text Books	1. Isaac M. Daniels, Ori Ishai, “Engineering Mechaincs of Composite Materials”, Oxford University Press, 1994. 2. Bhagwan D. Agarwal, Lawrence J. Broutman, “Analysis and Performance of fiber composites”, John Wiley and Sons, Inc. 1990. 3. Mathews, F. L. and Rawlings, R. D., “Composite Materials: Engineering and Science”, CRC Press, Boca Raton, 03.						

Reference Books	1. Madhujit Mukhopadhyay, “Mechanics of Composite Materials and Structures”, University Press, 04. 2. Mazumdar S. K., “Composaite Manufacturing – Materials, Product and Processing Engineering”, CRC Press, Boca Raton, 02. 3. Robert M. Jones, “Mechanics of Composite Materials”, Taylor and Francis, Inc., 1999.	

Audit Course 1 can be offered

Course Code	MED505						
Course Title	**Research Paper Writing and Ethics**						
Course Outcomes	On the completion of the course the student will be able to: CO1: Understand that how to improve your writing skills and level of readability CO2: Learn about what to write in each section CO3: Understand the skills needed when writing a Title CO4: Ensure the good quality of paper at very first-time submission						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Writing***						
	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions, useful phrases, how to ensure paper is as good as it could possibly be the first- time submission						CO1
Unit 2	***PHILOSOPHY***						
	Introduction to Philosophy: Definition, nature and Scope, Concept, Branches. Ethics: definition, moral philosophy, nature of moral judgements and reaction Ethics with respect to science and research Intellectual honesty and research integrity Scientific misconducts: Falsification, Fabrication, and Plagiarism(FFP) Redundant publications: duplicate and overlapping publications, salami slicing Selective reporting and misrepresentation of data						CO2
Unit 3	***ETHICS***						
	Publication ethics: definition, introduction and importance Best practices /Standards setting initiatives and guidelines: COPE. WAME, etc., Conflicts of interest Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types Violation of publication ethics, authorship and contributor ship. Identification of publication misconduct, complaints and appeals. Predatory publishers and journals						CO3
Unit 4	***Publishing***						
	Open access publications and initiatives SHEERPA/RoMEO online resource to check publisher copyright & Self – archiving policies Software tool to identify predatory publications developed by SPPU Journal finder /Journal suggestion tools viz.JANE., Elsevier journal Finder, Springer Journal Suggester, etc., PUBLICATION MISCONDUCT A. Group Discussions 1. Subject specific ethical issues, FFP, authorship						CO4

	2. Conflicts of interest 3. Complaints and appeals: examples and fraud from India and abroad B. Software tools Use of plagiarism software like Turnitin, Urkund and other open source software tools Databases 1. Indexing databases 2. Citation databases: Web of Science, Scopus, etc. Research Metrics 1. Impact Factor of Journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score 2. Metrics: h-index, g index, i10 index, altmetrics	
Text Books	1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books) 2. Bird, A.(2006). Philosophy of Science.Routledge	
Reference Books	1. MacIntyre, Alasdair (1967) A Short History of Ethics. London 2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press 3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook . 4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011	

Course Code	MED551						
Course Title	**CAD/CAM**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To learn about the applications and benefits of CAD. CO2: To learn about various geometric transformations. CO3: To learn about various curves and modelling techniques. CO4: To learn about automation & CAPP.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Introduction***						
	Introduction to CAD, Design Process, Introduction to CAM/ CIMS, Importance and Necessity of CAD, Applications of CAD, Coordinate System (WCS, UCS, SCS) **2DTransformations** Introduction, transformation of points and line, 2-D rotation, reflection, scaling and combined transformation, homogeneous coordinates.						CO1
Unit 2	**3-D Transformations**						
	3-D Transformations 3-D scaling, shearing, rotation, reflection and translation, concatenations, concepts of hidden-line removal, shading and rendering. **Wireframe Modelling** Geometric Construction Models, Curve representation methods, Parametric representation of cubic splines, Bezier and B-spline curves, blending functions, trimming and segmentation of curve.						CO2
Unit 3	**Modelling**						
	Surfaces Modelling Surface entities, Plane surface, ruled surface, polygon and quadric surface, surface of revolution, Bi-Cubic, Bezier Surface and B-Spline surfaces. **Solids Modelling** Solid models and representation scheme, boundary representation, constructive solid geometry, sweep representation.						CO3
Unit 4	**Controls**						
	Automation and Numerical Control Introduction, fixed, programmable and flexible automation, types of NC systems, MCU and other components, NC part programming. Manual, Computer assisted part programming, APT Languages, Adaptive control. **Manufacturing Planning Systems and Process Control** CAPP - Computer Integrated production planning systems, MRP, Capacity planning, Shop Floor control factory, Data collection systems, Computer process interface, types of computer process control, process monitoring, supervisory computer control.						CO4
Text Books	1. Alavala, C. R. *CAD/CAM Concepts and Applications***.** New Delhi:PHI Learning. Print. 2. Groover M.P. and Zimmer, W..*CAD/ CAM***.** New Delhi: Prantice Hall. Print.						

	3. Zeid I.*CAD/ CAM Theory and Practice***.** New Delhi:Tata McGraw Hill.Print. **4.** ChirsMc and BrowneJimmie.*CAD/CAM Principles, Practice & Manufacturing Management*. Wesley. Print.	
Reference Books	1. Groover Mikell P., *Automation production systems and computer – integrated manufacturing.*Prentice Hall of India. Ltd., 1998. 2. Rao, P.N.Tewari, N.K. and Kundra,T.K. *Computer Aided Manufacturing*, New Delhi:Tata McGraw Hill, 2001. 3. Koren Yoram, *Computer integrated manufacturing systems.*New Delhi:McGraw Hill, 1983 4. Ranky Paul G. *Computer integrated manufacturing.*New Delhi:Prentice Hall, 1990	

Specialization courses 1, 2, 3 Generic Elective 1, 2 as per respective baskets.

