



Shri Vile Parle Kelavani Mandal's

# Dwarkadas J. Sanghvi College of Engineering

*(Autonomous College Affiliated to the University of Mumbai)*

Scheme and detailed syllabus (DJ19)

Final Year B.Tech.

in

Mechanical Engineering

(Semester VII and VIII)

*Revision: 1 (2019)*

*With effect from the Academic Year: 2022-2023*



**Scheme for Final Year of B.Tech. Program in Mechanical Engineering: Semester VII (Autonomous)**  
(Academic Year 2022-2023)

**Semester VII**

Sr	Course Code	Course	Teaching Scheme				Semester End Examination						Continuous Assessment								Aggregate (A+B)	Credits earned	
			Theory (hrs.)	Laborator y (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	SEE Total (A)	Term Test 1 (TT1)	Term Test 2 (TT2)	Avg (TT1 & TT2)	Termwork			CA Total (B)				
																Laboratory Work	Tutorial / Mini project / Presentation/ Journal	Term Work Total					
1	DJ19MEC701	Machine Design II	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	4	
	DJ19MEL701	Machine Design II Laboratory	--	2	--	1	--	--	25	--		25	--	--	--	15	10	25	25	50	1		
2	DJ19MEC702	Production Planning and Control	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	4	
	DJ19MEL702	Production Planning and Control Laboratory	--	2	--	1	--	--	--	25	25	--	--	--	15	10	25	25	50	1			
3	DJ19MEC703	Finite Element analysis	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	4	
	DJ19MEL703	Finite Element analysis Laboratory	--	2	--	1	--	--	--	25	25	--	--	--	15	10	25	25	50	1			
4@	DJ19MEC7011	Additive Manufacturing	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3	
	DJ19MEC7012	Computational Fluid Dynamics	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3	
	DJ19MEC7013	Machine Health Monitoring Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3	
	DJ19MEC7014	Big Data Analysis	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3	
	DJ19MEC7015	Robotics	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3	
	DJ19MEC7016	Tribology	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3	
	DJ19MEC7017	Automobile Engineering	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3	
5#	DJ19ILO7011	Product Lifecycle Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3	
	DJ19ILO7012	Management Information System	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3	
	DJ19ILO7013	Operations Research	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3	
	DJ19ILO7014	Cyber Security and Laws	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3	
	DJ19ILO7015	Personal Finance Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3	
	DJ19ILO7016	Energy Audit and Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3	
	DJ19ILO7017	Disaster Management and Mitigation Measures	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3	
	DJ19ILO7018	Science of Well-being	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3	
	DJ19ILO7019	Research Methodology	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3	
	DJ19ILO7020	Public Systems and Policies	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3	
7	D19MEP704	Project I	-	6	--	3	--	--	--	50	50	--	--	--	50	--	50	50	100	3	3		
		Total	15	12	0	21	--	375	25	0	100	500	125	125	125	95	30	125	250	750	21		



**Scheme for Final Year of B.Tech. Program in Mechanical Engineering: Semester VIII (Autonomous)**  
(Academic Year 2022-2023)

**Semester VIII**

Sr	Course Code	Course	Teaching Scheme				Semester End Examination						Continuous Assessment							Aggregate (A+B)	Credits earned	
			Theory (hrs.)	Laborator y (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	SEE Total (A)	Term Test 1 (TT1)	Term Test 2 (TT2)	Avg (TT1 & TT2)	Termwork			CA Total (B)			
																Laboratory Work	Tutorial / Mini project / Presentation/ Journal	Term Work Total				
1	DJ19MEC801	Design of Mechanical Systems	3	--	--	3	3	75	--	--	-	75	25	25	25	-	-	-	25	100	3	4
	DJ19MEL801	Design of Mechanical Systems Laboratory	-	2	-	1	-	-	25	--	--	25	-	-	-	15	10	25	25	50	1	
2	DJ19MEC802	Industrial Engineering	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
3	DJ19MEC803	CAD/CAM/CIM	3	--	--	3	3	75	--	--	-	75	25	25	25	-	-	-	25	100	3	4
	DJ19MEL803	CAD/CAM/CIM Laboratory	-	2	-	1	-	-	25	--	--	25	-	-	-	15	10	25	25	50	1	
4@	DJ19MEC8011	Smart Industries	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19MEC8012	Sustainable Energy Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19MEC8013	Industrial Waste Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19MEC8014	Business Analytics	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19MEC8015	IoT and Applications	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19MEC8016	Process Equipment Design	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19MEC8017	Motor Sports Engineering	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19MEC8018	Advanced Quantitative Techniques	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
5#	DJ19ILO8021	Project Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19ILO8022	Entrepreneurship Development and Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19ILO8023	Corporate Social Responsibility	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19ILO8024	Human Resource Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19ILO8025	Corporate Finance Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19ILO8026	Logistics and Supply Chain Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19ILO8027	IPR and Patenting	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19ILO8028	Digital Marketing Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19ILO8029	Environmental Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19ILO8030	Labour and Corporate Law	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
6	DMEP804	Project II	-	12	--	6	--	--	--	100	100	--	--	--	100	--	100	100	200	6	6	
			15	16	0	23	15	375	50	0	100	525	125	125	125	130	20	150	275	800	23	

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering								Semester : VII			
Course : Machine Design -II								Course Code: DJ19MEC701			
Course : Machine Design -II Laboratory								Course Code: DJ19MEL701			
Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)	
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.		
				75			25	25	25	100	
				Laboratory Examination			Term work		Total Term work	50	
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal			
				25	--	--	15	10	25		

**Pre-requisite:** Basic Knowledge of Strength of Materials and Basic concepts of Design of machine element with different modes of failures.

**Objectives:**

1. To acquaint with functional and strength design principles of important machine elements.
2. To familiarize selection of standard elements such as rolling contact bearings, chains etc.

**Outcomes:** Learner will be able to...

1. Select appropriate gears for power transmission on the basis of given power and speed.
2. Design gears based on the given conditions.
3. Select bearings for a given application from the manufacturers catalogue.
4. Design the flywheel for given applications.
5. Design cam and follower mechanisms.
6. Design clutches and brakes.



**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Design of Gears:</b> <b>Gears:</b> Design of spur, helical, bevel and worm gears with strength, wear and thermal considerations. <b>Gear Box:</b> Two stage Gear box with fixed ratio consisting of spur, helical and bevel gear pairs: gear box housing layout and housing design.	<b>13</b>
<b>2</b>	<b>Rolling Contact Bearings:</b> Types of bearing, designation, selection of rolling contact bearings based on constant / variable load & speed conditions (includes deep groove ball bearing, cylindrical roller, spherical roller, taper roller, self-aligning bearing and thrust bearing)	<b>05</b>
<b>3</b>	<b>Sliding Contact Bearings:</b> Design of hydro dynamically lubricated bearings (self-contained), Introduction to hydro static bearings, Types and selection of Mechanical seals.	<b>05</b>
<b>4</b>	<b>Design of Cams and Followers:</b> Design of Cam and Roller follower Mechanisms with spring and shaft. Design and selection of standard roller chains. <b>Design of Brakes:</b> Shoe and drum type, disk type. Design of lever arm.	<b>09</b>
<b>5</b>	<b>Design of Flywheel</b> – Introduction, Fluctuation of energy and speed, turning moment diagram, estimating inertia of flywheel for reciprocating prime movers and machines, Weight of the flywheel, flywheel for punches, rim constructions, stresses in rims and arms, Construction of flywheel. <b>Design of Clutches:</b> Introduction, types, Basic theory of plate and cone type clutches, Design of single plate, multi-plate and cone clutches with spring, lever design.	<b>10</b>

Laboratory work comprises of parts **A** and **B**.

**A) 1. Design Exercises:** Design and detailed assembly drawing of minimum two from the following list (Computer aided drawing on **A3 size sheets**)

1. Design of Gears and gear box
2. Design of cam and followers
3. Design of clutches
4. Design of brakes

**2. Course Project:** Students in a group of two to four will design and prepare working drawings of any system having minimum 5 to 6 components by applying the knowledge gained during the course.

**B) Assignment:** Each assignment containing at least 2 problems of design calculations with sketches on following topics.

1. Rolling contact bearings
2. Sliding contact bearing
3. Chain and flywheel

**Books Recommended:**

*Text books:*

1. Design of Machine Elements - V.B. Banadari - Tata McGraw Hill Publication
2. Design of Machine Elements - Sharma, Purohil - Prentice Hall India Publication
3. Machine Design -An Integrated Approach - Robert L. Norton - Pearson Education
4. Mechanical Engineering Design by J.E.Shigley - McGraw Hill
5. Fundamentals of Machine Elements - Hawrock, Jacobson - McGraw Hill
6. Design of Machine Elements - V.M.Faires
7. Design of Machine Elements - Spotts

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

*Reference Books:*

1. Machine Design - Pandya & Shah - Charotar Publishing
2. Machine Design – Reshetov - Mir Publication
3. Machine Design - Black Adams - McGraw Hill
4. Machine Design - R.C.Patel, Pandya, Sikh, Vol-I & II - C. Jamnadas & Co
5. Design Data book - P.S.G. College of Technology, Coimbatore.
6. Design Data Book - Mahadevan

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

Oral examination will be based on the entire syllabus including, the design exercises performed during laboratory sessions.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

*Laboratory:*

Term Work comprises of work carried out during laboratory hours.

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

- i. Part (A): 15 Marks
- ii. Part (B): 10 marks

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

Prepared by

Checked by

Head of the Department

Principal

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering								Semester: VII		
Course: Production Planning and Control								Course Code: DJ19MEC702		
Course: Production Planning and Control Laboratory								Course Code: DJ19MEL702		
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total Marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	-	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / Presentation / Journal		
				25	-	-	15	10	25	

**Objectives:**

1. To provide an exposure to Production Planning & Control (PPC) and its significance in Manufacturing Industries
2. To give insight into the ongoing & futuristic trends in the Material Management and Inventory Control.
3. To appraise about need and benefits of planning functions related to products and the processes.
4. To give exposure to production scheduling and sequencing so as to optimize the resources
5. To give exposure to latest trend in PPC.

**Outcomes:** Learner will be able to...

1. Illustrate production planning functions and manage manufacturing functions in a better way.
2. Forecast the demand of the product and prepare an aggregate plan.
3. Develop the skills of Inventory Management and Control.
4. Develop competency in scheduling and sequencing of manufacturing operations.
5. Understand the significance of implementation of ERP.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<p><b>Manufacturing systems-</b> Components and types, Transformation from Industry 1.0 to Industry 4.0</p> <p><b>Manufacturing Systems-</b> projects &amp; jobbing products, batch, mass / flow production, continuous / process production, Introduction to JIT, Lean Production, FMS, Agile Manufacturing, etc.</p> <p><b>PPC –</b> Need and functions of PPC, relationship of PPC with other departments. Factors influencing PPC in the organization,</p> <p><b>Organization of PPC-</b> status of PPC department, internal structure, degree of centralization, PPC as an integrated approach.</p> <p><b>Prerequisites of PPC-</b> data pertaining to design, equipment, raw materials, tooling, performance standards, labor &amp; operating systems.</p> <p><b>Order preparation-</b> works order preparation for various manufacturing methods, subsidiary orders, shop or production orders, inspection orders and stores issue orders, etc.</p>	<b>8</b>
<b>2</b>	<p><b>Forecasting for operations-</b> requirements for forecasting, importance of forecasting, basic categories of forecasting methods, qualitative methods, quantitative methods, accuracy and control of forecasts,</p> <p><b>Aggregate planning:</b> Concept of aggregate planning, decision rules, strategies and methods</p> <p><b>Capacity Planning:</b> Measurement of capacity, Measures of capacity, Factors influencing effective capacity, short range, medium range and long-range capacity planning, rough cut capacity planning</p>	<b>8</b>
<b>3</b>	<p><b>Material Planning</b></p> <p>Role of Materials Management- materials and profitability, Purchase functions, Procurement procedures including bid systems, Vendor selection and development, Vendor rating, ethics in purchasing. Roles and responsibilities of purchase professionals. Concepts of lead time, purchase requisition, purchase order, amendments, forms used and records maintained.</p> <p><b>Independent Demand Inventory Models -</b> The nature and importance of inventories, requirements for effective inventory management, types of inventory models, Deterministic models, Quantity discount models, re-order point, concept of safety stock, Dynamic Models, Probabilistic models</p> <p><b>Dependent Demand Inventory models</b>–MRP–An overview of material requirements planning, MRP inputs, MRP outputs MRP processing, MRP in service, benefits, requirement of MRP and MRP II systems.</p>	<b>8</b>
<b>4</b>	<p><b>Job Shop Scheduling:</b></p> <p>Introduction to Job Sequencing, Objectives, Sequencing Problems, Solution to Sequencing Problem, processing of n Jobs on 1 machine, Johnson’s Rule for optimal sequence of processing n jobs on 2 machines (n/2 problem), processing of n Jobs on 3 Machines (n/3 problem) and processing of 2 Jobs on m Machine (2/m) problem.</p> <p><b>Project Scheduling:</b></p> <p>Inputs for scheduling, loading and scheduling devices, factors influencing scheduling, scheduling techniques, use of Gantt Charts and basic scheduling problems. Concepts of project planning, monitoring and control, Project scheduling by using elements of network analysis –PERT &amp; CPM, cost analysis &amp; crashing, resource leveling,</p>	<b>12</b>

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
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<b>5</b>	<b>Enterprise Resource Planning (ERP)</b> ERP Introduction, Benefits, Origin, Evolution and Structure, Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP. <b>ERP- Functional Modules:</b> Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications. <b>ERP Implementation Basics,</b> ERP Implementation Life Cycle, ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into organizational culture.	<b>6</b>
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**List of Assignments:**

1. Assignment on Manufacturing System and Importance of PPC department
2. Assignment on Forecasting Techniques and Capacity Management.
3. Assignment on Material Management and Scientific Inventory Control.
4. Assignment on Job Shop and Project scheduling.
5. Assignment on structure, modules and implementation of an ERP.

**Books Recommended:**

*Text books:*

1. Production Planning and Control – L C Jhamb - Everest Publishing House
2. Inventory Management – L C Jhamb - Everest Publishing House
3. Problems in Operations Research (Principles and Solutions) – Hira and Gupta- S Chand Publications
4. Enterprise wide Resource Planning: Theory and Practice – Rahul V. Altekhar- PHI Publication

*Reference Books:*

1. Elements of Production Planning and Control– Samuel Eilon- Universal Publishing Corporation
2. Production Planning and Control, W. Boltan- Pearson Education Limited
3. Production Systems- Planning, Analysis& Control, James. L. Riggs-John Wiley & Sons
4. Manufacturing Planning and Control Systems, Thomas E. Vollman, William L. Berry & Others- Galgotia Publishers.
5. Manufacturing Process Planning and Systems Engineering, Anand Bewoor-Dreamtech Press
6. Production and Operations Management, S.N.Chary- TMH publishing company
7. Modernization & Manufacturing Management, L.C. Jhamb - Everest Publishing House

**Evaluation Scheme:**

**Semester End Examination (A):**

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

Oral examination will be based on the entire syllabus including, the exercises performed during laboratory sessions.

**Continuous Assessment (B):**

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

*Laboratory (Term Work):*

Term work shall consist of at least 1 assignment on each module from syllabus.

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

Assignments:	10 Marks
Case Study Presentation:	15 Marks

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

Prepared by

Checked by

Head of the Department

Principal

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering								Semester : VII		
Course : Finite Element Analysis								Course Code: DJ19MEC703		
Course : Finite Element Analysis Laboratory								Course Code: DJ19MEL703		
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	25	15	10	25	

**Pre-requisite:** Knowledge of Matrices, Differential Equations and Numerical Integrations.

**Objectives:**

1. To familiarize learners with concepts of FEA
2. To study the applicability of FEA to engineering problems
3. To familiarize learners with the FEA softwares to solve Engineering Problems.