Course Code	MED506						
Course Title	**Mechanical Laboratory-1 (Manufacturing)**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To understand the different lathe operations. CO2: To understand the different shaper operations. CO3: To understand the milling and shaper operations. CO4: To understand the functioning of drilling machine.						
Examination Mode	Practical						
Assessment Tools	Written Quiz	Project Work/Lab Performance	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	-	20%	-	30%		50%	-
Syllabus							**CO Mapping**
Content	***List of experiments***						
	1. Practice on Lathe: 05 Jobs (Jobs should cover various lathe operations like centering, facing, turning, stepped turning, parting, threading, taper turning, chamfering and knurling) 2. Practice on Shaper: 01 Job (Slot cutting) 3. Practice on milling machine: 01 Job (Slot cutting) 4. Practice on Surface grinder: 01 Job (Creating Flat surface) 5. Practice on Drilling Machine: 01 Job (Marking and drilling operations)						

<table>
<tr><td>Course Code</td><td colspan="7">MED</td></tr>
<tr><td>Course Title</td><td colspan="7">Mechanical Labortaory-II (CAD/ CAM)</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On the completion of the course the student will be able to:
CO1: To understand the different lathe operations.
CO2: To understand the different shaper operations.
CO3: To understand the milling and shaper operations.
CO4: To understand the functioning of drilling machine.</td></tr>
<tr><td>Examination Mode</td><td colspan="7">Practical</td></tr>
<tr><td>Assessment Tools</td><td>Written Quiz</td><td>Project Work/Lab Performance</td><td>MSE</td><td>MTP</td><td>ESE</td><td>EPR</td><td>ABL/PBL</td></tr>
<tr><td>Weightage</td><td>-</td><td>20%</td><td>-</td><td>30%</td><td></td><td>50%</td><td>-</td></tr>
<tr><td>Syllabus</td><td colspan="6"></td><td>CO Mapping</td></tr>
<tr><td>Content</td><td colspan="6">List of experiments</td><td></td></tr>
<tr><td></td><td colspan="6">The students will be required to carry out the following exercises using educational software (I-DEAS, Pro-Engineer, Solid Work etc.)
1. Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing, naming layers, setting line types for different layers using various type of lines in engineering drawing, saving the file with drawing extension.
2. Layout drawing of a building using different layer and line colors indicating all Building details. Name the details using text commands, Make a title Block.
3. To Draw Orthographic Projection Drawings (Front, Top and side) of boiler safety valve giving name the various components of the valve.
4. Make an Isometric dimensioned drawing of a connecting Rod using isometric grid and snap.
5. Draw quarter sectional isometric view of a cotter joint.
6. Draw different types of bolts and nuts with internal and external threading in Acme threading standards. Save the bolts and nuts as blocks suitable for insertion.
7. Draw 3D models by extruding simple 2D objects, dimension and name the objects.
8. Draw a spiral by extruding a circle.</td><td></td></tr>
</table>

Course Code	MED (Specialization Course 1)						
Course Title	**Engineering Tribology**						
Course Outcomes	On the completion of the course the student will be able to: CO1: Design of surfaces in contact is a critical problem for mechanical engineering. CO2: To deal with fundamentals of surface contact, friction, wear and lubrication. CO3: Students will learn about Bearing Design and Rolling Friction. CO4: Students will learn about the Tests and Instrumentation in Tribology.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Introduction***						
	friction, wear and lubrication, types of engineering contacts: conforming and non-conforming, Types of motion: rubbing, sliding, oscillating, rolling, surface of interaction, elastic and plastic deformations, properties of materials, surface energy and flash temperature theory. Friction:Laws of sliding friction, concept of adhesion, Tabor's model of elastic thermo friction, rolling friction, measurement of friction						CO1
Unit 2	***Wear and Lubrication***						
	Wear: Laws of wear types of wear such as adhesive, declamation, abrasive, corrosive, fretting, erosive and oxidative, Measurement of wear and friction in atmosphere and different environments, Prevention and control of wear and friction in machines, wear of cutting tools and dies, study of abrasion in grading, lapping/ honing Lubrications: Mechanism of lubrication, Boundary, squeeze film hydrodynamic and elasto hydrodynamic and hydrostatic lubrication, plasto hydrodynamic lubrication, solution of Reynolds's equation in two- and three-dimensional flow, pressure distribution load carrying capacity friction forces in oil film and coefficient of friction in journal bearing, Solid, Liquid and Gas lubricants types and their applications						CO2
Unit 3	***Bearing Design and Rolling Friction***						
	Design of bearing clearance in journal bearing, minimum film thickness, sommar field number, oil grooves and flow of oil in axial and circumferential grooves cavitation's and turbulence in oil bearings, Heat generation and cooling or bearing hydrostatic and dynamic and their applications in machine tools, Design of air bearings and other gas bearings. Reynold slip, Heathe cote concept selection of roller bearings and their methods of lubrication design aspects and modes of bearing failures and elasto hydrodynamic lubrication.						CO3
Unit 4	***Tests and Instrumentation in Tribology***						
	Sliding friction and wear abrasion test, rolling contact and fatigue test, solid particle and erosion test, Corrosion test Special instruments for lubricant analysis such as optical and infrared spectroscopy and infra-red spectroscopy, atomic absorption and emission spectroscopy, mass spectroscopy, NMR spectroscopy, X ray diffraction and chromatographic techniques, Use of transducers and instruments in Tribology- film						CO4

	thickness measurement using modern techniques – Development of test rigs for Tribology research	
Text Books	1.Gwidon, W. Stachowiah and Gwidon, W. Engineering Tribology, 2013. Print. 2.Bhusan, Bharat. Principles and Application of Tribology, 1999. Print. 3.Khonsari, and Booser Applied Tribology: Bearing Design and Lubrication, 2008. Print.	
Reference Books	1.Srivastva, Sushil kumar. Tribology in Industries. 2001.Print. 2.Majumdar, B.C. Introduction to Tribology of Bearing, 1999. Print.	

Course Code	MED (Specialization Course 1)						
Course Title	**Advanced Fluid Dynamics**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To understand the fundamental principles of materials, processes and manufacturing. CO2: To gain knowledge of various manufacturing processes and related technical analysis. CO3: To apply the various manufacturing processes in engineering applications. CO4: To evaluate the importance of economic considerations in the selection of manufacturing processes						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Governing equations in Fluid Dynamics***						
	Review of Basic Concepts and Fluid Properties: Basic law of Fluid Motion, Internal stresses and external forces on fluid elements, Review of Concepts of Kinematics of fluid motion, vorticity, circulation, velocity potential and stream function, irrotational flow. Governing equations in Fluid Dynamics: Derivation of Continuity and Momentum equations using integral and differential approach, dimensionless form of governing equations, special forms of governing equations, integral quantities.						CO1
Unit 2	**Exact Solutions of Navier-Stokes Equations**						
	Exact Solutions of Navier-Stokes Equations: Fully developed flows, parallel flow in straight channel, Couette flow, Creeping flows • Potential Flow: Kelvin's theorem, Irrotational flow, Stream function-vorticity approach.						CO2
Unit 3	***Boundary layers***						
	Laminar Boundary layers: Boundary layer equations, flow over flat plate, Momentum integral equation for boundary layer, approximate solution methodology for boundary layer equations. Turbulent Flow: Characteristics of turbulent flow, laminar turbulent transition, time mean motion and fluctuations, derivation of governing equations for turbulent flow, shear stress models, universal velocity distribution						CO3
Unit 4	***Experimental Techniques***						
	Experimental Techniques: Role of experiments in fluid, layout of fluid flow experiments, sources of error in experiments, data analysis, design of experiments, review of probes and transducers, Introduction to Hot wire Anemometry, Laser Doppler Velocimetry and Particle Image Velocimetry						CO4
Text Books	1. Fluid Mechanics for Engineers, A Graduate Textbook, Meinhard T. Schobeiri, 2010. http://www.petronet.ir/documents/10180/2324299/Fluid_Mechanics_for_Engineers 2. Advanced Fluid Mechanics, W. P. Graebel, 2007. www.engmatl.com/...engineering-mechanics/204-advanced-fluid-mechanics 3. White, F.M. 1991 Viscous Fluid Flow (second edition), McGraw Hill.						

	4. Boundary Layer Theory, H. Schlichting. Sherman, F.S. 1990 Viscous Flow. McGraw Hill. 5. McCormack , P.S. & Crane, L.J. 1973 Physical Fluid Dynamics, Academic Press	
Reference Books	1. Muralidhar and Biswas, Advanced Engineering Fluid Mechanics, , Alpha Science International, 2005 2. Irwin Shames, Mechanics of Fluids, , McGraw Hill, 2003 3. Fox R.W., McDonald A.T , Introduction to Fluid Mechanics, John Wiley and Sons Inc, 1985 4. Pijush K. Kundu, Ira M Kohen and David R. Dawaling, Fluid Mechanics, Fifth Edition, 2005	

Course Code	MED (Specialization Course 1)						
Course Title	**Metal Casting and Forming**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To Understand the various casting parameters and molding methods. CO2: Learn about casting processes and furnaces. CO3: To Understand different forming processes. CO4: To deal with classification of forming processes.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Casting and Moulding Methods***						
	General, Classification of manufacturing processes, various kinds of Production System, Computers in manufacturing, Selection of manufacturing process. Introduction, advantages, limitations and applications of casting process, Classification of casting process, Steps involved in casting, Pattern types, Allowances for pattern, pattern, materials, colour coding and storing of patterns. Molding methods and Processes, Moulding materials, Molding sands and its ingredients, Properties of moulding sand, Cores, Sand casting defects, Design of castings.						CO1
Unit 2	***Casting processes and Furnaces***						
	Pressures die casting, Permanent mould casting, Centrifugal casting, Precision investment casting and its types, Cleaning and finishing of casting, Inspection and testing of casting, Defects in castings. Selection of furnace-crucibles oil fired furnaces, electric furnaces cupola, calculation of cupola charges, hot blast, cupola-Degasifications, inoculation-pouring equipment, Inspection of castings. Need-Areas for mechanization-Typical layout-sand reclamation techniques-material handling, pollution control in Foundry, Computers in casting process.						CO2
Unit 3	***Forming***						
	Metallurgical aspects of metal forming slip, twining mechanics of plastic deformation effects of temperature, strain rate-microstructure and friction in metal forming, yield criteria and their significance-classification of metal forming processes, Principle classification equipment, tooling processes, parameters and calculation of forces during forging and rolling processes, Ring compression tests, Post forming heat treatment, Defects (cause and remedy) applications. Classification of extrusion processes, tool, equipment and principle of these processes, influence of friction, Extrusion force calculation, Defects and analysis: Rod/wire drawing-tool, equipment and principle of processes defects, Tube drawing and sinking processes-Mannesmann processes of seamless pipe manufacturing.						CO3
Unit 4	***Classification of forming process***						

	Classification conventional and HERF processes Presses types and selection of presses, formability of sheet metals, Principle, process parameters, equipment and application of the following processes. Deep drawing, spinning, stretch forming, plate bending, press brake forming, Explosive forming, electro hydraulic forming, magnetic pulse forming. Super plastic forming, electro forming-fine blanking, P/M forging-Isothermal forging-high speed, hot forging high velocity extrusion.	CO4
Text Books	1.Raghuwanshi B.S. A Course in Workshop Technology. Vol. 1. New Delhi: Dhanpat Rai. 10th Edition 2009. Print. 2.Taylor & Wulff, J. Foundry Engineering. Wiley Eastern Limited, 1993. Print.	
Reference Books	1.Lindberg R.A. Processes and Materials of Manufacture. New Delhi: Prentice Hall of India (P) Ltd. 1996. Print 2. Jain Kalpak. Manufacturing engineering and Technology. Edition III. Addison Wesley Publishing Co. 1995. Print 3.William and Robert M. Caddel. Metal forming. Prentice Hall Publishing Co.1990. Print.	

Course Code	MED (Specialization Course 1)						
Course Title	Quality Control and Reliability						
Course Outcomes	CO1:To impart knowledge about the concepts of quality and quality control. CO2:To make students understand the concepts of acceptance sampling. CO3:To make students understand the concepts of TQM. CO4:To impart knowledge about reliability.						
Examination Mode	**Theory**						
Assessment Tools	**Written Quiz**	**Assignment/ Project Work**	**MSE**	**MTP**	**ESE**	**EPR**	**ABL/PBL**
Weightage	10	10	25		50		5
Syllabus							**CO Mapping**
Unit 1							
	Introduction Concept of quality, Need, Factor influencing quality, Types of quality, Quality control, Cost of quality control, Quality assurance, Benefits, Modern concept, Inspection and quality control, Quality characteristics, Quality circles with case study. **Statistical Concepts and Control Charts** Review of fundamental statistical concept, Frequency distribution, Central tendency, measures of dispersion, Probability distributions, statistical quality control, Theory of control charts, Control charts for variables and attributes ($\bar{x}$, R, P, np and C chart), their advantages and disadvantages, Applications						CO1
Unit 2							
	Acceptance Sampling Introduction, Advantages and Disadvantages, Operating Characteristics curve, Producer's and consumer's risk, Quality indices for acceptance sampling plans, Types of sampling Plans-single double sequential sampling plan, Sampling plan for variables, continuous sampling plans, Skip lot sampling plans, Chain sampling plan.						CO2
Unit 3							
	Total Quality Management Introduction, Concept of Total quality, Quality function deployment tools for continuous quality improvement with case study, ISO 9000:2000 family of standards, Six sigma: DMAIC and its comparison with ISO system						CO3
Unit 4							
	Reliability Introduction, Factors affecting Reliability, Failure and its types, Failure curve, reliability and its management, MTBF, MTTF, Relationship b/w reliability failure rate and MTBF, and its characteristics, reliability predictions and analysis, System reliability analysis, Reliability test and life testing plans, Types of test, Maintainability and Availability.						CO4
Text Books	1.Mitra, Amitava**.** *Fundamental of Quality Control and Improvement*. Wiley. 2016. Print. 2. Sharma, D.D. *Total Quality Control.* New Delhi: Tata McGraw Hill. 2011. Print.						