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

1. Summarize the basics of finite element analysis.
2. Evaluate differential equations using weak and Non-weak form methods.
3. Implement the basic finite element formulation techniques to solve one dimensional engineering problems using elements such as bar/beam/link element.
4. Implement the basic finite element formulation techniques to solve two dimensional engineering problems using elements such as triangular and quadrilateral elements.
5. Implement the basic finite element formulation techniques to find natural frequency of dynamic system.
6. Use commercial FEA software, to solve problems related to mechanical engineering.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<p><b>Introductory Concepts:</b> Introduction to FEM, Historical Background, General FEA procedure, Applications of FEM in various fields, Advantages and disadvantages of FEA.</p> <p><b>Definitions of Various Terms used in FEA:</b> Element, order of the element, internal and external node/s, degree of freedom, primary and secondary variables and boundary conditions.</p> <p>Mathematical Modelling of field problems in engineering, Governing equations, Differential equations in different fields. Approximate solution of differential equations.</p>	<b>08</b>
<b>2</b>	<p><b>Weak and Non-Weak Form Methods:</b> Discrete and Continuous Models, Weighted Residual Methods and Ritz Technique.</p> <p><b>Minimization of a Functional:</b> Principle of minimum total potential, Piecewise Rayleigh-Ritz method, Formulation of stiffness matrix, transformation and assembly concepts.</p>	<b>08</b>
<b>3</b>	<p><b>One Dimensional Finite Element Formulations:</b></p> <p>One dimensional second order equations - discretization-element types - linear and higher order elements -derivation of shape functions and stiffness matrices and force vectors.</p> <p><b>Assembly of Matrices:</b> solution of problems in one dimensional structural analysis, heat transfer and fluid flow (stepped and taper bars, fluid network and Spring-Cart Systems). Analysis of Plane trusses and Analysis of Beams.</p>	<b>10</b>
<b>4</b>	<p><b>Two Dimensional Finite Element Formulations:</b></p> <p>Three node triangular element, four-node rectangular element, four-node quadrilateral element and eight node quadrilateral element. Global, Local, Natural coordinates and coordinates transformations: serendipity and Lagrange's methods for deriving shape functions for triangular and quadrilateral element. Sub parametric, Iso-parametric, super parametric elements, Compatibility conditions, Patch test, Convergence criterion and sources of errors in FEA.</p>	<b>08</b>
<b>5</b>	<p><b>Stress Analysis of Two Dimensional Elements:</b></p> <p>Equations of Elasticity-Plane stress, plane strain and axisymmetric problems. Jacobian matrix, stress analysis of CST and four node Quadratic element.</p> <p><b>Finite Element Formulation of Dynamic Systems:</b></p> <p>Applications to free vibration problems of rod and beam, Lumped and consistent mass matrices.</p> <p>Solutions techniques to Dynamic problems, longitudinal vibration frequencies and mode shapes, Fourth order beam equation, transverse deflections and natural frequencies of beams.</p>	<b>08</b>

**List of Laboratory Experiments:**

Students should use the commercial software (ANSYS/ABAQUS/NASTRAN/HYPERWORKS) or programmes from the text-books or self-developed programs to verify the results obtained by manual calculations.

Students should complete the following exercises.

1. Any two problems using 1D element: Analysis of axially loaded stepped/Tapered bar and beam.
2. Any two problems using truss element: Analysis of plane trusses.
3. Any two problems using 2D element: Analysis of plate with hole/notch.
4. Any one problem on steady state heat conduction.



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5. Any one problem using axisymmetric element: Analysis of pressure vessel.
6. Any one problem of free vibration analysis for dynamic system.

While performing the analysis the students should understand the concepts of selection of element type, meshing and convergence of solution.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

**Course Project:** A group of not more than four students, shall do Finite Element Analysis of any mechanical engineering component /system, which involves element selection, assigning properties, meshing, assigning loads, and boundary conditions, analysis and result interpretation.

**Books Recommended:**

*Text books:*

1. Text book of Finite Element Analysis – P. Seshu - Prentice-Hall of India Pvt. Ltd.
2. The Finite Element Method Engineering- S S Rao-Butter Worth Heinemann.

*Reference Books:*

1. Finite Element Method - J N Reddy - Tata McGraw Hill.
2. Finite Element Methods - R Dhanraj and K Prabhakaran Nair - Oxford University Press.
3. A first course in Finite Element Method - D. L. Logan - Asia Pvt Ltd.
4. Concepts and Applications of Finite Element Analysis - R. D. Cook, D. S. Malkus, M. E. Plesha - John Wiley Sons.
5. Introduction to Finite Elements in Engineering - Chandrupatla and Belegundu - Prentice-Hall of India Pvt. Ltd.
6. Fundamental Finite Element Analysis and Application with Mathematica and MATLAB Computations - M. Asghar Bhatti - Wiley India Pvt. Ltd.

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

1. Oral and Practical examination will be based on the entire syllabus and the practicals performed during laboratory sessions.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

*Laboratory: (Term work)*

Term work shall consist of 6 exercises by using FEA software, Course Projects and minimum 2 assignments.

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

- i. Laboratory work (Performance of Experiments): 15 Marks
- ii. Journal Documentation (Write-up, Power Point Presentation and Assignments): 05 marks

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iii. Course Project: 05 Marks.

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

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**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

Program: Mechanical Engineering								Semester : VII			
Course : Additive Manufacturing								Course Code: DJ19MEC7011			
Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)				Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Assign.	Avg.	100
				75			25	25	25	25	
				Laboratory Examination			Term work				
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Course Project		--	
				--	--	--	--	--			--

**Pre-requisite:** Knowledge of Production Processes and Material Technology.

**Objectives:**

1. To familiarize with importance of Rapid Prototyping in Product Development.
2. To make students aware about latest additive manufacturing technology used in industry,
3. To make students aware about various additive manufacturing processes and material availability.
4. To enable students to understand, describe and evaluate the different post processing techniques currently used on Additive Manufacturing parts.
5. To make students aware about latest research in the area of additive manufacturing.

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

1. Understand importance of Rapid Prototyping in product development.
2. Apply basic knowledge of additive manufacturing to decide type of additive manufacturing process and material according components design requirement.
3. To calculate and justify the cost of a typical additive manufacturing operation including labour costs, overhead costs, and consumable costs.
4. Evaluate the different post processing techniques used on AM parts, including those required for removal of support structures, improvement of surface characteristics and structural integrity.
5. Conduct research work and research writing in the field of additive manufacturing.

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<b>Detailed Syllabus: (unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Introduction:</b> Product Development Cycle and the product Life Cycle. Problems in Product Development. Relationship between Product Development Cost and the Selling Price. Rapid prototyping need, Classification of RP systems, advantages and limitations of RP, Applications and scope of RP, Introduction to additive manufacturing.	<b>8</b>
<b>2</b>	<b>Classification of Additive Manufacturing Processes:</b> Seven Classes of Additive Manufacturing, Binder jetting, Directed Energy Deposition, Powder Bed Fusion, Sheet Lamination, Material Extrusion, Material Jetting, Vat Photo Polymerization Detailed discussion on latest technique available on each type of additive manufacturing processes. Specification, working principal, material compatibility and Post processing.	<b>12</b>
<b>3</b>	<b>Additive Manufacturing System Design:</b> Process selection, Material selection, labor cost involved, overhead cost calculation, consumables cost, machine maintenance, Project Planning, Sensors used , Jigs and fixtures, Thermal management , Manufacturing Quality management.	<b>8</b>
<b>4</b>	<b>Applications of Additive Manufacturing:</b> Aerospace Applications, Medical applications, Art and Design applications, Energy applications, architecture applications.	<b>8</b>
<b>5</b>	<b>Intellectual Property Rights, IPR in Additive Manufacturing:</b> Case studies on Latest patents in the field of additive manufacturing, Case studies based on latest article Published in Scopus, SCI, and ESCI indexed journal.	<b>6</b>

**Books Recommended:**

*Text books:*

1. Additive Manufacturing Technologies – Ian Gibson, David W Rosen, Brent Stucker., Mahyar Khorasani – Springer.
2. Additive Manufacturing – Juan Pou, Antonio Riveiro and J. Paulo Davim – Elsevier

*Reference books:*

1. Multi-dimensional Additive Manufacturing – Soshu Kiriheral, Kazuhiro Nakata – Springer
2. Additive Manufacturing Processes – SanjayKumar – Springer
3. Polymer Based Additive Manufacturing – Declan M. Devine – Springer
4. Materials for Additive Manufacturing – Yusheng Shi, Chunze Yan, Yan Zhou, Jiamin Wu, Yan Wang, Shengfu Yu, Ying Chen – Academic Press, Elsevier
5. Additive Manufacturing (A Tool for Industrial Revolution 4.0) – M. Manjaiah, K. Raghavendra, N. Balashanmugam, J. Paulo Davim – Woodhead Publishing

**Evaluation Scheme:**

**Semester End Examination (A):**

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

**Continuous Assessment (B):**

1. Two term tests of 25 marks each will be conducted during the semester
2. Total duration allotted for writing each of the paper is 1 hr.

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3. Assignment based on each module carrying 25 marks or Student can complete any Massive Open Online Course (MOOC) based on syllabus of each module.
4. Presentation based on module 6.
5. Average of the marks scored in both the tests and assignment will be considered for final grading.

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Head of the Department

Principal

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

Program: Fourth Year Mechanical Engineering								Semester: VII		
Course: Computational Fluid Dynamics								Course Code: DJ19MEC7012		
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3		--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Pre-requisite:** Knowledge of physical science related to heat and Basic concepts learnt in fluid mechanics with respect to boundary conditions

**Objectives:**

1. To Study the working of CFD, governing Equations and discretization techniques
2. To Study basic heat transfer concepts numerically applicable for steady state and transient conditions

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

1. Explain the working of a CFD code
2. Understand the various Governing Equations
3. Understand turbulence modelling and various algorithms used in numerical techniques
4. Apply Finite Volume Method to solve numerical problems
5. Understanding the software used for simulation of numerical problems.

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<b>Detailed Syllabus: (unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Introduction:</b> What is CFD, Scope and Application of CFD, Methods of Predictions like Experimental and theoretical, Working of Commercial CFD Software's, Solution methodology-Preprocessing, Solver, Post processing	<b>05</b>
<b>2</b>	<b>Mathematical description of Physical Phenomenon:</b> Governing Differential Equations, Meaning of Differential equation, The Continuity Equation, A Momentum equation, The Energy Equation, The General Differential Equation, Boundary Conditions, Initial and Boundary Conditions, Initial and Boundary Value problems	<b>08</b>
<b>3</b>	<b>Turbulence Modelling:</b> Basic Theories of Turbulence, The Time-Averaged Equation for Turbulent Flow, The SIMPLE, SIMPLER Algorithm, Introduction to Finite Difference Method	<b>08</b>
<b>4</b>	<b>Finite Volume Method applied to Heat Conduction, Convection and Diffusion:</b> Steady One-dimensional Conduction, Convection, Diffusion, Unsteady One-dimensional Conduction, Two and Three-dimensional Situations introduction	<b>16</b>
<b>5</b>	<b>Simulation Softwares:</b> Introduction to the software used for Simulating numerical problems. Demonstrating the use of Python for solving basic fluid problems	<b>05</b>

**Books Recommended:**

*Text Books:*

1. An introduction to computational fluid dynamics-The finite volume method, Versteeg, H.K., Malalasekera, W., Prentice Hall

*Reference Books:*

1. Computational Fluid Mechanics and Heat Transfer, Anderson, D.A., Tannehill, I.I., and Pletcher, R.H., Hemisphere Publishing Corporation, New York, USA, 1984
2. Introduction to Computational Fluid Dynamics, Niyogi P., Laha M.K., Chakrabarty S.K., Pearson Education, India
3. Computational Fluid Flow and Heat Transfer, Muralidhar, K., and Sundararajan, T., Narosa Publishing House, New Delhi
4. Computer Simulation of flow and heat transfer, Ghoshdasdar, P. S., Tata McGraw-Hill Publishing Company Ltd
5. Finite Element Programming of the Navier Stoke's Equation, Taylor, C and Hughes J.B., Pineridge Press Ltd. U.K.
6. Computational Techniques for Fluid Dynamics: Fundamental and General Techniques, Fletcher, C.A.J., Springer-Verlag
7. Numerical Fluid Dynamics, Bose, T. K., Narosa Publishing House
8. T. J. Chung, Computational Fluid Dynamics, Cambridge University Press
9. Anderson, J.D. Computational Fluid Dynamics, McGraw Hill

**Evaluation Scheme:**

**Semester End Examination (A):**

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

**Syllabus for Fourth Year of B. Tech. Program in Mechanical Engineering:  
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***Continuous Assessment (B):***

***Theory:***

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

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Principal



**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

Program: Mechanical Engineering								Semester : VII			
Course : Machine Health Monitoring Management								Course Code:DJ19MEC7013			
Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)				Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Assign.	Avg.	100
				75			25	25	25	25	
				Laboratory Examination			Term work				
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Course Project		--	
				--	--	--	--	--			

**Pre-requisite:** Knowledge of Mechanical Vibrations

**Objectives:**

1. To introduce parameters involved in machine health monitoring management.
2. To make students aware about Instrumentation and Signal Processing in machine health monitoring management.
3. To introduce importance of pattern recognition in machine health monitoring management.
4. To impart knowledge about the application of artificial intelligence techniques in Condition Monitoring
5. To impart knowledge about the application of Machine learning techniques in Condition Monitoring

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

1. Understand basics of machine health monitoring management.
2. Apply basic Instrumentation and signal processing technique in machine health monitoring management.
3. Recognize pattern in problems involved in machine health monitoring.
4. Gain knowledge about the application of artificial intelligence techniques in Condition Monitoring
6. Gain knowledge about the application of Machine learning techniques in Condition Monitoring

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
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<b>Detailed Syllabus: (unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Introduction to asset Management:</b> Digital Asset Management, Fixed Asset Management, IT Asset Management, Enterprise Asset Management, Financial Asset Management, Infrastructure Asset Management <b>Introduction to maintenance strategies :</b> Proactive Maintenance, Predictive Maintenance, Planned Maintenance, Condition-Based Maintenance, Responsive Maintenance, Emergency Maintenance	<b>10</b>
<b>2</b>	<b>Introduction to Machine Health Monitoring Management:</b> Machine failures, Maintenance strategies, machine condition monitoring, Vibration signatures of faults in rotating and reciprocating machines, detection and diagnosis of faults. <b>Instrumentation and Signal Processing:</b> Types of sensors used in machine health monitoring: vibration, acoustics and noise, acoustic emission, temperature, ultrasonic and infrared sensors - Signal processing: basic signal and systems concepts, time domain analysis, frequency domain analysis, time-frequency analysis.	<b>12</b>
<b>3</b>	<b>Pattern Recognition:</b> Feature extraction and feature selection methods, feature reduction using PCA - discriminant functions and decision boundaries, decision trees, maximum likelihood and nearest neighbor. Application and case studies of machine health monitoring: Bearings, gear boxes, engines, structural health monitoring, machine tool condition monitoring etc.	<b>8</b>
<b>4</b>	<b>Introduction to Condition Monitoring Using Artificial Intelligence:</b> Approaches to Condition Monitoring, Components of Condition Monitoring, Measurement System and Preprocessing, Feature Extraction, Statistical Features, Vibration-based Condition Monitoring, Dissolved Gas Analysis, Artificial Intelligence Approaches, Single AI Approaches, Hybrid AI Approaches	<b>6</b>
<b>5</b>	<b>Introduction to Machine Learning in Conditioning monitoring:</b> Machine Learning Tools, Artificial Neural Network, Support Vector Machine, Extension Neural Network, Fuzzy ARTMAP. Introduction to Incremental Learning and its Application to Condition Monitoring	<b>6</b>

**Books Recommended:**

*Reference Books:*

1. Asset Management – Telli Van der Lei, Paulien Herder and Ype Wijnia – Springer
2. Machine Component Analysis with MATLAB – Dan B. Marghitu and Mihai Dupac – Butterworth-Heinemann, Elsevier.
3. Mechanical Vibrations and Condition Monitoring – Juan Carlos A. Jauregui Correa and Alejandro A. Lozano Guzman – Academic Press, Elsevier.
4. Intelligent Data-Analytics for Condition Monitoring – Hasmat Malik, Nuzhat Fatema and Atif Iqbal – Academic Press, Elsevier.
5. Predictive Maintenance of Pumps Using Condition Monitoring – Ray S. Beebe – Elsevier Science
6. Instrumentation and Control Systems – William Bolton – Newnes, Elsevier.
7. Emerging Trends in Image Processing, Computer Vision and Pattern Recognition – Leonidas Deligiannidis and Hamid R. Arabnia – Morgan Kaufmann, Elsevier.
8. Introduction to Pattern Recognition – Sergios Theodoridis, Aggelos Pikrakis, Konstantinos Koutroumbas and Dionisis Cavouras – Academic Press, Elsevier.
9. Neural Fuzzy Systems – Lin C. and Lee G. – Prentice Hall International Inc.

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10. Intelligent Data-Analytics for Condition Monitoring – Hasmat Malik, Nuzhat Fatema and Atif Iqbal – Academic Press, Elsevier.
11. Fuzzy Logic and Expert Systems Applications – Cornelius Leondes – Academic Press, Elsevier.

**Evaluation Scheme:**

**Semester End Examination (A):**

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

**Continuous Assessment (B):**

1. Two term tests of 25 marks each will be conducted during the semester
2. Total duration allotted for writing each of the paper is 1 hr.
3. Assignment based on each module carrying 25 marks or Student can complete any Massive Open Online Course (MOOC) based on syllabus of each module.
4. Average of the marks scored in both the tests and assignment will be considered for final grading.

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**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering								Semester : VII			
Course : Big Data Analytics								Course Code: DJ19MEC7014			
Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)				Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	100	
				75			25	25	25		
				Laboratory Examination			Term work				Total Term work
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal			
				--	--	--	--	--	--		

**Pre-requisite:** Knowledge of Data Base Management System

**Objectives:**

1. To Provide an Overview of an exciting growing field of Big Data Analytics.
2. To introduce the tools required to manage and analyze big data like Hadoop, NoSql, Map Reduce.
3. To teach the fundamental techniques in achieving big data analytics with scalability and streaming capability.

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

1. Understand the key issues in big data management.
2. Acquire fundamental enabling techniques using tools in big data analytics.
3. Achieve adequate perspectives of big data analytics in various applications like sensor, recommender systems, social media applications etc.