Reference Books	**1)** Harrism and Wadsworth, M. *Modern Methods for Quality Control and Improvement.*Wiley. 2002.Print. **2)** Grant, E. and Leavenworth R. *Statistical quality control*, New Delhi: Tata McGraw Hill. 2008. Print. **3)** Ebeling. *An introduction to reliability and maintainability engineering.* New Delhi: Tata McGraw Hill. 2004. Print. **4)** Raju, N.V.S. *Industrial Engineering and Management*. Cengage Learning. 2013. Print.	

Course Code	MED (Specialization Course II)						
Course Title	**Finite Element Method**						
Course Outcomes	On the completion of the course the student will be able to: CO1: Students will learn about the basic concepts of FEM. CO2: To provide the knowledge of one, two dimensional and axisymmetric Problems in FEM. CO3: To provide the information of static, scalar field and dynamic problems. CO4: To know about the dynamic considerations and computer implementations.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Introduction***						
	Introduction: Historical Background, Mathematical modeling of field problems in engineering, governing equations, discrete and continuous models, boundary and initial value problems, Weighted Residual Methods, Variational formulation of boundary value problems, Ritz technique, Basic concept of Finite Element Method.						CO1
Unit 2	***Dimensional Problems***						
	One Dimensional Problems: One dimensional second order equation, discretization, linear and higher order elements, derivation of shape functions, Stiffness matrix and force vectors, assembly of elemental matrices, solution of problems from solid mechanics. Two Dimensional Problem: Finite Element Modeling, Constant Strain Triangle (CST), problem modelling and boundary conditions. The Four Node Quadrilateral, Numerical Integration, Higher Order Elements; Nine Node Quadrilateral, Eight Node Quadrilaterals, Six Node Triangle.						CO2
Unit 3	***Beams***						
	Introduction, Finite element modelling formulation, load vector, boundary considerations, shear force and bending moment, beams on elastic supports. Scalar Field Problems: Introduction, Steady-state heat transfer, Torsion						CO3
Unit 4	***Dynamic Considerations***						
	Dynamic Considerations: Element Mass Matrices, Evaluation of Eigen Values and Eigen Vectors. Computer Implementation: Introduction; Computer Program Organization for Calculation of System Matrices, Introduction to FE software.						CO4
Text Books	1. Chandrupatla, T.R and Belegundu A.D, T.S. Introduction to Finite Elements in Engineering, New Delhi: Pearson Education: 2015. Print. 2. Alavala, C. R.Finite Element Methods, New Delhi: PHI Learning Pvt. Ltd.2015.Print. 3. Moaveni, S. Finite Element Analysis, New Delhi: PHI Learning Pvt. Ltd. 2015.Print.						
Reference Books	1. Seshu, P. Textbook of Finite Element Analysis, New Delhi: PHI Learning Pvt. Ltd. 2015.Print. 2. Reddy, J. N.An Introduction to the Finite Element Method, New Delhi: McGraw Hill Education.2015. Print						

Online Resources	http://nptel.ac.in/courses/112104116/	

Course Code	MED (Specialization Course II)						
Course Title	**Modelling of I C Engine**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To impart the basic engine design skills to the learners such that there is seamless transition to advanced design concepts. CO2: A basic understanding of several types of engine models that will include zero dimensional thermodynamic model, one dimensional and multi-dimensional, single zone, two zone etc models CO3: Fuel spray behavior and the performance evaluation and emission standards for such modeled engines CO4: Students will develop models and simulate them for diesel engine petrol engine, gas engine						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Fundamentals***						
	Governing equations, Equilibrium charts of combustion chemistry, chemical reaction rates, and approaches of modeling, model building and integration methods, gas exchange through valves, engine and porting geometry, exhaust gas recirculation, valve lift curves.						CO1
Unit 2	***Thermodynamic Combustion Models of CI Engines***						
	Single zone models, premixed and diffusive combustion models, combustion heat release using wiebe function, wall heat transfer correlations, ignition delay, internal energy estimations, two zone model, application of heat release analysis.						CO2
Unit 3	***Fuel spray behavior***						
	Fuel injection, spray structure, fuel atomization, droplet turbulence interactions, droplet impingement on walls. Modeling of charging system: Constant pressure and pulse turbo charging, compressor and turbine maps, charge air cooler						CO3
Unit 4	***Mathematical models of SI Engines***						
	Simulation of Otto cycle at full throttle, part throttle and supercharged conditions. Progressive combustion, Autoignition modeling, single zone models, mass burning rate estimation, SI Engine with stratified charge. Friction in pumping, piston assembly, bearings and valve train etc. friction estimation for warm and warm up engines						CO4
Text Books	1.Ramoss.A.L., "Modelling of Internal Combustion Engines Processes", McGraw Hill Publishing Co., 1992. 2.Ganesan.V. "Computer Simulation of spark ignition engine process", Universities Press (I) Ltd, Hyderbad, 1996.						
Reference Books	1. Haywood, "I.C. Engines", Mc Graw Hill. 2. Ramos J (1989) Internal Combustion Engine Modeling. Hemisphere Publishing Company 3. C. D. Rakopoulos and E. G. Giakoumis, "Diesel Engine Transient 4. Operation Principles of Operation and Simulation Analysis", Springer, 2009.						

	5. V. Ganeshan, “Internal Combustion Engines”, Tata McGraw Hill, New Delhi, 1996. 6. P.A. Lakshminarayanan and Y. V. Aghav, “Modelling Diesel Combustion” Springer, 2010 7. Bernard Challen and Rodica Baranescu, “Diesel Engine Reference Book” ButterworthHeinemann, 1999	

Course Code	MED (Specialization Course II)						
Course Title	**Welding Technology**						
Course Outcomes	On the completion of the course the student will be able to: CO1: This course is designed to provide students with an overview of a wide variety of manufacturing processes for fabricated of engineering materials. CO2: The students will learn principles, operations and capabilities of various metal joining processes. CO3: To deal with welding power sources. CO4: To get the knowledge of metal transfer and melting rate.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Introduction***						
	Basic classification of welding processes, weld ability, weld thermal cycle, metallurgy of fusion welds, solidification mechanism and microstructural products in weld metal, epitaxial, cellular and dendritic solidification, metallurgical changes in weld metal, phase transformation during cooling of weld metal in carbon and low alloy steel, prediction of microstructures and properties of weld metal. Heat affected zone, re-crystallization and grain growth of HAZ, gas metal reaction, effects of alloying elements on welding of ferrous metals						CO1
Unit 2	***Welding Arc and Coated Electrodes***						
	Arc efficiency, temperature distribution in the arc; arc forces, arc blow, electrical characteristics of an arc, mechanism of arc initiation and maintenance, role of electrode polarity on arc behaviour and arc stability, analysis of the arc. Electrode coatings, classification of coatings of electrodes for SMAW, SAW fluxes, role of flux ingredients and shielding gases, classification of solid and flux code wires						CO2
Unit 3	***Fusion Welding and Welding Power Sources***						
	Manual metal arc welding MMAW, GTAW, GMAW, FCAW and CO welding processes, plasma arc, submerged arc welding, electro gas and electro slag welding, analysis of the process. Arc welding power sources basic charters tics of power sources for various arc welding processes, duty cycles, AC, DC welding power source, DC rectifiers, thyristor controlled rectifiers, transistorized units, inverter systems. Arc length regulation in mechanized welding processes						CO3
Unit 4	***Metal Transfer and Melting Rate***						
	Mechanism and types of metal transfer, forces affecting metal transfer, modes of metal transfer, metal transfer in various welding processes, effective of polarity on metal transfer and melting rate. Theory and mechanism of solid state welding, Techniques and scope of friction welding, diffusion welding, cold pressure welding and ultrasonic welding. Technique, scope and application of the electron beam and laser welding processes						CO4
Text Books	1.Parmar, R.S. Welding Engineering & Technology. New Delhi: Khanna Publishers.1997. Print.						