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(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Introduction to Big Data Analytics &amp; Hadoop Ecosystem:</b> Introduction to Big Data, Big Data characteristics, types of Big Data, Traditional vs. Big Data business approach. Technologies Available for Big Data, Infrastructure for Big Data, Big Data Challenges, Case Study of Big Data Solutions. Introduction to Hadoop. Core Hadoop Components, Physical Architecture, Hadoop limitations. Introduction, Components of the Hadoop Ecosystem:HDFS (Hadoop Distributed File System), MapReduce, YARN, HBase, Pig, Hive, Sqoop, Flume, Kafka, Zookeeper, Spark	<b>12</b>
<b>2</b>	<b>NoSQL</b> Introduction to NoSQL, NoSQL business drivers, NoSQL case studies. NoSQL data architecture patterns: Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores, Variations of NoSQL architectural patterns. Analysing big data with a shared-nothing architecture; Choosing distribution models: master-slave versus peer-to-peer Introduction to MongoDB, MongoDB commands.	<b>09</b>
<b>3</b>	<b>MapReduce</b> MapReduce and The New Software Stack: Distributed File Systems, Physical Organization of Compute Nodes, Large Scale File-System Organization. MapReduce: The Map Tasks, grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping with Node Failures Matrix vector multiplication using MapReduce, Case studies on MapReduce using Java/Python	<b>07</b>
<b>4</b>	<b>Big Data Analytics Applications</b> Recommendation Systems: Introduction, A Model for Recommendation Systems, Collaborative-Filtering System: Nearest Neighbor Technique, Example. Mining Social-Network Graphs: Social Networks as Graphs, Types of Social-Network. Clustering of Social Graphs, Applications	<b>07</b>
<b>5</b>	<b>Understanding Analytics and Big Data</b> Analytical Approaches and Tool to Analyse Data, Exploring R, Reading Datasets and Exporting Data from R, Manipulating and Processing Data in R, Working with Functions and Packages in R, Performing Graphical Analysis in R, Integrating R and Hadoop	<b>07</b>

**Books Recommended:**

*Text Books:*

1. Radha Shankarmani and M Vijayalakshmi —Big Data Analytics, Wiley
2. Alex Holmes —Hadoop in Practice, Manning Press, Dreamtech Press.
3. Dan McCreary and Ann Kelly —Making Sense of NoSQL – A guide for managers and the rest of us, Manning Press.

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*Reference Books:*

1. Bill Franks, — Taming The Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Wiley
2. Chuck Lam, — Hadoop in Action, Dreamtech Press
3. Tom White “Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Prepared by

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Head of the Department

Principal

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering							Semester : VII			
Course : Robotics							Course Code: DJ19MEC7015			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	
				Laboratory Examination			Term work		Total Term work	
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Assignments		--
				--	--	--	--	--	--	

**Pre-requisite:** Knowledge of basic electronic devices like Diodes, BJT etc. and basic digital electronics.

**Objectives:**

1. To study the basics of robotics and its control
2. To study various design principles of robotics through kinematic analysis, workspace analysis, and trajectory planning
3. To study applications of robots in industrial inspection and material handling

**Outcomes:**

On completion of the course, learner will be able to...

1. Demonstrate the basic functioning of a robot
2. Identify various components of robots
3. Carryout kinematic analysis, workspace analysis, and trajectory planning for a robot
4. Identify suitable sensors/actuators for robot
5. Select an appropriate robot for given industrial inspection and material handling systems.

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Semester VII (Autonomous)  
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<b>Detailed Syllabus: (unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration</b>
<b>1</b>	<b>Introduction</b> Definition of robot, Evolution of robots, Laws of robots, International Robotic Standards, Types of robots, Selection of robots, Robot Classifications, Degrees of freedom, Robot configuration, Accuracy and repeatability, Specification of a robot, Robot feedback controls: Point to point control and Continuous path control, Control system for robot joint, Adaptive control, Actuators and sensors, Drives and transmission systems, End effectors, Applications of robots	<b>09</b>
<b>2</b>	<b>Kinematics of Robots</b> <b>Direct:</b> Link coordinates D-H Representation, The ARM equation, Direct kinematic analysis for Four axis, SCARA Robot and three, five, and six axis Articulated Robots. <b>Inverse:</b> The inverse kinematics problem, General properties of solutions, Tool configuration, Inverse kinematics of four axis SCARA robot and three and five axis Articulated robot.	<b>09</b>
<b>3</b>	<b>Root Intelligence and Robot task planning</b> Introduction, State space search, Problem reduction, use of predictive Logic, Means. Ends Analysis, Problem solving, Robot learning and Robot task planning.	<b>08</b>
<b>4</b>	<b>Robot application in manufacturing</b> Robotic vision systems, Image representation, Object recognition and categorization, Depth measurement, Image data compression, Visual inspection, Software considerations Concepts of material handling, Principles and considerations in material handling systems design Conventional material handling systems - Industrial trucks, Monorails, Rail guided vehicles. Assembly & inspectors, robotic Cell design & control, Social issues & Economics of Robotics.	<b>08</b>
<b>5</b>	<b>Programming for Robots</b> Method, Robot Programme as a path in space, Motion interpolation, Motion & task level Languages, Robot languages, Programming using Python and characteristics of robot .	<b>08</b>

**Books Recommended:**

*Text books:*

1. Robotics for engineers - Yoram Korean - McGrew Hill Co.
2. Industrial Robotics Technology programming and Applications- M.P. Groover, M. Weiss, R.N. Nagel, and N.G. Odrey -McGraw-Hill,
3. Ashitava Ghosal -Robotics: Fundamental Concepts and Analysis - Oxford University Press

*Reference Books:*

1. Robotics and Control -R.K. Mittal and I.J. Nagrath- TMH Publications
2. Fundamentals of Robotics Analysis and Control - Robert J. Schilling - PHI Learning
3. Control in Robotics and Automation Sensor – Based integration - Bijay K. Ghosh, Ning Xi, T.J. Tarn, - Academic Press
4. Robotics Control Sensing, Vision and Intelligence - K.S.Fu, R.C.Gonzalez, and C.S.G.Lee - McGrew hill Book co.
5. Kinematics and Synthesis of linkages - Hartenberg and Denavit - McGrew Hill Book Co.
6. Kinematics and Linkage Design - A.S. Hall - Prentice Hall
7. Kinematics and Dynamics of Machinery - J.Hirchhorn - McGrew Hill Book Company



**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Prepared by

Checked by

Head of the Department

Principal

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering								Semester : VII		
Course : Tribology								Course Code: DJ19MEC7016		
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	
3	-	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				-	--	--	-	-	-	

**Pre-requisite:** Knowledge of Engineering Mechanics, Fluid Mechanics and Machine Design.

**Objectives:**

1. To provide overview of tribology and practical relevance in mechanical design.
2. To appreciate the behaviour of material, nature of surfaces, their profile and surface design procedure.
3. To understand the provenance of friction, the theories/laws.
4. To gain an understanding about wear and its mechanisms, theories of wear applied in machine elements.

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

1. Apply the principles of lubrication, lubrication regimes, and theories of hydrodynamic, elasto-hydrodynamic and mixed / boundary lubrication.
2. Understand the principles of design considerations, principles of bearing selection and arrangement in machines.
3. Design of mechanical components from the aspect of friction, wear and lubrication.
4. Understand the principles for selecting compatible materials for minimizing friction and wear in machinery.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

<b>Detailed Syllabus: (unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Introduction:</b> Tribology in design- bearing material its properties and construction, Tribological design of oil seals and gasket, Tribology in industry, Lubricants selection for general application and special application such as low temperatures, high temperature, extreme pressure etc. Tribological considerations- Nature of surfaces and their contact; mechanical properties of surface layer, Geometrical properties of surfaces, methods of studying surfaces; Study of contact of smooth and rough surfaces.	<b>08</b>
<b>2</b>	<b>Friction and wear:</b> Role of friction and laws of static friction, causes of friction, theories of friction, Laws of rolling friction, Friction of metals and non-metals, Friction measurements, Stick-slip motion and friction instabilities. Definition of wear, mechanism of wear, types and measurement of wear, Wear properties of friction and anti-friction metallic and non-metallic materials, Theories of wear. Design of mechanical components against wear. Design of friction surfaces used in clutches and brakes.	<b>08</b>
<b>3</b>	<b>Hydrodynamic theory of lubrication:</b> Theory of hydrodynamic lubrication, mechanism of pressure development in oil film. Two dimensional Reynold's equation and its limitations, Petroff's equation. Hydrodynamic thrust bearing-Introduction, types. Flat plate thrust bearing-Pressure equation, load, centre of pressure, frictional force equation. Hydrodynamic lubrication: design of plain fixed pad and tilting pad, slider bearing for steady and varying –loads. Full and partial journal bearing of infinite length, design of journal bearing for steady loads and varying loads.	<b>09</b>
<b>4</b>	<b>Elastohydrodynamic Lubrication</b> Introduction to design of aerostatic bearings and its applications, Elasto-hydrodynamic lubrication: Principle, application to antifriction bearings, cams and gears, Fault diagnosis in bearings and its solutions, bearing maintenance.	<b>08</b>
<b>5</b>	<b>Lubrication and lubricants:</b> Introduction, Importance of Lubrication, Boundary lubrication; classic hydrodynamics, hydrostatic and elasto hydrodynamic lubrication, Functions of lubricants, Types of lubricants and their industrial uses; SAE classification, recycling, disposal of oils, properties of liquid and grease lubricants; lubricant additives, general properties and selection. <b>Special Topics:</b> Diagnostic maintenance of Tribological components and considerations in IC engines and automobile parts, roller chains and wire rope, lubrication systems. Air/gas lubricated bearing and its Advantages and disadvantages	<b>09</b>

**Books Recommended:**

*Text books:*

1. Basu S K., Sengupta A N., Ahuja B. B., Fundamentals of Tribology, PHI 2006
2. Mujumdar B. C., Introduction to Tribology bearings, Wheelers and company pvt. Ltd 2001.
3. Cameron A., Basic Lubrication Theory, Wiley Eastern Ltd.
4. Andras Z. Szeri, Fluid film lubrication theory & design, 1st Edition, 2005

*Reference Books:*

1. Fuller, D., Theory and Practice of Lubrication for Engineers, New York company 1998
2. Moore, Principles and applications of Tribology, Pergamaon press 1998

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

3. Srivastava S., Tribology in industries, S Chand and Company limited, Delhi 2002
4. Redzimoskay E I., Lubrication of bearings – theoretical principles and design, Oxford press company 2000
5. J. Bhatia, Advances in industrial Tribology

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Prepared by

Checked by

Head of the Department

Principal

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering							Semester: VII			
Course: Automobile Engineering							Course Code: DJ19MEC7017			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Pre-requisite:** Knowledge of manufacturing processes, mechanics, dynamics, basic electronics & fluid mechanics.

**Objectives:**

1. To describe the working of different mechanical systems of an automobile.
2. To illustrate the working of electrical systems of an automobile.
3. To discuss the advancements in automobile technology.

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

1. Describe the types and working of clutch and transmission system.
2. Illustrate the working of steering and braking systems.
3. Describe the role of vehicle suspension systems and vehicle body.
4. Describe the different automotive electrical systems.
5. Acquaint with recent developments in automobiles.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<p><b>Introduction:</b> Classification of automobiles, Importance of various sub-systems of an automobile, development of an automobile, aspects of automotive engineering.</p> <p><b>Clutch:</b> Requirements of Clutches, Types of Clutches; Single Plate, Multi-plate, Wet Clutch, Centrifugal clutch. Clutch materials. Clutch operating mechanisms; Mechanical, Electric, Hydraulic and Vacuum. Trouble shooting and remedies. Clutch-by-wire.</p> <p><b>Transmission:</b> Necessity of gear box. Sliding mesh, Constant mesh, and Synchromesh Gearbox. Gear selector mechanisms. Overdrives, under-gearing, over-gearing, tractive effort and hydrodynamic torque converter, Epicyclic gear train and automatic transmissions. Trouble shooting and remedies. Automated Manual Transmission (AMT) and Continuously Variable Transmission (CVT).</p> <p><b>Final Drive and Differential:</b> Types of Final drive; spiral, bevel, Hypoid and worm drives. Necessity of differential, Working of differential, Conventional and non-slip differential, Trouble shooting and remedies.</p>	<b>10</b>
<b>2</b>	<p><b>Propeller Shaft and Axle:</b> Propeller shafts and universal joints: Types and construction, Different types of universal joints and constant velocity joints. Trouble shooting and remedies. Classification of axles, Loads on axles, Semi, Three quarter and Full floating axles.</p> <p><b>Steering System:</b> Steering geometry, Steering requirements, Steering linkages and steering gears. Over-steer and Under-steer, Cornering power, Reversibility of steering gears. Trouble shooting and remedies.</p> <p><b>Braking System:</b> Requirement of brakes, Classification of brakes, Brake Actuation Methods: Mechanical, Hydraulic, Pneumatic, Electro and vacuum brakes. Types of Disc brakes and Drum Brakes, Brake trouble shooting, Antilock braking system (ABS).</p>	<b>09</b>
<b>3</b>	<p><b>Suspension System:</b> Objects of suspension, Basic requirements, Sprung and un-sprung mass, Types of Independent, semi-independent and rigid axle suspension. Air suspension and its features. Pitching, rolling and bouncing. Shock absorbers and its types, Trouble shooting and remedies. Electronically controlled active suspension system.</p> <p><b>Wheels and Tyres:</b> Requirements of wheels and tyres. Types of wheels, types of tyres and types of carcass. Tyre and wheel manufacturing processes. Trouble shooting and remedies. Airless tyres &amp; run flat tyres.</p> <p><b>Body Engineering:</b> Importance of vehicle body and its types. Loads on vehicle body, materials for body construction. Layouts of passenger cars, Bus and truck bodies. Chassis types and structure types: Open, Semi integral and integral structures. Frames: Types of frames and their functions, Loads on frames, Load distribution of structure. Vehicle aerodynamics, Importance of crumple zone in vehicles, Crash safety ratings in India.</p>	<b>10</b>
<b>4</b>	<p><b>Automotive Electrical System:</b> <b>Storage Systems:</b> Lead-Acid Battery; construction, working, ratings, types of charging methods, Alkaline battery, ZEBRA and Sodium Sulphur battery.</p>	<b>07</b>

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
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	<p>Lithium ion battery, battery pack for electric vehicles, Battery management system.</p> <p><b>Charging System:</b> Dynamo: Principle of operation, Construction and Working. Regulators, combined current and voltage regulator.</p> <p>Alternator: Principle of operation, Construction, Working. Rectification from AC to DC.</p> <p><b>Starting system:</b> Requirements, Various torque terms used, Starter motor drives; Bendix drive, Pre-engaged drive, Overrunning Clutch. Starter motor solenoids, switches and relays.</p>	
<b>5</b>	<p><b>Recent developments in Automobiles:</b></p> <p>Active and Passive Safety systems in an automobile. Cruise Control, Adaptive Cruise Control (ACC), Electronic Stability Program (ESP), Electronic, Brake Distribution (EBD), Traction Control System (TCS). Integrated Starter Alternator (ISA), Hill assist, Launch control, Connected cars with V2V communication &amp; pre-collision technology.</p>	<b>06</b>

**Books Recommended:**

*Text books:*

1. Automobile Engineering, Dr. Kirpal Singh, Vol I & II, Standard publishers
2. Automobile Engineering, S. K. Gupta, S Chand Publications
3. Automobile Engineering, R. K. Rajput, Laxmi Publications

*Reference Books:*

1. Automotive Engineering Fundamentals, Jeffrey Ball, Richard Stone, SAE International.
2. Encyclopaedia of Automotive Engineering, David Crolla, Wiley Publication
3. Automotive Electrical and Electronic Systems, Tom Denton, Routledge
4. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, Mehrdad, Yimin, Sebastian, Ali, CRC Press

**Evaluation Scheme:**

**Semester End Examination (A):**

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

**Continuous Assessment (B):**

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which. Total duration allotted for writing each of the paper is 1 hr.
2. Average of the marks scored in both the two tests will be considered for final grading.

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

Prepared by

Checked by

Head of the Department

Principal

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

Program: Final Year (Common for All Programs)							Semester: VII			
Course: Product Life Cycle Management							Course Code: DJ19ILO7011			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Pre-requisite:** Knowledge of basic concepts of Management.