	2.Nandkarni, S.V. Modern Arc Welding Technology. New Delhi: Oxford & IBH publishing Co.1996.Print..	
Reference Books	1.Cary, Howard,Modern Welding Technology. Prentice Hall, 1998.Print. 2. Richard, L. Welding & Welding Technology. Tata McGraw Hill. 2001. Print. 3. Bohnart, E.R.Welding:Principles & Practices. Tata McGraw Hill.2014. Print.	

Course Code	MED (Specialization Course II)						
Course Title	Material Management						
Course Outcomes	CO1: Students will learn about the role of material management in business. CO2: Students will learn about the concepts of inventory management. CO3: Students will learn about the concepts of traffic and store management. CO4: Students will also be familiarized with different purchasing and procurement policies and procedures.						
Examination Mode	**Theory**						
Assessment Tools	**Written Quiz**	**Assignment/ Project Work**	**MSE**	**MTP**	**ESE**	**EPR**	**ABL/PBL**
Weightage	10	10	25		50		5
Syllabus							**CO Mapping**
Unit 1							
	Role of Material Management in Business Types of materials organizations (Purchasing, Procurement, Materials management, Physical Distribution Management, Logistic Management) **Fundamental of Purchasing and Procurement** Importance of supplier, Factors in supplier selection, Sources of supplier information, Long-term, strategic materials planning, Evaluating potential suppliers, post-selection problems.						CO1
Unit 2							
	Inventory Management Function and definition of inventories, ABC Concept, Dependent and Independent Demand, Type of Inventory Control System (Cyclic Ordering System, Order Point System, Material Requirement Planning System), Determination of Order Quantity, EOQ Concept, Applications and Limitations of EOQ, Determination of order point and safety stock, **Capital Equipment** Differences in procurement of capital equipment, Procedure of purchase of capital equipment, Purchasing's role in capital equipment procurement, Techniques of economic analysis						CO2
Unit 3							
	Traffic Carrier selection and routing (Shipping terms, Modes of transportation, Types of carriers, Regulation and Deregulation, Class rates and Commodity rates), Loss and damage of fright, Transportation cost reduction**.** **Receiving and Stores** Responsibilities of receiving and stores, receiving procedures and paperwork, Identification of materials, Stores systems, Storing of materials, Methods and equipment's, Automated warehousing, layout						CO3
Unit 4							
	Policies and Procedures Centralization of purchasing, Policies affecting vendors, Ethics in purchasing **General Procurement Procedures**						CO4

	Definition, Description and Transmission of need, Supplier selection and order preparation, Order follow up, Receipt and inspection, invoice audit and order completion **Purchasing Records** Open orders, closed orders, purchase log, Commodity records, Supplier records, and Contract and tool records Handling “rush” orders Handling “small” orders	
Text Books	1Raju, N.V.S. *Industrial Engineering and Management*. New Delhi: Cengage Learning. Print. 2Chunawala. *Production and Operation Management.* New Delhi: Himalaya Publication. Eighth Edition, 2013. Print.	
Reference Books	1Donald W. Dobler. *Purchasing and materials management.* TMH. Fourth Edition. Print. 2Nair. *Purchasing and materials management.* New Delhi: Vikas Publishers. Print.	

Course Code	MED (Specialization Course III)						
Course Title	**Advanced Materials**						
Course Outcomes	On the completion of the course the student will be able to: CO1: Students will learn about the nano materials CO2: Students will learn about the Composite materials CO3: Students will learn about the Plastic materials CO4: Students will learn about the design and development of composite materials						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Nano materials***						
	Carbon nanotubes, structure and properties, chemistry of carbon nanotubes, graphite whiskers, cones and polyhedral crystals, nano crystalline diamond, carbide derived carbon nanotubes in multifunctional polymer nano composites, nano structured materials for field emission devices, nano textured carbons for electrochemical energy storage.						CO1
Unit 2	***Composites***						
	Introduction, reinforcements, matrix materials, processing, interface, micromechanics, monotonic behaviour, cyclic fatigue, creep, wear, applications, shape memory alloys (SMAs), metallic foam, recemat metal foam etc.						CO2
Unit 3	***Plastics***						
	Introduction to plastics, polymeric materials (molecular viewpoint),microstructures in polymers, mechanical properties (macro view point) chemical and physical properties (macro view point), designing with plastics, thermoplastic materials (commodity plastics), thermoplastic materials(engineering plastics), thermo set materials, elastomeric (rubber) materials, extrusion, injection moulding, blow moulding, thermoforming, rotational moulding, casting, foaming, compression moulding, transfer moulding, and related processes, radiation, finishing, adhesion and assembly operations and management, Environmental aspects of plastics.						CO3
Unit 4	***Development of Advanced Composite Materials***						
	Micromechanical behaviour of a lamina, Mechanics of materials and elasticity approach to stiffness, Comparison of approaches, Mechanics of materials approach to strength. Fatigue behaviour in composites, Effect of holes in laminates, Fracture mechanics with reference to composites, transverse shear effects, Post curing shapes of un symmetric laminates, Environmental effects. Design of Composite Materials: Introduction to design of composite structures, structural design, material selection, configuration selection, laminate joints, Design requirements and design failures criteria, optimization concepts, design analysis philosophy for composite structures.						CO4
Text Books	1Sehgal, Lindberg R.A. Materials, their Nature, Properties and Fabrication. New Delhi: S Chand. Print.						

	2Polmear, I. J. Light alloys: Metallurgy of Light Metals. Arnold. 3rd Edition. 1995. Print.	
Reference Books	1Robert, M. Mechanics of Composite Materials. Print.	