**Objectives:**

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

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

1. Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
2. Illustrate various approaches and techniques for designing and developing products.
3. Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc.
4. Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant



**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Introduction to Product Lifecycle Management (PLM):</b> Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications <b>PLM Strategies:</b> Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM	<b>10</b>
<b>2</b>	<b>Product Design:</b> Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process	<b>08</b>
<b>3</b>	<b>Product Data Management (PDM):</b> Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation <b>Virtual Product Development Tools:</b> For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modelling and simulations in Product Design, Examples/Case studies	<b>08</b>
<b>4</b>	<b>Integration of Environmental Aspects in Product Design:</b> Sustainable Development Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design.	<b>08</b>
<b>5</b>	<b>Life Cycle Assessment and Life Cycle Cost Analysis:</b> Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis	<b>08</b>

**Books Recommended:**

*Text books:*

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

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

*Reference Books:*

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

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

Program: Final Year (Common for All Programs)							Semester: VII			
Course: Management Information System							Course Code: DJ19ILO7012			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Objectives:**

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

**Outcomes:** Learner will be able to...

1. Explain how information systems Transform Business
2. Identify the impact information systems have on an organization
3. Describe IT infrastructure and its components and its current trends
4. Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making
5. Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Foundation Concepts:</b> Information Systems in Business, Functional Area Information System, The Components of Information Systems, Impact of IT on organizations and society, Organizational Strategy, Information systems for strategic advantage.	<b>05</b>
<b>2</b>	<b>Information Technologies:</b> Hardware and Software <b>Computer Systems:</b> End User and Enterprise Computing <b>Computer Peripherals:</b> Input, Output, and Storage Technologies <b>Application Software:</b> End User Applications <b>System Software:</b> Computer System Management <b>Data Resource Management:</b> Technical Foundations of Database Management, Managing Data Resources, Big data, Data warehouse and Data Marts, Knowledge Management <b>Networks:</b> The Networked Enterprise (Wired and wireless), Pervasive computing, Cloud Computing models	<b>08</b>
<b>3</b>	<b>MIS Tools and applications for Decision making:</b> ERP and ERP support of Business Process Reengineering, <b>Business intelligence (BI):</b> Managers and Decision Making, BI for Data analysis and Visualization <b>Artificial Intelligence Technologies in Business</b>	<b>08</b>
<b>4</b>	<b>Security and Ethical Challenges:</b> Security, Ethical, and Societal Challenges of IT Security Management of Information Technology	<b>06</b>
<b>5</b>	<b>Social Computing (SC):</b> Web 2.0 and 3.0, SC in business-shopping, Marketing, Operational and Analytic CRM, E-business and E-commerce – B2B B2C, Mobile commerce.	<b>07</b>
<b>6</b>	<b>Information System within Organization:</b> Acquiring Information Systems and Applications: Various System development life cycle models. <b>Enterprise and Global Management of Information Technology:</b> Managing Information Technology, Managing Global IT.	<b>08</b>

**Books Recommended:**

*Reference Books:*

1. Management Information Systems, 11<sup>th</sup> edition by James A O'Brien, George M., Ramesh Behl.
2. Kelly Rainer, Brad Prince, Management Information Systems, Wiley.
3. K.C. Laudon and J.P. Laudon, Management Information Systems: Managing the Digital Firm, 10<sup>th</sup> Ed., Prentice Hall, 2007.
4. D. Boddy, A. Boonstra, Managing Information Systems: Strategy and Organization, Prentice Hall, 2008

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

Program: Final Year (Common for All Programs)							Semester: VII			
Course: Operations Research							Course Code: DJ19ILO7013			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Pre-requisites:** Basic Knowledge of Algebra, Probability and Statistics.

**Objectives:**

1. To formulate a real-world decision problem as a mathematical programming model.
2. To learn the mathematical tools that are employed to solve mathematical programming models.

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

1. **Convert** a real-world problem in to a Linear Programming Problem and **analyse** the solution obtained using Simplex method or other algorithms.
2. **Identify** real-world problems as Transportation Problem and Assignment Problem and **Solve** the decision problem by choosing appropriate algorithm.
3. **Identify** the decision situations which vary with time and **analyse** them using principle of dynamic programming to real life situations.
4. **Explain** reasons of formation of queues, classify various queuing systems and **apply** parameters defined for various queuing systems for decision making in real life situations.
5. **Understand** the concept of decision making in situation of competition and **recommend** strategies in case of two-person zero sum games.
6. **Describe** concept of simulation and **apply** Monte Carlo Simulation technique to systems such as inventory, queuing and **recommend** solutions for them.
7. **Understand** need for right replacement policy and **determine** optimal replacement age.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Introduction to Operations Research:</b> Concept of decision making. Definition of OR. Formulation of decision problem as OR model, Concept of Optimization, <b>Linear Programming Problem:</b> Mathematical Formulation. Finding optimal solution - Graphical method, Simplex Method, Big M-method, Two Phase Method. Duality, Primal – Dual construction, Symmetric and Asymmetric Dual. Dual Simplex Method.	10
<b>2</b>	<b>Assignment Problems:</b> Mathematical Formulation, Finding optimal solution - Hungarian Method <b>Transportation problem:</b> Mathematical Formulation, Finding initial basic feasible solution – Northwest corner rule, row minima, column minima, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method. Improving the solution.	08
<b>3</b>	<b>Dynamic Programming:</b> Bellman's Principle of optimality - Applications of dynamic programming- Employment smoothening problem, capital budgeting problem, shortest path problem, cargo loading problem	06
<b>4</b>	<b>Queuing Models:</b> Characteristics of queuing models. Single Channel – Single and multi phase servers, Poisson arrivals, exponential service time - with infinite population and finite population models – with infinite and finite capacity. Multichannel – Single phase server - Poisson arrivals, exponential service time with infinite population. <b>Game Theory:</b> Introduction. Minimax & Maximin Criterion and optimal strategy. Solution of games with saddle points, rectangular games without saddle points - 2 x 2 games, dominance principle. Approximate methods - Iterative method, m x 2 & 2 x n games -Graphical method and method of sub-games. Expressing game as LPP.	10
<b>5</b>	<b>Simulation:</b> Definition. Types of simulation models. Monte Carlo simulation technique. Applications of simulation - Inventory and Queuing problems. Simulation Languages. <b>Replacement Models:</b> Replacement of items that deteriorate with time - when money value is not counted and counted, Replacement of items that fail suddenly – individual and group replacement policy.	08

**Note:** Educator is expected to introduce relevant software available for solving various mathematical models.

**Books Recommended:**

*Text books:*

1. Operations Research, Sharma J. K., Trinity Press
2. Operations Research, Gupta P. K., Hira D. S., S. Chand Limited

*Reference Books:*

1. Operations Research - An Introduction; Taha, H.A.; Prentice Hall

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2. Operations Research: Principles and Practice; Ravindran, A, Phillips, D. T and Solberg, J. J.; John Willey and Sons
3. Introduction to Operations Research; Hiller, F. S. and Liebermann, G. J.; Tata McGraw Hill
4. Operations Research Principles and Practice; Pradeep Prabhakar Pai; Oxford University Press
5. Operations Research, R. Panneerselvam, PHI Publications.
6. Operations Research, A. M. Natarajan, P. Balasubramani, A. Tamilarasi, Pearson Education.
7. Operations Research; Kanti Swarup, P. K. Gupta and Man Mohan; Sultan Chand & Sons

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.



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**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

<b>Program: Final Year (Common for All Programs)</b>				<b>Semester: VII</b>				
<b>Course: Cyber Security and Laws</b>				<b>Course Code: DJ19ILO7014</b>				
<b>Teaching Scheme (Hours / week)</b>				<b>Evaluation Scheme</b>				
				<b>Semester End Examination Marks (A)</b>		<b>Continuous Assessment Marks (B)</b>		<b>Total marks (A+ B)</b>
<b>Lectures</b>	<b>Practical</b>	<b>Tutorial</b>	<b>Total Credits</b>	<b>Theory</b>		<b>Term Test 1</b>	<b>Term Test 2</b>	<b>Avg.</b>
				<b>75</b>		<b>25</b>	<b>25</b>	<b>25</b>
				<b>Laboratory Examination</b>		<b>Term work</b>		<b>Total Term work</b>
<b>3</b>	<b>--</b>	<b>--</b>	<b>3</b>	<b>Oral</b>	<b>Practical</b>	<b>Oral &amp; Practical</b>	<b>Laboratory Work</b>	<b>Tutorial / Mini project / presentation/ Journal</b>
				<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>

**Objectives:**

1. To understand and identify different types cybercrime and cyber offences.
2. To recognized Indian IT Act 2008 and its latest amendments
3. To learn various types of security standards compliances

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

1. Understand the different types of cybercrime and security issues E Business.
2. Analyses different types of cyber threats and techniques for security management.
3. Explore the legal requirements and standards for cyber security in various countries to regulate cyberspace.
4. Impart the knowledge of Information Technology Act and legal frame work of right to privacy, data security and data protection.

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<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Introduction to Cybercrime:</b> Cyber Crime, Cyber Law, Cyber Security, History of Cyber Crime, Hacking, Data Theft, Cyber Terrorism, Virus & Worm's, Email Bombing, Pornography, online gambling, Forgery, Web Defacements, Web Jacking, Illegal online Selling, Cyber Defamation, Software Piracy, Electronics/ Digital Signature, Phishing, Password Cracking, Key loggers and Spywares, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing Identity Theft (ID Theft) <b>Cyber offenses:</b> How criminal plan the attacks, Social Engineering, Cyber stalking, Cyber café and Cybercrimes, Botnets, Attack vector	<b>12</b>
<b>2</b>	<b>Cyber Threats Analysis</b> Knowledge of Dynamic and Deliberate Targeting Knowledge of Indications and Warning Knowledge of Internal Tactics to Anticipate and/or, Emulate Threat Capabilities and Actions Knowledge of Key Cyber Threat Actors and their Equities Knowledge of Specific Target Identifiers and Their Usage <b>Cyber Security Management</b> Knowledge of Emerging Security Issues, Risks, and Vulnerabilities	<b>08</b>
<b>3</b>	<b>Electronic Business and legal issues</b> Evolution and development in Ecommerce, Policy Frameworks for Secure Electronic Business, paper vs paper less contracts, E-Commerce models- B2B, B2C, E security. E-Payment Mechanism; Payment through card system, E-Cheque, E-Cash, E-Payment Threats & Protections, Security for E-Commerce.	<b>06</b>
<b>4</b>	<b>Indian IT Act</b> Cyber Crime and Criminal Justice, Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments <b>Security aspect in cyber Law</b> The Contract Aspects in Cyber Law , The Security Aspect of Cyber Law, The Intellectual Property Aspect in Cyber Law ,The Evidence Aspect in Cyber Law ,The Criminal Aspect in Cyber Law	<b>08</b>
<b>5</b>	<b>Security Industries Standard Compliances</b> IT Security v/s IT Compliance, Cyber Security Standards, critical security controls for cyber security, GRC (Governance, Risk Management, and Compliance), SOX, GLBA, HIPAA, ISO/IEC 27001, NIST Cyber Security Framework (CSF), PCI-DSS. OWASP Top Ten Project, GDPR (General Data Protection Regulation), NIST (National Institute of Standards and Technology), CIS Controls (Center for Internet Security Controls)	<b>08</b>

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**Books Recommended:**

*Reference Books and Material:*

1. Nina Godbole, Sunit Belapure, Cyber Security, Wiley India, New Delhi
2. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi
3. The Information Technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
4. E-Commerce Security and Privacy", Anup K. Ghosh, Springer Science and Business Media, 2012
5. Izzat Alsmadi , The NICE Cyber Security Framework Cyber Security Intelligence and Analytics, Springer
6. Cyber Law & Cyber Crimes, Advocate Prashant Mali; Snow White Publications, Mumbai
7. Nina Godbole, Information Systems Security, Wiley India, New Delhi
8. Kenneth J. Knapp, Cyber Security & Global Information Assurance Information Science Publishing.
9. William Stallings, Cryptography and Network Security, Pearson Publication
10. Websites for more information is available on : The Information Technology ACT, 2008- TIFR : <https://www.tifrh.res.in>
11. Website for more information, A Compliance Primer for IT professional:  
<https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals-33538>

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

Program: Final Year (Common for All Programs)							Semester: VII			
Course: Personal Finance Management							Course Code: DJ19ILO7015			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Pre-requisites:** Basic Knowledge of Algebra, Probability and Statistics.

**Objectives:**

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

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

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

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**Semester VII (Autonomous)**  
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<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>01</b>	<p><b>Overview of Indian Financial System:</b> Characteristics, Components and Functions of Financial System. Financial Instruments and Financial Markets, Financial inclusion.</p> <p><b>Introduction to Personal Finance</b></p> <p>Person Financial Planning in Action, Money Management Skills, Taxes in Your Financial Plan, Savings and Payment Services.</p> <p>Consumer Credit: Advantages, Disadvantages, Sources and Costs.</p>	<b>07</b>
<b>02</b>	<p><b>Personal Financial Management</b></p> <p><b>Loans:</b> Home, Car, Education, Personal, Loan against property and Jewel loan.</p> <p><b>Insurance:</b> Types of Insurance – ULIP and Term; Health and Disability Income Insurance, Life Insurance.</p> <p><b>Investment:</b> Investing Basics and Evaluating Bonds, Investing in Stocks and Investing in Mutual Funds, Planning for the Future.</p>	<b>07</b>
<b>03</b>	<p><b>Income Tax</b></p> <p><b>Income Tax Act Basics-</b> Introduction to Income Tax Act, 1961</p> <p><b>Heads of Income and Computation of Total Income and Tax Liability-</b> Heads of Income and Computation of Total Income under various heads, Clubbing Provisions, Set off and Carry forward of Losses, Deductions, Assessment of Income and tax liability of different persons.</p> <p><b>Tax Management, Administrative Procedures and ICDS - TDS, TCS and Advance Tax Administrative Procedures, ICDS.</b></p>	<b>08</b>
<b>04</b>	<p><b>Goods and Services Tax</b></p> <p>GST Constitutional framework of Indirect Taxes before GST (Taxation Powers of Union &amp; State Government); Concept of VAT: Meaning, Variants and Methods; Major Defects in the structure of Indirect Taxes prior to GST; Rationale for GST; Structure of GST (SGST, CGST, UTGST &amp; IGST); GST Council, GST Network, State Compensation Mechanism, Registration.</p> <p><b>Levy and Collection of GST</b></p> <p>Taxable event- "Supply" of Goods and Services; Place of Supply: Within state, Interstate, Import and Export; Time of supply: Valuation for GST- Valuation rules, taxability of reimbursement of expenses; Exemption from GST: Small supplies and Composition Scheme: Classification of Goods and Services</p>	<b>10</b>
<b>05</b>	<p><b>Introduction to Micro – finance</b></p> <p>Micro-Finance: Definitions, Scope &amp; Assumptions, Types of Microfinance, Customers of Micro-finance, Credit Delivery Methodologies, SHG concept, origin, Formation &amp; Operation of Self Help Groups (SHGs).</p> <p><b>Models in Microfinance -</b> Joint Liability Groups (JLG), SHG Bank Linkage Model and GRAMEEN Model: Achievements &amp; Challenges,</p> <p><b>Institutional Mechanism</b></p> <p>Current Challenges for Microfinance, Microfinance Institutions (MFIs): Constraints &amp; Governance Issues, Institutional Structure of Microfinance in India :NGO-MFIs, NBFC-MFIs, Co-operatives, Banks, Microfinance Networks and Associations; Demand &amp; Supply of Microfinance Services in India, Impact assessment and social assessments of MFIs,</p>	<b>10</b>

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**Books Recommended:**

*Reference Books:*

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

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Consisting **One Class Tests for 25 marks** based on approximately 50% of contents and one case study with presentations for 25 Marks.
2. Total duration allotted for writing test paper is 1 hr.
3. Average of the marks scored in the tests and case study will be considered for final grading.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

Program: Final Year (Common for All Programs)							Semester: VII			
Course: Energy Audit and Management							Course Code: DJ19ILO7016			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Objectives:**

1. To understand the importance of energy security for sustainable development and the fundamentals of energy conservation.
2. To identify and describe the basic principles and methodologies adopted in energy audit of a utility
3. To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management.
4. To relate the data collected during performance evaluation of systems for identification of energy saving opportunities.

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

1. To identify and describe present state of energy security and its importance.
2. To identify and describe the basic principles and methodologies adopted in energy audit of a utility.
3. To describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.
4. To describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities.
5. To analyze the data collected during performance evaluation and recommend energy saving measures.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>01</b>	<b>Energy Scenario:</b> Present Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security, Energy Conservation and its Importance, Energy Conservation Act-2001 and its Features. Basics of Energy and its various forms, Material and Energy balance.	<b>05</b>
<b>02</b>	<b>Energy Audit:</b> Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution. Elements of monitoring & targeting, Energy audit instruments. Technical and economic feasibility, Classification of energy conservation measures. Safety considerations during energy audit. <b>Financial analysis techniques:</b> Simple payback period, NPV, Return on investment (ROI) Internal rate of return (IRR).	<b>10</b>
<b>03</b>	<b>Energy Management and Energy Conservation in Electrical System:</b> Electricity billing, Electrical load management and maximum demand Control; Power factor improvement, Energy efficient equipments and appliances, star ratings. Energy efficiency measures in lighting system, lighting control: Occupancy sensors, daylight integration, and use of intelligent controllers. Energy conservation opportunities in water pumps, compressor, fan and blower. industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives.	<b>10</b>
<b>04</b>	<b>Energy Management and Energy Conservation in Thermal Systems:</b> Review of different thermal loads; Energy conservation opportunities in: Steam distribution system, Steam leakages, Steam trapping, Condensate and flash steam recovery system. Waste heat recovery, use of insulation- types and application. Energy conservation opportunities in: Boiler system. Refrigeration system and HVAC system.	<b>10</b>
<b>05</b>	<b>Energy conservation in Buildings:</b> Energy Conservation Building Codes (ECBC): Green Building, LEED rating, Application of Non-Conventional and Renewable Energy Sources, Energy sources and energy management in electric vehicles.	<b>07</b>

**Books Recommended:**

*Reference Books:*

1. Handbook of Electrical Installation Practice, Geofry Stokes, Blackwell Science.
2. Designing with light: Lighting Handbook, By Anil Valia, Lighting System.
3. Energy Management Handbook, By W.C. Turner, John Wiley and Sons.
4. Handbook on Energy Audits and Management, edited by A. K. Tyagi, Tata Energy Research Institute (TERI).
5. Energy Management Principles, C.B. Smith, Pergamon Press.
6. Energy Conservation Guidebook, Dale R. Patrick, S. Fardo, Ray E. Richardson, Fairmont Press.
7. Handbook of Energy Audits, Albert Thumann, W. J. Younger, T. Niehus, CRC Press.
8. [www.energymanagertraining.com](http://www.energymanagertraining.com)
9. [www.bee-india.nic.in](http://www.bee-india.nic.in)



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**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Consisting of **Two Compulsory Class Tests for 25 marks**, First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

Program: Final Year (Common for All Programs)							Semester: VII			
Course: Disaster Management and Mitigation Measures							Course Code: DJ19ILO7017			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Objectives:**

1. To provide basic understanding hazards, disaster and various types and categories of disaster occurring around the world.
2. To identify extent and damaging capacity of a disaster.
3. To study and understand the means of losses and methods to overcome /minimize it.
4. To understand roles and responsibilities of individual and various organization during and after disaster.
5. To appreciate the significance of GIS, GPS in the field of disaster management.
6. To understand the emergency government response structures before, during and after disaster.

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

1. Know natural as well as manmade disaster and their extent and possible effects on the economy.
2. Know the institutional framework and organization structure in India for disaster management and get acquainted with government policies, acts and various emergency laws.
3. Get to know the simple dos and don'ts in such extreme events and build skills to respond accordingly.
4. Understand the importance of disaster prevention and various mitigation measure with the exposure to disasters hotspots across the globe.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**

**Semester VII (Autonomous)**

**(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>General Information about Disaster:</b> Brief concept of Hazards, definition and types of Disasters – Natural, Man-made, and hybrid, Groups of Disasters- Natural and Technological, global Scenario, Significance of studying various aspects of disasters, effects of disasters, India's vulnerability to disasters, Impact of disaster on National development. Study of Natural disasters: Flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion etc. Study of Human/Technology Induced Disasters: Chemical, Industrial and Nuclear disasters, Internally displaced persons, road and train accidents Fire Hazards, terrorism, militancy, Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.	<b>10</b>
<b>2</b>	<b>Disaster Management:</b> Brief Introduction, Disaster management cycle, Evolution of Disaster and Disaster management in India, Disaster management acts, policies and guidelines, laws of emergencies etc. Prior, During and Post disaster management activities: (Preparedness, strengthening emergency centers, Logistics, optimum resource management, emergency response and relief, Training, Public awareness, Research, Reconstruction of essential services and livelihood restoration.	<b>08</b>
<b>3</b>	<b>Institutional framework and Mechanism for disaster management in India:</b> Institutions in India for dealing with various disasters, Organizational structure, functions and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India, roles and responsibilities of central and state government during and after disaster, NGO's involved in disasters and their task, Jobs carried out by armed forces. Financial Relief During disaster (State, National and International Disaster Assistance)	<b>08</b>
<b>4</b>	<b>Disaster risk reduction and Mitigation Measures:</b> Need of disaster prevention and mitigation, mitigation guiding principles, challenging areas, structural and non-structural measures for disaster risk reduction. Mitigation measures for flood, earthquake, cyclone monitoring, air quality, water quality, climate change, land use, winter storms and aquatic biology etc. Use of information management, GIS, GPS and remote sensing Mitigation measure. Do's and don'ts in case of disasters and effective implementation of relief aids.	<b>08</b>
<b>5</b>	<b>Case studies on disaster (National /International):</b> Case study discussion of Hiroshima – Nagasaki (Japan), India – Tsunami (2004) , Bhopal gas tragedy, Kerala and Uttarakhand flood disaster, Cyclone Phailin (2013), Fukushima Daiichi nuclear disaster (2011), 26 <sup>th</sup> July 2005 Mumbai flood, Chernobyl meltdown and so on. (Discuss case studies on disaster with respect to reason for the disaster, incidents, effects of disaster, present scenario and safety measures taken)	<b>08</b>

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**Books Recommended:**

*Reference Books and Reports:*

1. Disaster Management, by Harsh K. Gupta, Universities Press Publications (2003).
  2. Disaster Management: An Appraisal of Institutional Mechanisms in India, by O.S. Dagur, published by Centre for land warfare studies, New Delhi, 2011.
  3. Introduction to International Disaster Management, by Damon Copolla, Butterworth Heinemann Elsevier Publications (2015).
  4. Disaster Management Handbook, by Jack Pinkowski, CRC Press, Taylor and Francis group (2008).
  5. Disaster management & rehabilitation, by Rajdeep Dasgupta, Mittal Publications, New Delhi (2007).
  6. Natural Hazards and Disaster Management, Vulnerability and Mitigation, by R B Singh, Rawat Publications (2006).
  7. Concepts and Techniques of GIS, by C.P. Lo Albert, K.W. Yonng, Prentice Hall (India) Publications (2006).
  8. Risk management of natural disasters, by Claudia G. Flores Gonzales, KIT Scientific Publishing (2010).
  9. Disaster Management – a disaster manager's handbook, by W. Nick Carter, Asian Development Bank (2008).
  10. Disaster Management in India, by R. K. Srivastava, Ministry of Home Affairs, GoI, New Delhi (2011)
  11. The Chernobyl Disaster: Legacy and Impact on the Future of Nuclear Energy, by Wil Mara, Marshall Cavendish Corporation, New York, 2011.
  12. The Fukushima 2011 Disaster, by Ronald Eisler, Taylor & Francis, Florida, 2013.
- (Learners are expected to refer reports published at national and international level and updated information available on authentic web sites)

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

Program: Final Year (Common for All Programs)							Semester: VII			
Course: Science of Well-being							Course Code: DJ19ILO7018			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Objectives:**

1. To create consciousness about importance of holistic health and physical as well as mental well-being.
2. To make learners aware of the concepts of Happiness, Gratitude, Self-Compassion, Empathy etc.
3. To introduce the learners to the means of mental and physical well-being, ill effects of mal-practices like alcoholism, smoking etc.
4. To equip the learners to manage and cope up with stress in their daily living.

**Outcomes:** Upon Completion of the course, the learner should be able to:

1. Describe concepts of holistic health and well-being, differentiate between its true meaning and misconceptions and understand the benefits of well-being.
2. Recognize meaning of happiness, practice gratitude and self-compassion and analyze incidents from one's own life.
3. Understand the causes and effects of stress, identify reasons for stress in one's own surrounding and self.
4. Recognize the importance of physical health and fitness, assess their life style and come up with limitations or effectiveness.
5. Inspect one's own coping mechanism, assess its effectiveness, develop and strategize for betterment and execute it.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Health and well-being:</b> The concept of health, dimensions of health, the notion of well-being, various facets of well-being, relation between health and well-being. Concept of holistic health, its principles and importance, concept and benefits of holistic care, misconceptions about holistic health approach, the application of a true holistic approach to our well-being.	<b>06</b>
<b>2</b>	<b>Concepts of happiness:</b> Happiness: what is it and how do we measure it? Philosophical perspectives on happiness, Happiness: Nature or Nurture? Happiness in the modern world: impediments and accelerators, Narrow vs. Broad Band Approaches to Happiness, Benefits of Happiness, Self-Compassion and Gratitude. Misconceptions of happiness.	<b>08</b>
<b>3</b>	<b>Stress and mental health/well-being:</b> Nature and concept of stress, meaning and definitions of stress, types of stress, meaning of stressors, types of stressors, symptoms of stress, effects of stress, different models of stress. Sources of stress and how does stress cause illness, various sources of stress, delineate between external and internal sources of stress, differentiate between continuous and discrete stressors, the effects of these stressors on health and well-being, diversity of stressors and their health consequences, relation between stress and illness from different perspectives association between stress related physiological mechanisms and different illnesses.	<b>10</b>
<b>4</b>	<b>Physical Well-being / Health management:</b> concept of health behaviours, dimensions of health behaviours. Health enhancing behaviors: Exercise and Weight control, application and importance of these health enhancing behaviours. Health protective behaviors and illness management: concept of illness management, effectiveness of illness management. Concept of Nutrition, Role of Nutrition, Components of Nutrition, concept of Malnutrition, Health compromising behaviours: Alcoholism, Smoking and its effects on health.	<b>10</b>
<b>5</b>	<b>Dealing with Difficult Times / Coping mechanisms:</b> The concept of chronic stress, Health and safety risks of chronic stress, Forms and Treatment of chronic stress, Coping with Acute and Chronic stress, theories of the stress-illness link, role of stress in mental disorders. Concept of coping, Ways of coping and stress management, basic knowledge about stress management, various techniques of stress management, stress management programs. Mental strengths and virtues, Hope, Optimism, Resilience – concept, pathways and models, Meditation and Self-introspection.	<b>08</b>

**Books Recommended:**

*Textbooks:*

1. The Science of well-being by Felicia Huppert, Nick Baylis, Barry Keverne; Oxford University Press
2. Health and Well-Being: Emerging Trends by S. Ojha, U. Rani Srivastava, Shobhna Joshi, Global Vision Publishing House
3. Positive psychology: The scientific and practical explorations of human strengths by Shane J. Lopez, Jennifer Teramoto Pedrotti, Charles Richard Snyder; Sage Publications.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

*Reference Books:*

1. The pursuit of happiness and the realization of sympathy: Cultural patterns of self, social relations, and well-being by Kitayama, S., & Markus, H. R, Culture and subjective well-being, The MIT Press.
2. Man Adapting by Dubos, R; New Haven: Yale University Press.
3. Happiness a history by McMahon D. M., Atlantic Monthly Press.
4. Well-being: The foundations of hedonic psychology by D. Kahneman & E. Diener & N. Schwarz, New York: Russell Sage
5. Selye H. The Stress of Life. New York; McGraw-Hill; 1984.

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

**Syllabus for Final Year of B.Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering							Semester: VII			
Course: Research Methodology							Course Code: DJ19ILO7019			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	100
				75			25	25	25	
				Laboratory Examination			Term work			
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Pre-requisites:** Basic Knowledge of Probability and Statistics.

**Objectives:**

1. To understand Research and Research Process
2. To acquaint learners with identifying problems for research and develop research strategies
3. To familiarize learners with the techniques of data collection, analysis of data and interpretation

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

1. Prepare a preliminary research design for projects in their subject matter areas
2. Accurately collect, analyze and report data
3. Present complex data or situations clearly
4. Review and analyze research findings
5. Write report about findings of research carried out



**Syllabus for Final Year of B.Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Basic Research Concepts</b> Meaning of research, Objectives of research, Types of research, Significance of research Research process	07
<b>2</b>	<b>Research Methodology:</b> Identification of research problem, Literature review, Formulation of hypothesis, Formulation of Research design.	10
<b>3</b>	<b>Research and Sample Design:</b> Meaning of research and sample design, Need of research design, Features of good research design, Important concepts, Different research designs, Types of sampling designs	10
<b>4</b>	<b>Data Collection and Data Analysis:</b> Types of data, Methods for collecting data: Experiments and surveys, Collection of primary and secondary data, Hypothesis testing and interpretation of Data	10
<b>5</b>	<b>Interpretation and Report Writing:</b> Interpretation and drawing conclusions on the research, Preparation of the report, Ethical Issues	05

**Books Recommended:**

*Reference Books:*

1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors.
2. Kothari, C.R., 1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited.
3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2<sup>nd</sup> Edition), Singapore, Pearson Education

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

Program: Final Year (Common for All Programs)							Semester: VII			
Course: Public Systems and Policies							Course Code: DJ19ILO7020			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Pre-requisites:** Basic Knowledge of Social science and Current affairs

**Objectives:**

1. To analyze the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.
2. To understand public systems in a fast-changing environment in the global context.
3. To provide an in-depth understanding of the ills prevailing in the society and aids to identify the solutions for them.
4. To explain public policy and its operations with special focus on policy relating to Government finance.
5. To analyze and evaluate the impact of the public policy on firms and economy at large.

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

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

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Introduction and Overview of Public Systems:</b> Ideology of Public Systems; Mechanistic and Organic view of Society and Individuals, The Legal Framework; Federal Government; State and Local Governments, Government growth; The size of Government.	10
<b>2</b>	<b>Public Sector in the Economics Accounts:</b> Public Sector in the circular flow; Public Sector in the National Income Accounts.	6
<b>3</b>	<b>Public Choice and Fiscal Politics:</b> Direct Democracy; Representative Democracy; The Allocation Function; The Distribution Function; The Stabilization Function; Coordination of Budget Functions; The Leviathan Hypothesis.	8
<b>4</b>	<b>Introduction and Overview of Public Policy:</b> Markets and Government; Social goods and Market failure, Public expenditure and its evaluation; Cost Benefit Analysis, Public policy and Externalities, Taxation Policy and its impact, Income distribution, redistribution and social security issues Fiscal & Budgetary Policy, Fiscal Federalism in India.	12
<b>5</b>	<b>Case Studies in Expenditure Policy: Public Services</b> A) National Defense B) Highways C) Outdoor Recreation D) Education	6

**Books Recommended:**

**Reference Books:**

1. Introduction to Public Policy by Charles Wheelan, W.W. Norton & Company.
2. Understanding Public Policy by Thomas R. Dye, Prentice Hall.
3. Public Policy-Making: An Introduction by Anderson J.E., Boston, Houghton.
4. Public Administration by Avasthi & Maheshwari, Lakshminarayan Agarwal, Agra.
5. New Horizons of Public Administration by Bhattacharya, Mohit, Jawahar Publishers, New Delhi.
6. Public Administration and Public Affairs by Henry, Nicholas, Prentice Hall of India, New Delhi.
7. Public Finance 10<sup>th</sup> Edition by Harvey S Rosen and Ted Gayer, McGraw-Hill Education, 2013.
8. Public Finance in Theory and Practice by Musgrave and Musgrave.

**Evaluation Scheme:**

**Semester End Examination (A):**

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VII (Autonomous)**  
**(Academic Year 2022-2023)**

***Continuous Assessment (B):***

***Theory:***

1. Two term tests of 25 marks each will be conducted during the semester, out of which one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in the two tests will be considered for final grading.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering							Semester: VII			
Course: Project - I							Course Code: DJ19MEP704			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				--			--	--	--	--
				Laboratory Examination			Term work		Total Term work	100
--	6	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	50	--	50	--	

**Pre-requisite:** Knowledge of mechanical and inter-disciplinary subjects, concepts & analytical software.

**Objectives:**

1. To acquaint with the process of undertaking literature survey/industrial visit and identifying the problem
2. To familiarize the process of solving the problem in a group
3. To acquaint with the process of applying basic engineering fundamental in the domain of practical applications
4. To inculcate the process of research

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

1. Apply basic engineering fundamentals in the domain of practical applications.
2. Identify the engineering problems based on literature review.
3. Attempt a problem solution with systematic approach and ethics.
4. Develop the habit of working in a team, and communicate efficiently with engineering community and society.
5. Apply the principles of project management and financial aspects in multidisciplinary environments.
6. Recognize the need for lifelong learning activities to cope up with technological changes.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

**Project-I**

1. To proceed with the project work it is very important to select a right topic. Project can be undertaken on any subject addressing Mechanical &/or inter-disciplinary concepts.
2. Research and development projects on problems of practical and theoretical interest should be encouraged.
3. Project work must be carried out by the group of at least two students and maximum four and must be original.
4. Students can certainly take ideas from anywhere, but be sure that they should evolve them in the unique way to suit their project requirements.
5. The project work can be undertaken in a research institute or organization/company/any business establishment.
6. Student must consult internal guide along with external guide (if any) in selection of topic.
7. Head of department and senior staff in the department will take decision regarding projects.
8. Student has to submit a progress report every 15 days to the internal guide and internal guide has to keep track on the progress of the project and also has to maintain attendance report. This progress report along with a synopsis report can be used for awarding term work marks.
9. In case of industry projects, regular monitoring by internal guide will be preferred.

**Guidelines for Assessment of Project - I**

Project - I should be assessed based on following points:

1. Quality of problem selected (Objective, Problem definition & Project motivation)
2. Clarity of Problem definition and Feasibility of problem solution
3. Relevance to specialization
4. Breadth and depth of literature survey
5. Project scope
6. Project methodology

Project - I should be assessed through a project report & a presentation by the student project group to a panel of examiners.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering								Semester : VIII			
Course : Design of Mechanical Systems								Course Code: DJ19MEC801			
Course : Design of Mechanical Systems Laboratory								Course Code: DJ19MEL801			
Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)	
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.		
				75			25	25	25		
				Laboratory Examination			Term work		Total Term work		
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		50	
				25	--	--	15	10	25		

**Pre-requisite:** Knowledge of Material Technology, Power Engineering, Machine Design I and Machine Design II.

**Objectives:**

To study design of snatch block, belt conveyors, engine system, pumps and machine tool gearbox.