Course Code	MED (Specialization Course III)						
Course Title	**Design of Solar and Wind Systems**						
Course Outcomes	On the completion of the course the student will be able to: CO1: Analyze the characterization of electricity generation from the wind and its integration issues. CO2: Identify suitable power electronic converter for wind energy systems. CO3: Importance of isolated wind systems and its impact on power system. CO4: Demonstrate the knowledge of physics of solar power generation and the associated issues.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Nuclear energy***						
	Conventional sources of energy, Nuclear, Alternative energy sources.						CO1
Unit 2	***Solar energy***						
	Solar Radiation-estimation, prediction & measurement, Solar energy utilization, Performance of Solar flat plate collectors, concentrating collectors, thermal storage						CO2
Unit 3	***Wind energy***						
	Wind energy, Direct Energy conversion- PV, MHD						CO3
Unit 4	**Fuel cells**						
	Fuel cells, thermionic, thermoelectric, Biomass, biogas, hydrogen, Geothermal						CO4
Text Books	1. Thomas Ackermann, Wind power in Power Systems, John Willy and Sons Ltd., 2005. 2. Siegfried Heier, Grid integration of wind energy conversion systems, John Willy and Sons Ltd., 2006.						
Reference Books	1. D.Y. Goswami, F. Kreith and J.F. Kreider, "Principle of Solar Engineering", Taylor and Francis, 2000. 2. Sukhatme S.P., "Solar Energy", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1994. 3. Bansal and othes, "Non-Conventional Energy Sources". 4. J.F. Kreider, F. Kreith, "Solar Energy Handbook", McGraw Hill, 1981 5. J.A. Duffie and W.A. Beckman, "Solar Engineering of Thermal Processes", John Wiley, 1991						

Course Code	MED						
Course Title	**Non –Destructive Testing**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To understand the basics of NDT. CO2: To be familiar with Visual Inspection and Penetrant Testing. CO3: To know about the Magnetic Particle Testing and Radiographic Examination. CO4: To get the knowledge of Ultrasonic Methods and Eddy Current Testing						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Introduction to NDT***						
	Non-destructive testing, Scope of non-destructive testing, Advantage of non-destructive testing, destructive methods of testing, Comparison between non-destructive and destructive testing, Common NDT methods, Flaws and defects, Applications, Attractive use of NDT in detecting surface cracks and bond strength due to failure fatigue.						CO1
Unit 2	***Visual Inspection and Penetrant Testing***						
	Introduction, Basic terms associated with Visual inspection, Equipment used for Visual inspection, Machine vision, Ringing test/ Hammer test, Chalk test, Attractive use of visual inspection in welding defects, Practical visual inspection tips in welding, Advantages and limitations of visual inspection. Introduction, Principle of permanent test, Tests and standards, Test stations, Accessories, Advantages and disadvantages of permanent test, Examples of applications of DPT, Types of penetrants, Characteristics of good penetrants, Developers and its types, Quality and process control, Health and Safety and Precautions in liquid penetrant inspection, Standards applicable to liquid penetrant testing, Leak test, Zyglo fluorescent penetrant test.						CO2
Unit 3	***Magnetic Particle Testing and Radiographic Examination***						
	Introduction, Principles of magnetic particle testing, Scope of magnetic particle testing, Basic terms associated with magnetic materials, Classification of magnetic materials, Domains and hysteresis, Magnetic field orientation, Methods of magnetization, DC and AC magnetization – Skin Effect, Equipment's, Lights, Magnetic field indicator, Testing techniques, Advantages, Disadvantages and Applications of magnetic particle testing. History of radiography, Types of radiations, Basic properties, X-ray radiography principle and radiation sources, Scattered radiations, X-ray film and accessories, Film interpretation and viewing radiographs, Geometric principles in radiography, Digital radiography, Advantages, Disadvantages and Applications of radiography, Types of radiographic techniques, Precautions against radiation hazards and health.						CO3
Unit 4	***Ultrasonic Methods and Eddy Current Testing***						

	Introduction, Basic terms associated with ultrasonic testing, Principles of ultrasonic testing, Equipment of ultrasonic testing, Ultrasonic probes, Radiated field of ultrasonic transducers, Advantages, Disadvantages and Applications of ultrasonic testing, Ultrasonic inspection techniques, CRO, Data presentation. Introduction, Working principles of eddy current testing, Factors affecting eddy current, Eddy current flow characteristics, eddy current instruments and probes, Advantages, Disadvantages and Applications of eddy current testing.	CO4
Text Books	1. Lari & Kumar.Basics of Non Destructive Testing. New Delhi: S K Kataria & Sons.2013. Print. 2. Davies, Troxell, and Hauck G.F.W. The testing of Engineering materials, New York: McGraw Hill. Print.	
Reference Books	1.Cary, Howard,Modern Welding Technology. Prentice Hall, 1998.Print. 2. Richard, L. Welding & Welding Technology. Tata McGraw Hill. 2001. Print. 3. Bohnart, E.R.Welding:Principles & Practices. Tata McGraw Hill.2014. Print.	

Course Code	MED (Specialization Course III)						
Course Title	Supply Chain Management						
Course Outcomes	CO1:To impart knowledge about the importance and strategic decisions involved in supply chain management. CO2:To evaluate various types of sources and transport management in a supply chain. CO3:Students will also be made familiar with the concept of Information Technology& CO4:Systems in Supply Chain Students will also be made familiar with the concept of Reverse Supply Chain.						
Examination Mode	Theory						
Assessment Tools	**Written Quiz**	**Assignment/ Project Work**	**MSE**	**MTP**	**ESE**	**EPR**	**ABL/PBL**
Weightage	10	10	25		50		5
Syllabus							**CO Mapping**
Unit 1							
	Supply Chain Management: What and Why? Background of supply chain management, Concept of SCM, Generic types of supply chains, Various dimensions and implications, Major drivers of supply chain, SCM as profession. **Strategic Decisions in Supply Chain Management** Introduction, Business Strategy (Model for strategy formation, Order winners and qualifiers, Supply Chain strategies, Value in supply chain: quality, delivery, flexibility and cost), Core competencies in supply chains, Strategic supply chain decisions, Customer Relationship Management Strategy, Supplier Relationship Management Strategy						CO1
Unit 2							
	Source Management in Supply Chain Introduction, Elements of strategic sourcing, A Collaborative perspective, Development of partnership **Transportation Management in Supply Chain** Introduction, Strategy, Transportation selection, Trade Off, Modes of transportation and distribution, Third party logistic (3PL), Overview of an Indian infrastructure for transportation						CO2
Unit 3							
	Information Technology in Supply Chain Introduction, Typical IT solutions: Electronic Data Interchange, Internet/Extranet, Data mining/Data warehousing, E-Commerce, E-Procurement, Bar Coding technology, other technologies **Information System in Supply Chain** Introduction, Computer based information system, Computer Models, Perceptions about ERP, ERP and SCM						CO3
Unit 4							
	Reverse Supply Chain Introduction, Reverse Supply Chain vs Forward Supply Chain, Types of reverse flows, Issues in the management of reverse supply chain, Reverse supply chain for food items, Reverse logistics, and environmental impact **Cases in Supply Chain** Newspaper supply chain, Book Publishing, Supply chain in Disaster Management						CO4
Text Books	1Mohanty. *Supply Chain Management.* New Delhi: Biztantra. Print.						