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

1. Design gear boxes for a given machine tool application.
2. Design hoisting mechanism of an Electric overhead traveling crane.
3. Design belt conveyor systems.
4. Design engine components such as cylinder, piston, connecting rod and crankshaft.
5. Design pumps for a given application.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

<b>Detailed Syllabus: (unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Design of Gear Box:</b> Requirements of a gear box, Determination of variable speed range, Graphical representation of speeds, Structure diagram, Ray diagram, Selection of optimum ray diagram, Estimation of numbers of teeth on gears, Deviation diagram, Layout of gear box	<b>10</b>
<b>2</b>	<b>Design of Hoisting mechanism:</b> Selection of wire rope, Design and selection of sheave pulley, axle and bearings, Selection of hook, Design of nut, Selection of thrust bearing, Design of cross-piece with trunion, Design of shackle plate, Design of rope drum, drum shaft and bearing, Selection of motor	<b>08</b>
<b>3</b>	<b>Design of belt conveyors:</b> Selection of belt, Selection of motor, Design of drive pulley assembly, Design of driven pulley assembly, Design of over running idler assembly, Design of under running idler assembly	<b>08</b>
<b>4</b>	<b>Engine Design (Petrol and Diesel):</b> Design of cylinder, Design of piston with pin and rings, Design of connecting rod, Design of crank shaft with bearings	<b>08</b>
<b>5</b>	<b>Design of gear pump:</b> Selection of motor, Design of gear, Selection of bearing, Design of bolts, Design of suction and delivery pipe <b>Design of centrifugal pump:</b> Selection of motor, Design of impeller and impeller shaft, Design of volute casing, Design of suction and delivery pipe	<b>08</b>

**List of Laboratory Experiments/Sheets/Tutorials:**

- Design and detailed assembly drawing (computer aided drawing on A3 size sheets) of minimum two design problems, from the following:
  - Design of hoisting mechanisms
  - Design of belt conveyors
  - Design of pumps
- Assignment:** Exercises on following topics in the form of design calculations with sketches and / or drawings.
  - Engine design
  - Design of gearbox
- Course Project:** Students in a group (2 to 4 students) should be able to apply and integrate the knowledge gained during the course. Design and preparation of working drawings of any system having minimum 5 to 6 components is expected.

**Books Recommended:**

*Text books:*

- Mechanical Engineering Design - J. E. Shigley and C. R. Mischke - McGraw-Hill Education
- Design of Machine Elements – V. B. Bhandari - McGraw-Hill Education
- Mechanical System Design - S. P. Patil - JAICO Publishing House

*Reference Books:*

- Material Handling Equipment – N. Rudenko - M.I.R. publishers
- Design of machine tools - S. K. Basu and D. K. Pal - Oxford and IBH Pub. Co.
- Machine tool design - N. K. Mehta - McGraw-Hill Education
- Gear Design Handbook - Gitin Maitra - McGraw-Hill Education



**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
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5. Design Data book by P.S.G. College of Technology, Coimbatore.
6. Design Data Book- Design of engine parts by Khandare S. S. & Kale A. V.

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

*Laboratory: (Term work)*

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

- i. Laboratory work (CAD drawings/Tutorials): 15 Marks
- ii. Assignments : 05 marks
- iii. Course project : 05 marks

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

Prepared by

Checked by

Head of the Department

Principal

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering								Semester : VIII		
Course : Industrial Engineering								Course Code: DJ19MEC802		
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Pre-requisite:** Basic knowledge of Manufacturing processes and various manufacturing systems.

**Objectives:**

1. To familiarise with concept of integration of various resources and the significance of optimizing them in manufacturing and allied Industries.
2. To acquaint with various productivity enhancement techniques.

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

1. Illustrate the need for optimization of resources and its significance.
2. Develop ability in integrating knowledge of design along with other aspects of value addition in the conceptualization and manufacturing stage of various products.
3. Demonstrate the concept of value analysis and its relevance.
4. Manage and implement different concepts involved in method study and understanding of work content in different situations.
5. Describe different aspects of work system design and facilities design pertinent to manufacturing industries.
6. Illustrate concepts of Agile manufacturing, Lean manufacturing and Flexible manufacturing.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Introduction to Industrial Engineering:</b> history and contribution, Industrial engineering approach, Definition and concept of Productivity, productivity measurements, factors influencing productivity and productivity improvement techniques. Value Engineering and Value Analysis: Distinction between value engineering & value analysis and their significance. Steps in value engineering & analysis and check lists.	<b>8</b>
<b>2</b>	<b>Work study:</b> Method study: micro-motion study and principles of motion economy, Therbligs, Work measurement: Time Study, Work Sampling, Standard Data, Predetermined Motion Time System (PMTS); Maynard Operation Sequence Technique (MOST).	<b>8</b>
<b>3</b>	<b>Work system design:</b> Introduction to ergonomics and its scope in relation to work. Outline of discipline of anatomy, physiology and psychology, with respect to ergonomics building blocks such as anthropometry and biomechanics; Industrial Psychology concept, aim & objectives and scope of industrial psychology; Job evaluation, merit rating, incentive schemes, wage administration and business process reengineering.	<b>10</b>
<b>4</b>	<b>Facility Design:</b> Facility location factors and evaluation of alternate locations; types of plant layout and their evaluation; computer aided layout design techniques; Line Balancing: objectives, constraints, terminology in assembly line, heuristic methods like Kilbridge-Wester, Largest Candidate rule, Rank positional weight; Materials handling systems, AGV. Concepts of Group Technology and cellular manufacturing.	<b>8</b>
<b>5</b>	<b>Agile manufacturing:</b> Introduction, developing agile manufacturing, Integration of Product/Process Development, Application of IT/IS concepts, Agile supply chain management, Design of skill and knowledge and Computer control of Agile manufacturing. Flexible manufacturing, Lean Manufacturing, Value Stream Mapping.	<b>8</b>

**Books Recommended:**

*Text books:*

1. Industrial Engineering and Management, Ravi Shankar, Galgotia Publications Pvt Ltd.
2. Industrial Engineering and Management, O.P. Khanna, Dhanpat Rai Publications.

*Reference Books:*

1. Introduction to Work study, ILO, Geneva, and Oxford & IBH Pub Co. Pvt. Ltd.
2. Ergonomics at Work, Murrell
3. Plant Layout and Material Handling, James M. Apple, John Wiley & Sons
4. Facility Layout and Location – An Analytical Approach, Richard L. Francis & John A. White, Prentice Hall
5. Production Planning and Control, Samuel Elion
6. Production and Operations Management, Joseph G. Monks
7. Quality planning and analysis, J M Juran, FM Gryana, TMH
8. Total Quality Management, D. H. Bester Field et al. prentice hall
9. TQM in new product manufacturing, HG Menon; TMH

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Prepared by

Checked by

Head of the Department

Principal

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

Program: Mechanical Engineering								Semester : VIII			
Course : CAD/CAM/CIM								Course Code: DJ19MEC803			
Course : CAD/CAM/CIM Laboratory								Course Code: DJ19MEL803			
Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)				Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Assign.	Avg.	
				75			25	25	25	25	
				Laboratory Examination			Term work				Total Term work
				3	2	--	4	Oral	Practical	Oral & Practical	
				-	--	25	15	10	25		

**Pre-requisite:** Knowledge of CAMD and Finite Element Analysis.

**Objectives:**

1. To introduce CAD/CAM/CIM with particular focus on engineering product design and manufacturing.
2. To develop a holistic view of initial competency in engineering design and manufacturing by using CAM software.
3. To develop New API for CAD
4. To introduce capabilities of additive manufacturing to replace conventional machining.
5. To make students aware about computer Integrated manufacturing (CIM)

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

1. Understand basics of computer graphics and computer modelling technique.
2. Transform, manipulate objects and computer assisted generation of tool path
3. Apply Artificial Intelligence concept to Design and manufacturing.
4. Apply and replace conventional manufacturing process by additive manufacturing process
5. Apply computer integrated machining for product design and manufacturing

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
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<b>Detailed Syllabus: (unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Computer Graphics and Techniques for Geometric Modeling</b> Basics of computer graphics, Introduction to computer graphics algorithms, Raster Graphics, Vector Graphics, DDA Line generation Algorithm, Bresenham's Line Generation Algorithm, Introduction to Painters Algorithm, Introduction to Area Subdivision Algorithm, The parametric representation of geometry, Bezier curves. Constructive solid geometry (CSG), Boundary Representation (B-Rep), Wire Frame Modelling, Solid Modeling, Surface Modelling, Parametric Modelling.	<b>8</b>
<b>2</b>	<b>Introduction to Computer Aided Manufacturing (CAM) and CAM software</b> G Code, M Code, CNC Programming, writing a code for Turning Operation, Writing a code for Milling Operation. Machine Setup, Tool Selection, Tool simulation and stock material removal, Automatic Tool Path generation, Generation of CNC code for machining, Produce setup sheets. <b>2D &amp; 3D Transformations</b> (Translation, Rotation, Scaling & Magnification). Programming for Transformations.	<b>10</b>
<b>3</b>	<b>Artificial Intelligence in Design &amp; Manufacturing</b> The integration of predictive machine learning, Optimizing several variables, Unprecedented customization, Automated experimentation, Smart manufacturing, Predictive Maintenance, Smart Maintenance, 24x7 Production, Safer Operational Environment, Microscopic Defect Identification, Shop floor performance improvement, Generative design, Novel Opportunities for Humans. <b>Application Programming Interface (API)</b> Concept of customizing applications by writing programs, Creating Scripts and Add-Ins, Creating Programs for Assemblies, Joint, B-Rep & Geometry.	<b>08</b>
<b>4</b>	<b>Introduction to Additive Manufacturing:</b> Classification of additive manufacturing processes, Seven Classes of Additive Manufacturing, Binder jetting, Directed Energy Deposition, Powder Bed Fusion, Sheet Lamination, Material Extrusion, Material Jetting, Vat Photo Polymerization Discussion on latest technique available on each type of additive manufacturing processes. Specification, working principal, material compatibility and Post processing.	<b>06</b>
<b>5</b>	<b>Computer Integrated Manufacturing, Digital manufacturing</b> Introduction, Evolution, Objectives, CIM Hardware and Software, CIM Benefits, Nature and role of the elements of CIM, Identifying CIM needs, Data base requirements of CIM, Role of CAD/CAM in CIM, Obstacles to Computer Integrated Manufacturing, Concept of the future CIM systems, Socio -techno- economic aspects of CIM. <b>Computer Aided Product Design and Manufacturing</b> Overview of toy design for entertainment and play, creative product design, Ideas for new toys that serve clients in the community, Fundamental aspects of the product development process, Determining customer needs, brainstorming, estimation, sketching, sketch modeling, concept development, design aesthetics, detailed design, and prototyping.	<b>10</b>

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
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**List of Laboratory Experiments:**

1. Programming for transformations by using coding language (Translation, Rotation, Scaling & Magnification)
2. Creating a script for generating a component or a sketch on software.
3. Simulation of turning operation program on software. (2 Programs)
4. Simulation of milling operation program on software. (2 Programs)
5. Program and Process Sheet Generation for turning operation by using CAM Software. (Two components)
6. Program and Process Generation for Milling operation by using CAM Software ( Two components )
7. Development of physical 3D mechanical component using any one of the additive manufacturing technique 3 D printer.
8. Development of physical 3D mechanical component on Automatic Turning centre (Computerized).
9. Development of physical 3D mechanical component on vertical Machining Centre (Computerized).

**Books Recommended:**

*Textbooks:*

1. CAD/CAM: Computer Aided and Manufacturing – Mikell P. Groover and Emory W. Zimmers, Jr. – Pearson Education
2. CAD/ CAM: Theory & Practice – Ibrahim Zeid, R. Sivasubramanian – Tata McGraw Hill Publications
3. CAD/CAM Principles and Applications – P.N. Rao – Tata McGraw Hill Publications

*Reference Books:*

1. Computer Graphics – Donald Hearn and M. Pauline Baker – Eastern Economy Edition
2. Principle of Computer Graphics – William.M. Neumann and Robert.F. Sproul – McGraw Hill publishers.
3. Fundamental of CIM technology – David L. Goetsch – Delmar publication
4. Computer Integrated Design and Manufacturing – David Bedworth – McGraw Hill publishers.
5. CNC Machines – B.S. Pabla and M. Adithan – New Age International Publishers.
6. Numerical Control and Computer Aided Manufacturing – T.K. Kundra, P.N. Rao and N.K. Tiwari – Tata McGraw Hill publishers
7. CNC Technology and Programming – Krar S. and Gill A. – McGraw Hill publishers
8. Computer Integrated Manufacturing - An Introduction with Case Studies – Paul G. Ranky – Prentice Hall International
9. Additive Manufacturing Technologies – Ian Gibson, David W Rosen, Brent Stucker., Mahyar Khorasani – Springer.
10. Additive Manufacturing – Juan Pou, Antonio Riveiro and J. Paulo Davim – Elsevier
11. Additive Manufacturing (A Tool for Industrial Revolution 4.0) – M. Manjaiah, K. Raghavendra, N. Balashanmugam, J. Paulo Davim – Woodhead Publishing
12. Additive Manufacturing – An Elsevier Journal

**Evaluation Scheme:**

**Semester End Examination (A):**

**Theory:**

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

**Laboratory:**

1. Each student will be given a small task of design based on syllabus, which will be assessed by pair of examiners during the oral examination.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
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2. Distribution of marks for practical-oral examination shall be as follows:

Design Task: 15 marks                      Oral: 10 marks

3. Evaluation of practical/oral examination to be done based on the performance of design task

4. Students work along with evaluation report to be preserved till the next examination

**Continuous Assessment (B):**

Theory:

1. Two term tests of 25 marks each will be conducted during the semester

2. Total duration allotted for writing each of the paper is 1 hr.

3. Assignment based on each module carrying 25 marks or Student can complete any Massive Open Online Course (MOOC) based on syllabus of each module.

4. Average of the marks scored in both the tests and assignment will be considered for final grading.

**Laboratory: (Term work)**

Term work shall consist of

1. Any 4 experiments/exercises from 1 to 6 of above list

2. A course project in a group of not more than four students based on 7, 8 and 9 of above list

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

Exercises: 15 Marks

Course Project: 10 Marks

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

Prepared by

Checked by

Head of the Department

Principal



**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering								Semester : VIII		
Course : Smart Industries								Course Code: DJ19MEC8011		
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Assignments		
				--	--	--	--	--	--	

**Pre-requisite:** Knowledge of Basic courses in Mechanical Engineering

**Objectives:**

To provide students with a comprehensive understanding of the process of Industrial transformation and concepts of smart industry, Industry 4.0.

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

1. Understand the basic principles behind smart industry.
2. Identify smart industry key levers and drivers.
3. Understand the supporting technologies for Smart factories.
4. Learn from leading industries and develop smart factory roadmaps.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

<b>Detailed Syllabus: (unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Introduction to Smart Industry</b> Traditional Manufacturing Practices and Limitations, Industry Revolution, Introduction to Fourth Industrial Revolution and Concept of Smart Industry, Journey of Smart Industry, Key Drivers of smart industry/Industry 4.0, Changing society, product and processes, Need for renovating and standardizing production and manufacturing Industries to compete with global challenges, Smart Industry Roadmap, Opportunities and Challenges.	<b>07</b>
<b>2</b>	<b>Supporting Tools and Technologies for Smart Industries – Part I</b> Introduction to and Use of following Technologies in Smart Industries: IOT, Industrial IOT, Autonomous Robots, Additive Manufacturing, Horizontal and Vertical System Integration.	<b>10</b>
<b>3</b>	<b>Supporting Tools and Technologies for Smart Industries – Part II</b> Introduction to and Use of following Technologies in Smart Industries: AI, Cloud Computing, Big Data and ICT, Block chain, Simulation, Cyber Physical Systems, Augmented Reality and Virtual Reality in Smart Factories.	<b>10</b>
<b>4</b>	<b>Dimensions of Smart Manufacturing</b> Smart and connected products, Smart Machinery, Smart materials and manufacturing processes, and Smart material handling. Smart Logistics, Marketing and sales, post sales service and customer relationship management. Smart Money: Digital payment strategy in India.	<b>10</b>
<b>5</b>	<b>Smart Industry applications with case studies</b> Discussion on case studies and success stories across industries who had developed and implemented several smart factory solutions.	<b>05</b>

**Books Recommended:**

*Text Books:*

1. Handbook of Industry 4.0 and SMART Systems - Diego Galar Pascual, Pasquale Daponte and Uday Kumar – CRC Press.

*Reference Books:*

1. Implementing Industry 4.0: The Model Factory as the Key Enabler for the Future of Manufacturing - Carlos Toro, Wei Wang, and Humza Akhtar - Springer Publications.
2. Smart Digital Manufacturing: A guide of digital transformation with real case studies across industries - Rene Wolf and Raffaello Lepratti - Wiley-VCH publications.
3. Intelligent Transportation Systems: Smart and Green Infrastructure Design - Frank Kreith - Mechanical Engineering Series - Taylor and Francis Group.
4. The Internet of Things: Enabling Technologies, Platforms, and Use Cases - Pethuru Raj and Anupama C. Raman - CRC Press.
5. Internet of Things - Jeeva Jose - Khanna Publishing House, Delhi.
6. Block Chain Basics - Daniel Drescher - Apress.
7. Sensors and Actuators - C.W. de Silava - CRC Press.
8. Introduction to sensors - J. Vetelino and A. Reghu - CRC Press.
9. Smart Plant Factory: The Next Generation Indoor Vertical Farms - Toyoki Kozai - Springer Nature Publications.
10. Introduction to Industry 4.0 and Industrial Internet of Things - Prof. Sudip Misra - NPTEL Course - IIT Kharagpur.
11. Smart Industry & Smart Education - Michael E. Auer and Reinhard Langmann – Springer Publications.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Prepared by

Checked by

Head of the Department

Principal

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering								Semester : VIII		
Course: Energy Audit and Management								Course Code: D19MEC8012		
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	-
3	-	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				-	--	--	-	-	-	

**Pre-requisite:** Knowledge of fundamentals of Thermodynamics, Heat Transfer, Energy conversion systems.

**Objectives:**

1. To gain knowledge of present energy scenario in global and national level.
2. To understand the fundamental of energy economics and methods energy auditing.
3. To understand and analyze the energy efficiency in thermal and electrical utilities.