Reference Books	1Sahay. *Supply Chain Modelling and Solutions.* New Delhi: Macmillan. 2009. Print. 2Raghuram. *Logistics andSupply Chain Management.* New Delhi: Macmillan. Print.	

Course Code	MED (Specialization Course IV)						
Course Title	**Design of Robotic System**						
Course Outcomes	On the completion of the course the student will be able to: CO1: Students will learn about the robotic system. CO2: Students will learn about the kinematics of robot manipulator. CO3: Students will learn about the dynamics of robot manipulator. CO4: Students will learn about the design and application of robotic system.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Introduction***						
	Introduction: Automation and Robotics, Historical Development, Definitions, Basic Structure of Robots, Robot Anatomy, Complete Classification of Robots, Fundamentals about Robot Technology, Factors related to use Robot Performance, Basic Robot Configurations and their Relative Merits and Demerits, Types of Drive Systems and their Relative Merits, the Wrist & Gripper Subassemblies. Concepts and Model about Basic Control System, Transformation and Block Diagram of Spring Mass System, Control Loops of Robotic Systems, PTP and CP Trajectory Planning, Different Types of Controllers, Control Approaches of Robots						CO1
Unit 2	***Kinematics of Robot Manipulator:***						
	Kinematics of Robot Manipulator: Introduction, General Description of Robot Manipulator, Mathematical Preliminaries on Vectors & Matrices, Homogenous Representation of Objects, Robotic Manipulator Joint Coordinate System, Euler Angle & Euler Transformations, Roll-Pitch-Yaw (RPY) Transformation, Relative Transformation, Direct & Inverse Kinematics Solution, D H Representation & Displacement Matrices for Standard Configurations, Geometrical Approach to Inverse Kinematics. Homogeneous Robotic Differential Transformation: Introduction, Jacobian Transformation in Robotic Manipulation. Robotic Workspace & Motion Trajectory: Introduction, General Structures of Robotic Workspaces, Manipulations with n Revolute Joints, Robotic Workspace Performance Index, Extreme Reaches of Robotic Hands, Robotic Task Description. Robotic Motion Trajectory Design - Introduction, Trajectory Interpolators, Basic Structure of Trajectory Interpolators, Cubic Joint Trajectories. General Design Consideration on Trajectories- 4-3-4 & 3-5-3 Trajectories, Admissible Motion Trajectories.						CO2
Unit 3	***Dynamics of Robotic Manipulators***						

	Dynamics of Robotic Manipulators: Introduction, Bone, Graph Modeling of Robotic Manipulators, Examples of Bond Graph Dynamic Modeling of Robotic Manipulator. Brief Discussion on Lagrange-Euler (LE) Dynamic Modeling of Robotic Manipulators- Preliminary Definitions, Generalized Robotic Coordinates, Dynamic Constraints, Velocity & Acceleration of Moving Frames, Robotic Mass Distribution & Inertia Tensors, Newton's Equation, Euler Equations, The Lagrangian & Lagrange's Equations. Application of Lagrange-Euler (LE) Dynamic Modeling of Robotic Manipulators: - Velocity of Joints, Kinetic Energy T of Arm, Potential Energy V of Robotic Arm, The Lagrange L, Two Link Robotic Dynamics with Distributed Mass, Dynamic Equations of Motion for A General Six Axis Manipulator. Robot Teaching: Introduction, Various Teaching Methods, Task Programming, survey of Robot Level Programming Languages, A Robot Program as a Path in Space, Motion Interpolation, WAIT, SIGNAL & DELAY Commands, Branching, Robot Language Structure, various Textual Robot Languages Such as VAL II, RAIL, AML and their Features, Typical Programming Examples such as Palletizing, Loading a Machine Etc.	CO3
Unit 4	***Robot Sensing & Vision***	
	Robot Sensing & Vision: Various Sensors and their Classification, Use of Sensors and Sensor Based System in Robotics, Machine Vision System, Description, Sensing, Digitizing, Image Processing and Analysis and Application of Machine Vision System, Robotic Assembly Sensors and Intelligent Sensors. Industrial Applications: Objectives, Automation in Manufacturing, Robot Application in Industry, Task Programming, Goals of AI Research, AI Techniques, Robot Intelligence and Task Planning, Modern Robots, Future Application and Challenges and Case Studies.	CO4
Text Books	1. A Robot Engineering Textbook by Mohsen Shahinpoor; Harper & Row publishers, New York. 2. Robotics, control vision and intelligence by Fu, Lee and Gonzalez; McGraw Hill International. 3. Introduction to Robotics by John J. Craig; Addison Wesley Publishing. 4. Robotics for Engineers by Yoram Koren; McGraw Hill International. 5. Industrial Robotics by Groover, Weiss, Nagel; McGraw Hill International. 6. Robotics and Control by Nagrath-Mittal, TMH	
Reference Books	7. Robot Technology Fundamentals by Keramas, Thomson; Vikas Publication House. 8. Company Fundamentals of Robotics Analysis and Control by Schilling; Prentice Hall. 9. Introduction to Robotics by Niku; Pearson Education, Asia. 10. Foundation of Robotics by Yoshikawa; Prentice Hall (EEE).	

Course Code	MED (Specialization Course IV)						
Course Title	**Design of Heat Exchanger**						
Course Outcomes	On the completion of the course the student will be able to: CO1: A basic understanding of several types of heat exchangers that will include shell-and-tube, double pipe, plate-and-frame, finned tube, and plate-fin heat exchangers, Heat pipes. CO2: Design and analyses of shell-and-tube double pipe, compact, plate heat exchangers. CO3: Identify methods to quickly and accurately troubleshoot, diagnose and correct operating problems in distillation column reboilers and condensers. CO4: Evaluate the performance of heat exchangers and degradation of heat exchangers subject to fouling.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Introduction to Heat Exchangers***						
	– Classification according to transfer process, number of fluids, surface compactness, and construction features. Tubular heat exchanger, plate type heat exchangers, extended surface heat exchangers, heat pipe, Regenerators. Classification according to flow arrangement: counter flow, parallel flow, cross flow exchanger.						CO1
Unit 2	Heat exchanger design methodology						
	assumption for heat transfer analysis, problem formulation, e-NTU method, P-NTU method, Mean temperature difference method, fouling of heat exchanger, effects of fouling, categories of fouling, fundamental processes of fouling.						CO2
Unit 3	***Double Pipe Heat Exchangers***						
	Thermal and Hydraulic design of inner tube, Thermal and hydraulic analysis of Annulus, Total pressure drop, Compact Heat Exchangers: Thermal and Hydraulic design of compact heat exchanger, Shell and Tube heat exchangers – Tinker's, kern's, and Bell Delaware's methods, for thermal and hydraulic design of Shell and Tube heat exchangers						CO3
Unit 4	**Mechanical Design of Heat Exchangers**						
	Design standards and codes, key terms in heat exchanger design, material selection, and thickness calculation for major components such as tube sheet, shell, tubes, flanges and nozzles. Introduction to simulation and optimization of heat exchangers, flow induced vibrations.						CO4
Text Books	1. G. Walkers, "Industrial Heat Exchangers-A Basic Guide", McGraw Hill, 1982						
Reference Books	1. Ramesh K. Shah and Dusan P. Sekulic, "Fundamentals of Heat Exchanger Design" John Wiley & sons Inc., 2003. 2. D.C. Kern, "Process Heat Transfer", McGraw Hill, 1950. 3. Sadik Kakac and Hongton Liu, "Heat Exchangers: Selection, Rating and Thermal Design" CRC Press, 1998. 4. A .P. Frass and M.N. Ozisik, "Heat Exchanger Design", McGraw Hill, 1984						

	5. Afgan N. and Schlinder E.V. “Heat Exchanger Design and Theory Source Book”. 6. T. Kuppan, “Hand Book of Heat Exchanger Design”. 7. “T.E.M.A. Standard”, New York, 1999.	

Course Code	MED (Specialization Course IV)						
Course Title	**Design for Manufacturing and Assembly**						
Course Outcomes	On the completion of the course the student will be able to: CO1: Know the manufacturing issues that must be considered in the mechanical engineering design process CO2: Know the principles of assembly to minimize the assembly time CO3: Know the effect of manufacturing process and assembly operations on the cost of product (not included by others) CO4: Be familiar with tools and methods to facilitate development of manufactural mechanical designs						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Introduction***						
	Introduction Need Identification and Problem Definition, Concept Generation and Evaluation, Embodiment Design, Selection of Materials and Shapes. Properties of Engineering Materials, Selection of Materials – I, Selection of Materials – II, Case Studies – I, Selection of Shapes, Co-selection of Materials and Shapes, Case Studies – II,						CO1
Unit 2	***Design for Manufacturing***						
	Selection of Manufacturing Processes, Review of Manufacturing Processes, Design for Casting, Design for Bulk Deformation Processes, Design for Sheet Metal Forming Processes, Design for Machining, Design for Powder Metallurgy,Design for Polymer Processing, Selection of Materials and Processes, Case-Studies – III						CO2
Unit 3	***Design for Assembly and Welding***						
	Design for Assembly, Review of Assembly Processes, Design for Welding – I, Design for Welding – II, Design for Brazing and Soldering, Design for Adhesive Bonding, Design for Joining of Polymers, Design for Heat Treatment, Case-Studies - IV						CO3
Unit 4	***Design for Reliability***						
	Design for Reliability, Failure Mode and Effect Analysis and Quality, Design for Quality, Design for Reliability, Approach to Robust Design, Design for Optimization,						CO4
Text Books	1. G Dieter, Engineering Design - a materials and processing approach, McGraw Hill, NY, 2. M F Ashby and K Johnson, Materials and Design - the art and science of material selection in product design, Butterworth-Heinemann.						
Reference Books	1. S S Rao, Engineering Optimization: theory and practice, John Wiley, NY, 1996.						

	2. J G Bralla, Handbook for Product Design for Manufacture, McGraw Hill, NY, 1998. 3. G Boothroyd, P Dewhurst and W Knight, Product design for manufacture and assembly, John Wiley, NY: Marcel Dekkar, 1994.	

Course Code	MED (Specialization Course IV)						
Course Title	**Industrial and Organizational Psychology**						
Course Outcomes	CO1:Students will learn about Industrial and Organizational Psychology. CO2:To learn evaluating methods of employee performance. CO3:To learn the employee's training methods. CO4: Students will learn about Job Attitude and Emotions.						
Examination Mode	**Theory**						
Assessment Tools	**Written Quiz**	**Assignment/ Project Work**	**MSE**	**MTP**	**ESE**	**EPR**	**ABL/PBL**
Weightage	10	10	25		50		5
Syllabus							**CO Mapping**
Unit 1							
	Introduction Introduction of I/O psychology, Activities and settings of I/O psychology, I/O psychology as a profession, I/O psychology as a science, History of the field of I/O psychology, Recourses required to become an I/O psychologist, Ethics in I/O field, Humanitarian work psychology. **Job Analysis** Job analysis: Job orientation approach, Person orientated approach, Purposes of Job Analysis, Collection of Job Analysis information and sources of information, approaches to collecting job analysis information, Methods of job analysis, Reliability and validity of Job Analysis information, Job evaluation.						CO1
Unit 2							
	Performance Appraisal Need to appraise employees, Performance Criteria, Methods of assessing job performance (Both objective and subjective measures), Impact of technology on performance appraisal, Legal issues in performance appraisal. **Assessment Methods for Selection and Placement** Job-related characteristics, Psychological tests, Characteristics of tests, Ability tests, Knowledge and Skill tests, Biographical information, Interviews, Work samples, Assessment Centre, and Electronic assessment.						CO2
Unit 3							
	Selecting Employees The planning of human resource needs, Recruiting applicants, Selecting employees, Validity generalization, Getting applicants to accept and keep jobs offered, Unity of scientific selection International differences in selection practices. **Training** Needs assessment, Objectives, Training Design, Work environment, Training methods, Electronic Training, Mentoring, Executive coaching, Delivery of a training program, Evaluation of training program.						CO3
Unit 4							
	Theories of Employee Motivation						CO4

	Motivation: Motivation Theories, Need theories, Reinforcement theories, Expectancy theory, Self-efficacy theory, Justice theory, Goal setting theory, Control theory, and Action theory. **Job Attitude and Emotions** Nature of job satisfaction, Feelings of people about their Jobs, Assessment of job satisfaction, Antecedents of job satisfaction, Potential effects of job satisfaction, Organizational committee, Emotions at work.	
Text Books	1Spector. *Industrial and Organizational Psychology.* Wiley. 2015. Print.	
Reference Books	2Frank and Jeffrey. *Work in 21st Century, Introduction* to *Industrial and Organizational Psychology.* Wiley. 2009. Print.	

The Syllabus for Generic Elective I and II will be as per approved by respective BOS of other departments.

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