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

1. Know the present energy scenario, global environmental concern, and importance of sustainable energy management.
2. Analyze energy trends in energy intensive sectors and carry out energy action plan.
3. Understanding the energy economy of the energy intensive sectors.
4. Analyze the energy utilization in thermal and electrical utilities.
5. Evaluate the efficiency of boilers, steam systems, furnace, HVAC and refrigeration systems

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

<b>Detailed Syllabus: (unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration</b>
<b>1</b>	<b>Introduction:</b> Energy Scenario, various forms of energy, energy management and its importance, recent trends in energy conservation. <b>Global environmental concerns:</b> United Nations Framework Convention on Climate Change (UNFCCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon fund (PCF).	8
<b>2</b>	<b>Energy Action Planning:</b> Key elements, force field analysis, Energy policy purpose, perspective, contents, formulation, ratification, Organizing - location of energy management, top management support, managerial function, roles and responsibilities of energy manager, accountability. Motivating-motivation of employees: Information system-designing barriers, strategies; Marketing and communicating-training and planning.	8
<b>3</b>	<b>Energy Economics:</b> Simple payback period, time value of money, IRR NPV, life cycle costing, cost of saved energy, cost of energy generated. Monitoring and Targeting: Defining monitoring and targeting, elements of monitoring, targeting and reporting, Energy accounting, energy monitoring, energy audit process.	8
<b>4</b>	<b>Energy Efficiency in Thermal Utilities:</b> Boilers, steam systems, furnaces insulation and refractories, FBC boilers, cogeneration, waste heat recovery. <b>Energy Efficiency in Electrical Utilities:</b> Electrical systems, electric motors, compressed air system, HVAC and refrigeration systems, fans and blowers, pumps and pumping systems, cooling towers, lighting system, diesel generating system.	12
<b>5</b>	<b>Environmental Management:</b> Review National And International Protocols, Environmental Quality Criteria And Standards, Significant Sources of Water & Air Pollution, Indices of Environmental Quality.	6

**Books Recommended:**

*Text Books:*

1. Energy Management and Conservation – K. V. Sharma and P. Venkateshaiah, I. K. – International Publication House.
2. Industrial Energy Conservation – D. A Reay – Pergamon Press.
3. Energy Management – W. R. Murphy – Springer

*Reference Books:*

1. Energy Management and Conservation Handbook – Frank Kreith – CRC Press.
2. Energy Efficiency – Ming Yang and Xin Yu – Springer
3. Economics of Solar Energy & Conservation Systems – Kreith & RE West – CRC Press

**Evaluation Scheme:**

**Semester End Examination (A):**

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
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***Continuous Assessment (B):***

***Theory:***

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in the two tests will be considered for final grading.

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**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering								Semester : VIII		
Course : Industrial Waste Management								Course Code: DJ19MEC8013		
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	
				Laboratory Examination			Term work		Total Term work	
3	-	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				-	--	--	-	-	-	

**Pre-requisite:** Knowledge of fundamental of Thermodynamics and Energy conversion systems

**Objectives:**

1. To impart knowledge on source and characteristics of various industrial wastes.
2. To impart the strategies for prevention and control of industrial pollution.
3. To understand the methods and techniques of treatments for wastes.

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

1. Know the sources of pollution from industries.
2. Understand the characteristics of pollution.
3. Analyze the effects and hazardless of the industrial pollution.
4. Plan to minimize of industrial wastes.
5. Design facilities for the processing and reclamation of industrial waste water.

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<b>Detailed Syllabus: (unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Introduction:</b> Types of industries and industrial pollution, Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health – Environmental legislations related to prevention and control of industrial effluents and hazardous wastes	8
<b>2</b>	<b>Waste management:</b> Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and byproduct recovery – Applications.	8
<b>3</b>	<b>Industrial pollution:</b> Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants – Wastewater reclamation concepts	8
<b>4</b>	<b>Treatment Technologies:</b> Wastewater treatment, Equalisation – Neutralisation – Removal of suspended and dissolved organic solids - Chemical oxidation – Adsorption - Removal of dissolved inorganics – Combined treatment of industrial and municipal wastes – Residue management – Dewatering – Disposal	10
<b>5</b>	<b>Hazardous Waste Management:</b> Hazardous wastes - Physico chemical treatment – solidification – incineration – Secure land fills <b>Radioactive Waste Management:</b> Sources, Measures on health effects, nuclear power plants and fuel production, Waste generation from nuclear power plants, disposal options.	8

**Books Recommended:**

*Text Books:*

1. Industrial Pollution Prevention – T. T. Shen – Springer
2. Environmental Pollution and Management – Avnish Chauhan – Wiley Publication

*Reference Books:*

1. Environmental Management Systems and Cleaner Production Ruth Hillary – Wiley Publication
2. Industrial Water Pollution Control – W. W. Eckenfelder Jr – McGraw-Hill Publication Company
3. Wastewater Treatment – M. N. Rao and A. K. Dutta – Oxford Publication

**Evaluation Scheme:**

**Semester End Examination (A):**

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

**Continuous Assessment (B):**

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in the two tests will be considered for final grading.



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(Academic Year 2022-2023)**

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**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering								Semester: VIII			
Course: Business Analytics								Course Code: DJ19MEC8014			
Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment (B)		Marks		Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2		Avg.	
				75			25	25		25	
				Laboratory Examination			Term work			Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal			
				--	--	--	--	--		--	

**Pre-requisite:** Knowledge of basic statistics and Database

**Objectives:**

1. To Familiarize with Business Analytics refers to skills, practices and techniques used in converting data into information and knowledge that aid business decision making.
2. To acquaint with Statistical learning including quantitative, qualitative analysis techniques.
3. To acquaint with the use of the above analysis and visualization to aid decision making.

**Outcomes:** Students will be able to.....

1. Apply Base SAS programming.
2. Understand and demonstrate visual analytics.
3. Design the report using reporter
4. View various reports using different media devices.

**Syllabus for Final Year of B.Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

<b>Detailed Syllabus: (unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Introduction to Base SAS:</b> <b>SAS Program:</b> Introduction to SAS program, Submitting a SAS program – SAS Studio, SAS Enterprise Guide, SAS Windowing environment, SAS program syntax <b>Accessing Data:</b> Examining SAS Data sets, Accessing SAS Libraries <b>Producing Detail Reports:</b> Subsetting Report data, Sorting and Grouping Report data, Enhancing Reports <b>Formatting Data Values:</b> Using SAS Formats, User defined Formats	09
<b>2</b>	<b>Reading SAS Dataset, Spreadsheet and Database data</b> Reading SAS Dataset, Customize SAS Dataset, Router Reading Spreadsheet data, Reading database data.	06
<b>3</b>	<b>Visual Analytics</b> Getting Started with SAS Visual Analytics: Exploring SAS VA concepts, Using Home page Adminstrating the Environment and Managing Data: Exploring Data Builder, Exploring Administrator, Demonstrations and Exercises. <b>Using the Explorer</b> Selecting Data and defining Data Item properties, Creating Visualizations, Enhancing Visualizations with Analytics, Interacting with Visualizations and Explorations	12
<b>4</b>	<b>Designing Reports with Reporter</b> Creating a Simple Report, Creating Data Items and Working with Graphs Working with Filters and Report sections Working with other objects, Demonstrations and Exercises	09
<b>5</b>	<b>Viewing SAS VA Reports and Case Study</b> Creating Analyses and Reports. Viewing Reports on tthe Web, Viewing Reports on the Mobile Device/ Office Analytics, Case Study – Creating Analyses and Reports.	06

**Books Recommended:**

1. SAS programming 1 – Essentials.
2. SAS Visual Analytics – Fast Track.
3. SAS Support
4. Business Analytics, Data Analysis and Decision Making - S. Christian Albright, Wayne L. Winston - CENGAGE Learning
5. Business Analytics, A Data-Driven Decision Making Approach for Business, Volume I - Amar Sahay - Business Expert Press
6. Data Science for Business and Decision Making - Luiz Paulo Favero and Patricia Belfiore - Elsevier Science

**Evaluation Scheme:**

**Semester End Examination (A):**

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

**Continuous Assessment (B):**

*Theory:*

**Syllabus for Final Year of B.Tech. Program in Mechanical Engineering:  
Semester VII (Autonomous)  
(Academic Year 2022-2023)**

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Prepared by

Checked by

Head of the Department

Principal

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering								Semester: VIII		
Course: IoT and Applications								Course Code: DJMEC8015		
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Pre-requisite:** Knowledge of fundamentals of Electrical and Electronics Engineering and Internet Technology.

**Objectives:**

1. Understand general concepts of Internet of Things (IoT).
2. Recognize various devices, sensors and applications.
3. Apply design concept to IoT solutions.
4. Evaluate design issues in IoT applications.
5. Create IoT solutions using sensors, actuators and Devices.

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

1. Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved.
2. Understand IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules.
3. Market forecast for IoT devices with a focus on sensors.
4. Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

<b>Detailed Syllabus: (unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Introduction to Internet of Things:</b> IoT concepts, Definition and Characteristics of IoT, IoT standards, components of IOT System (Sensors, Actuators), relevance of IOT for the future, Physical Design of IoT – IoT Protocols, IoT communication models, IoT communication APIs, IOT enabled technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems.	<b>10</b>
<b>2</b>	<b>IoT Physical Devices and Endpoints:</b> Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins.	<b>08</b>
<b>3</b>	<b>Controlling Hardware:</b> Connecting LED, Buzzer, switching high power devices with transistors, Controlling AC power devices with relays, Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors. <b>Sensors:</b> Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, temperature and humidity sensor DHT11, Motion detection Sensors, Wireless bluetooth sensors, Level sensors, USB sensors, Embedded sensors, distance measurement with ultrasound sensor.	<b>10</b>
<b>4</b>	Introduction of automated high-end vehicles, Drone technology, Automated guided vehicles in material handling.	<b>06</b>
<b>5</b>	<b>IoT Applications:</b> Smart factories, Home automation, Smart city, environment, energy, agriculture and relevant case studies based on real world applications.	<b>08</b>

**Books Recommended:**

*Text books:*

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD).
3. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Michahelles, Florian, Springer.
4. Internet of Things (A Hands-On-Approach), Vijay Madisetti and Arshdeep Bahga, VPT.

*Reference books:*

1. Peter Waher, 'Learning Internet of Things', Packt Publishing, Editors Ovidiu Vermesan
2. Peter Friess, 'Internet of Things – From Research and Innovation to Market Deployment', River Publishers.
3. N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers.

**Evaluation Scheme:**

**Semester End Examination (A):**

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

***Continuous Assessment (B):***

***Theory:***

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Prepared by

Checked by

Head of the Department

Principal

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering								Semester : VIII		
Course : Process Equipment Design								Course Code: DJ19MEC8016		
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Pre-requisite:** Knowledge of Engineering Thermodynamics, Fluid mechanics, Materials Technology, Heat Transfer, Machine Design I, and Machine Design II

**Objectives:**

To understand the design process of various process equipment used in industries

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

1. Understand the basics of process equipment design
2. Design a reaction vessel to meet the given requirements
3. Design a storage tank as per industrial standards
4. Design a shell and tube heat exchanger for single phase heat transfer
5. Design vertical towers like distillation columns



**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

<b>Detailed Syllabus: (unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Process design parameters:</b> Basic concepts in process design, Block diagrams for flow of processes, Material flow balance, Design pressures & temperatures, Design stresses, Factory of safety, Minimum shell thickness and corrosion allowance, Weld joints efficiency, Design loading, Stress concentration and thermal stresses, Failure criteria, Optimization technique such as Lagrange's multiplier and golden section method, Cost and profitability estimation. Introduction to design codes like IS-2825, ASME-SECT, EIGHT-DIV-II TEMA.API-650, BS-1500 & 1515.	<b>08</b>
<b>2</b>	<b>Mechanical design of Reaction Vessel:</b> Mechanical design of shell, head, Jacket, coil, agitator, nozzle, body flange, etc., Different types of agitators & their selection criteria, Different types of agitator shaft sealing system & their selection criteria, Different types of power transmission system, Determination of power required for agitation, shaft diameter, blade thickness, etc., Different types of jackets & their selection criteria.	<b>09</b>
<b>3</b>	<b>Mechanical design of Storage Tank:</b> Classification of storage tank as per IS-803, Determination of storage tank capacity, diameter & height, Design of shell and bottom plate for storage tank, Design of conical roof, Selection of column, girders and rafters, roof curb angle and floating roof.	<b>08</b>
<b>4</b>	<b>Mechanical design of Shell &amp; Tube Heat Exchangers:</b> Mechanical design of shell, tube, tube sheet, head, channel shell, etc. of shell & tube heat exchanger.	<b>08</b>
<b>5</b>	<b>Mechanical design of Vertical Tall Tower (Distillation Column):</b> Mechanical design of shell, head, tray support, nozzle, body flange for vertical tall tower, Determination of shell thicknesses at various heights for tray tower & packed tower in case of internal & external pressure, Different types of tray supports & their selection criteria, Design of horizontal structural member with periphery ring type packing support.	<b>09</b>

**Books Recommended:**

*Text books:*

1. Process Equipment Design - M. V. Joshi and V. V. Mahajani- Mc-Millan publication
2. Introduction to Chemical Equipment Design (Mechanical Aspects) - B. C. Bhattacharya - CBS publication

*Reference Books:*

1. I.S.: 2825-1969 - Code for Unfired Pressure Vessels
2. ASME Boiler & Pressure Vessel Code (BPVC) – Section VIII
3. Pressure Vessel Design Manual - D. R. Moss - Gulf Professional Publishing
4. Pressure Vessel Handbook – E. F. Megyesy - Pressure Vessel Publishing
5. Process Equipment Design - Lloyd E. Brownell and Edwin H. Young - Wiley publication

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Prepared by

Checked by

Head of the Department

Principal

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering								Semester : VIII		
Course : Motor Sports Engineering								Course Code: D19MEC8017		
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	-
3	-	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				-	--	--	-	-	-	

**Pre-requisite:** Knowledge of fundamental concepts of materials technology, Finite Element analysis, Computational fluid dynamics (CFD) concept, electronics and electrical engineering.

**Objectives:**

1. To gain knowledge of different types of advanced materials and their manufacturing techniques for motorsports vehicle.
2. To Understand the fundamental scientific, and engineering principles involved in motorsport responsible for high performance.
3. Design, analysis and performance-based techniques of competition vehicles, and related aspects of materials science, aerodynamics, structural analysis, vehicle systems related to motorsport.

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

1. Define selection criteria and specifications of metallic and non-metallic materials.
2. Analyze modelling and simulation results with respect to structural responses behavior.
3. Distinguish the complex relationships between competition vehicle design aspects and competition vehicle performance.
4. Evaluate the matching of engine, transmission, and vehicle chassis for motorsport applications.
5. Understand application of aerodynamics in motorsports.
6. Design, evaluate and optimize data systems based on fundamental principles of electrical and digital information transfer.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

<b>Detailed Syllabus: (unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration</b>
<b>1</b>	<b>Introduction:</b> History of motorsport and competition vehicle development, Competition vehicle categories, Sporting, and technical regulations <b>Introduction to advance materials, application, and manufacturing:</b> The physical and metallurgical properties of high strength steels, stainless steels, metal matrix composites and aluminium, and titanium alloys, rubbers, elastomers, plastics, and honeycomb Advance materials application in Motorsport industry through case studies include Materials forms, performance, and selection, advance manufacturing technology and joining techniques in context with motorsports	8
<b>2</b>	<b>Design, analyses, and optimization techniques:</b> Design of competition vehicles with structural design context, analyses, finite element modelling and simulations, shape optimization, Identification of failure modes and non-destructive test methods	8
<b>3</b>	<b>Vehicle dynamics:</b> Tyre shear force development, measurement and characterization, Suspension geometry description and analysis, Steady turning equilibrium states, suspension/chassis interactions, stability and controllability ,Limit behavior and design aspects, differentials and brake balancing Simulation tools and model building, Vibration behavior of car and wheels, springs, dampers, track roughness, Minimum time optimization	8
<b>4</b>	<b>Powertrain:</b> The design of high-performance vehicle transmission systems, ,Mechanical design of high performance two and four stroke petrol and diesel motorsport engines, the matching of engine, transmission and vehicle, Hybrid and electric powertrains as used in motorsport Aerodynamics: The application of aerodynamic design principles to motorsport components, Mechanisms for controlling aerodynamic lift and drag generation, application of CFD	12
<b>5</b>	<b>Data Acquisition:</b> Electrical circuit design and its issues, sensors, signal conditioning, Sampling issues in amplitude and frequency domain, Data communications on vehicle and test cell, Data processing and analysis techniques, Introduction to real time software, Practical system packaging	6

**Books Recommended:**

*Reference Books:*

1. Advanced Motorsport Engineering - Andrew Livesey
2. Competition Car Composites: A Practical Handbook - Simon Mc Beath
3. Suspension Geometry and Computation - John C. Dixon.
4. Race Car Vehicle Dynamics - William F. Milliken and Douglas L. Milliken
5. Chassis Engineering - Herb Adams

**Evaluation Scheme:**

**Semester End Examination (A):**

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

***Continuous Assessment (B):***

***Theory:***

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in the two tests will be considered for final grading.

Prepared by

Checked by

Head of the Department

Principal

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering								Semester : VIII		
Course: Advanced Quantitative Techniques								Course Code: DJ19MEC8018		
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Assignments		
				--	--	--	--	--	--	

**Pre-requisite:** Knowledge of Basic courses in Mechanical Engineering

**Objectives:** To equip the students with the expert knowledge and skills needed to apply the various quantitative techniques for decision making.

**Outcomes:** At the end of the course the student will be able to...

1. **Explain** significance of sensitivity analysis of LPP and **perform** sensitivity analysis on various parameters involved in LP model.
2. **Recognize** the limitations of simplex method in deriving integer solution to LPP and **employ** suitable algorithm to obtain integer solution.
3. **Identify** real-world problems as special cases of Linear Programming Problem and **Solve** the decision problem by choosing appropriate algorithm.
4. **Analyse** various decision-making situations, **outline** decision alternatives and **select** the best alternative.
5. **Describe** a real-world problem as a Non-Linear Programming Problem and **Distinguish** local, global extreme points and point of inflection.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Introduction to Decision model and Quantitative techniques:</b> Concept of decision making and decision problem, Mathematical Model of decision problem, Concept of Optimization, Quantitative techniques for finding optimal solutions to decision problems. <b>Linear Programming Problem:</b> Mathematical Formulation. Overview of Simplex Method. Sensitivity Analysis. <b>Linear Goal programming:</b> Formulation as Goal programming model, Optimal solution by graphical method and simplex method.	10
<b>2</b>	<b>Integer Programming Problem:</b> Types of Integer Programming Problems. Gomory's cutting plane Algorithm, Branch and Bound Technique. Introduction to Decomposition algorithms.	07
<b>3</b>	<b>Traveling Salesman Problem:</b> Branch and Bound method <b>Transshipment Problem:</b> Formulation and finding optimal solution. <b>Network Optimization Models:</b> Shortest Path, Minimum Spanning Tree, and Maximum Flow Problems	07
<b>4</b>	<b>Decision Theory:</b> Decision Making under risk, under uncertainty, Decision Trees & Utility Theory, Bayesian approach in decision making Decision Making under certainty, Introduction to concepts of AHP (Analytic Hierarchy Process) & ANP (Analytic Network Process).	09
<b>5</b>	<b>Nonlinear programming problems (NLPP)</b> - Convex programming Unconstrained NLPP – Search Algorithm and Gradient method. Constrained NLPP – Kuhn-Tucker Conditions, Geometric Programming Quadratic programming.	09

**Note:** Educator is expected to introduce relevant software available for solving various mathematical models.

**Books Recommended:**

*Text books:*

1. Operations Research, Sharma J. K., Trinity Press
2. Operations Research, Gupta P. K., Hira D. S., S. Chand Limited

*Reference Books:*

1. Operations Research - An Introduction; Taha, H.A.; Prentice Hall
2. Operations Research: Principles and Practice; Ravindran, A, Phillips, D. T and Solberg, J. J.; John Willey and Sons
3. Introduction to Operations Research; Hiller, F. S. and Lieberman, G. J.; Tata McGraw Hill
4. Operations Research Principles and Practice; Pradeep Prabhakar Pai; Oxford University Press
5. Operations Research, R. Panneerselvam, PHI Publications.
6. Operations Research, A. M. Natarajan, P. Balasubramani, A. Tamilarasi, Pearson Education.
7. Operations Research; Kanti Swarup, P. K. Gupta and Man Mohan; Sultan Chand & Sons

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Prepared by

Checked by

Head of the Department

Principal



**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

Program: Final Year (Common for All Programs)							Semester: VIII			
Course: Project Management							Course Code: DJ19ILO8021			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Pre-requisites:** Basic concepts of Management.

**Objectives:**

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

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

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

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Project Management Foundation:</b> Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stage gate process. Role of project manager, Negotiations and resolving conflicts, Introduction to project leadership, ethics in projects, Multicultural and virtual projects, Project management in various organization structures, PM knowledge areas as per Project Management Institute (PMI).	<b>07</b>
<b>2</b>	<b>Initiating Projects:</b> How to get a project started, selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter, Effective project team, Stages of team development & growth (forming, storming, norming & performing), team dynamics.	<b>08</b>
<b>3</b>	<b>Project Planning:</b> Work Breakdown structure (WBS) and linear responsibility chart, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques, PERT, CPM, Crashing project time, Resource loading and levelling, Goldratt's critical chain, GANTT chart, Project Stakeholders and Communication plan, Introduction to Project Management Information System (PMIS). <b>Risk Management in projects:</b> Risk management planning, Risk identification and risk register, Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks.	<b>12</b>
<b>4</b>	<b>Monitoring and Controlling Projects</b> Planning monitoring and controlling cycle, Information needs and reporting, engaging with all stakeholders of the projects, communication and project meetings. Earned Value Management techniques for measuring value of work completed, using milestones for measurement, change requests and scope creep, Project audit. <b>Project Contracting</b> Project procurement management, contracting and outsourcing.	<b>08</b>
<b>5</b>	<b>Closing the Project:</b> Customer acceptance, Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report, doing a lessons learned analysis, acknowledging successes and failures.	<b>07</b>

**Books Recommended:**

*Text books:*

1. Project Management: A managerial approach, Jack Meredith & Samuel Mantel, 7th Edition, Wiley India.
2. Project Management: The Managerial Process, 6th edition, Erik Larson, Clifford Gray, McGraw Hill Education.

*Reference Books:*

1. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th Ed, Project Management Institute PA, USA.
2. Project Management, Gido Clements, Cengage Learning.
3. Project Management, Gopalan, Wiley India.
4. Project Management, Dennis Lock, 9th Edition, Gower Publishing England.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**

**Semester VIII (Autonomous)**

**(Academic Year 2022-2023)**

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which, one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

Program: Final Year (Common for All Programs)							Semester: VIII			
Course: Entrepreneurship Development and Management							Course Code: DJ19ILO8022			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Pre-requisites:** Basic concepts of Management.

**Objectives:**

1. To develop entrepreneurial abilities by providing background information about support systems, skill sets, financial and risk covering institutions.
2. To appraise the students with the fundamentals that can help them to make right decisions for starting and running an enterprise.

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

1. Develop idea generation, creative and innovative skills
2. Prepare a Business Plan
3. Compare different entrepreneur supporting institutions
4. Correlate suitable MSME scheme for an entrepreneur
5. Interpret financial and legal aspect of a business.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Entrepreneur &amp; Entrepreneurship:</b> Meaning of entrepreneur - Evolution of the concept - Functions of an Entrepreneur - Types of Entrepreneurs - Intrapreneur- an emerging class - Concept of Entrepreneurship - Evolution of Entrepreneurship - Development of Entrepreneurship - Entrepreneurial Culture - Stages in entrepreneurial process - Develop idea generation, creative and innovative skills	<b>6</b>
<b>2</b>	<b>Business Planning Process:</b> Meaning of business plan - Business plan process - Advantages of business planning - Marketing plan - Production/operations plan - Organization plan - Financial plan - Final Project Report with Feasibility Study - Preparing a model project report for starting a new venture.	<b>10</b>
<b>3</b>	<b>Institutions Supporting Entrepreneurs:</b> Small industry financing developing countries - A brief overview of financial institutions in India - Central level and state level institutions - SIDBI - NABARD - IDBI - SIDCO - Indian Institute of Entrepreneurship - District Industries Centers - Single Window System.	<b>6</b>
<b>4</b>	<b>Micro, Small, and Medium Enterprises (MSMES)</b> MSMEs – Definition and Significance in Indian Economy; MSME Schemes, Challenges and Difficulties in availing MSME Schemes, Forms of Business; Make-In India, Start-Up India, Stand-Up India. Women Entrepreneurship; Rural Entrepreneurship; Family Business and First-Generation Entrepreneurs	<b>8</b>
<b>5</b>	<b>Finance, Account, Costing and Legal Aspect of Business</b> Funding new ventures – Conventional Source of Finance - bootstrapping, crowd sourcing- angel investors, VCs, debt financing , due diligence, Legal aspects of business (IPR, GST, Labour law)- Cost, volume, profit and break-even analysis - Margin of safety and degree of operating leverage - Capital budgeting for comparing projects or opportunities - Product costing- Product pricing- Introduction to financial statements - Profit & Loss statement - Balance sheet - Cash flow - Closure of Business	<b>12</b>

**Books Recommended:**

*Reference Books:*

1. Effective Entrepreneurial Management: Strategy, Planning, Risk Management, and Organization - by Robert D. Hisrich • Veland Ramadani, Springer Publication (2017)
2. Entrepreneurship- Theory, Process Practice –by Donald F. Kuratko, Cengage Learning (2014)
3. Entrepreneurship 6/E –by Robert D. Hisrich McGraw-Hill Education (India) (2011)
4. Entrepreneurship and small business- by Burns, P. New Jersey: Palgrave. (2001).
5. Innovation and entrepreneurship by Drucker. F. Peter, Harper business, (2006).
6. Entrepreneurship development small business enterprises, Poornima M Charantimath Pearson Publication (2013)
7. Entrepreneurial Development -Jayshree Suresh, Margham Publishers, Chennai
8. The Design of Business- by Martin Roger, Harvard Business Publishing (2009)
9. Entrepreneurship- by Roy Rajiv Oxford University Press (2011)

**Syllabus for Final Year of B.Tech. (Common for All Programs)**

**Semester VIII (Autonomous)**

**(Academic Year 2022-2023)**

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which, one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

Program: Final Year (Common for All Programs)							Semester: VIII			
Course: Corporate Social Responsibility							Course Code: DJ19ILO8023			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	100
				75			25	25	25	
				Laboratory Examination			Term work			
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Objectives:**

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

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

1. Understand the key characteristics of Corporate Social Responsibility (CSR) in the context of present-day management.
2. Apprise regarding business decision-making which is informed by ethical values and respect for people communities and the environment.
3. Become aware of creating a strategic plan that enables an organization to reach out to its internal and external stakeholders with consistent messages.
4. Understand critical issues of Corporate Social Responsibility (CSR) in a cross-cultural setting

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Introduction to CSR</b> Meaning and Definition, History of CSR, Concepts of Charity, Corporate philanthropy, Corporate Citizenship, Sustainability and Stakeholder Management. Environmental aspect of CSR Chronological evolution and Models of CSR in India Carroll's model Major codes on CSR Initiatives in India.	<b>06</b>
<b>2</b>	<b>International framework for Corporate Social Responsibility</b> Millennium Development Goals, Sustainable Development Goals, Relationship between CSR and MDGs. United Nations (UN) Global Compact 2011. UN guiding principles on business and human rights. OECD CSR policy tool, ILO tri-partite declaration of principles on multinational enterprises and social policy.	<b>10</b>
<b>3</b>	<b>CSR-Legislation in India and the World</b> Section 135 of Companies Act 2013. Scope for CSR Activities under Schedule VII, Appointment of Independent Directors on the Board, and Computation of Net Profit's Implementing Process in India.	<b>10</b>
<b>4</b>	<b>The Drivers of CSR in India</b> Market based pressure and incentives, civil society pressure, the regulatory environment in India Counter trends, Review of current trends and opportunities in CSR, Review of successful corporate initiatives and challenges of CSR. Case Studies of Major CSR Initiatives Corporate Social Responsibility and Public-Private Partnership (PPP)	<b>08</b>
<b>5</b>	<b>Identifying key stakeholders of CSR</b> Role of Public Sector in Corporate, government programs, Nonprofit and Local Self Governance in implementing CSR, Global Compact Self-Assessment Tool, National Voluntary Guidelines by Govt. of India, Roles and responsibilities of corporate foundations.	<b>08</b>

**Books Recommended:**

*Text Books:*

1. Corporate Social Responsibility in India, Sanjay K Agarwal, Sage Publications, 2008
2. Corporate Social Responsibility in India, Bidyut Chakrabarty, Routledge, New Delhi, 2015.

*Reference Books:*

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



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**Semester VIII (Autonomous)**

**(Academic Year 2022-2023)**

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which, one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

Program: Final Year (Common for All Programs)							Semester: VIII			
Course: Human Resource Management							Course Code: DJ19ILO8024			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	100
				75			25	25	25	
				Laboratory Examination			Term work			
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Objectives:**

1. To introduce the students with basic concepts, techniques and practices of the human resource management.
2. To provide opportunity of learning Human resource management (HRM) processes, related with the functions, and challenges in the emerging perspective of today's organizations.
3. To familiarize the students about the latest developments, trends & different aspects of HRM.
4. To acquaint the student with the importance of inter-personal & inter-group behavioral skills in an organizational setting required for future stable engineers, leaders and managers.

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

1. Understand the concepts, aspects, techniques and practices of the human resource management.
2. Understand the Human resource management (HRM) processes, functions, changes and challenges in today's emerging organizational perspective.
3. Gain knowledge about the latest developments and trends in HRM.
4. Apply the knowledge of behavioral skills learnt and integrate it with in inter personal and intergroup environment emerging as future stable engineers and managers.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Introduction to HR</b> Human Resource Management- Concept, Scope and Importance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions. Human resource development (HRD): changing role of HRM – Human resource Planning, Technological change, Restructuring and rightsizing, Empowerment, TQM, Managing ethical issues.	<b>07</b>
<b>2</b>	<b>Organizational Behaviour (OB)</b> Introduction to OB Origin, Nature and Scope of Organizational Behaviour, Relevance to Organizational Effectiveness and Contemporary issues. Personality: Meaning and Determinants of Personality, Personality development, Personality Types, Assessment of Personality Traits for Increasing Self Awareness. Perception: Attitude and Value, Effect of perception on Individual Decision-making, Attitude and Behaviour. Motivation: Theories of Motivation and their Applications for Behavioural Change (Maslow, Herzberg, McGregor); Group Behaviour and Group Dynamics: Work groups formal and informal groups and stages of group development, Team Effectiveness: High performing teams, Team Roles, cross functional and self-directed team. Case study.	<b>08</b>
<b>3</b>	<b>Organizational Structure &amp; Design</b> Structure, size, technology, Environment of organization; Organizational Roles & conflicts: Concept of roles; role dynamics; role conflicts and stress. Leadership: Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership. Power and Politics: Sources and uses of power; Politics at workplace, Tactics and strategies.	<b>08</b>
<b>4</b>	<b>Human resource Planning</b> Recruitment and Selection process, Job-enrichment, Empowerment – Job Satisfaction, employee morale. Performance Appraisal Systems: Traditional & modern methods, Performance Counselling, Career Planning. Training & Development: Identification of Training Needs, Training Methods. <b>Strategic HRM:</b> Role of Strategic HRM in the modern business world, Concept of Strategy, Strategic Management Process, Approaches to Strategic Decision Making; Strategic Intent – Corporate Mission, Vision, Objectives and Goals.	<b>09</b>
<b>5</b>	<b>Labor Laws &amp; Industrial Relations:</b> Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act. <b>Emerging Trends in HR</b> Organizational development; Business Process Re-engineering (BPR), BPR as a tool for organizational development, managing processes & transformation in HR. Organizational Change, Culture, Environment.	<b>10</b>

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	Cross Cultural Leadership and Decision Making: Cross Cultural Communication and diversity at work, Causes of diversity, managing diversity with special reference to handicapped, women and ageing people, intra company cultural difference in employee motivation.	
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**Books Recommended:**

*Reference Books:*

1. Stephen Robbins, Organizational Behavior, 16th Ed, 2013
2. V S P Rao, Human Resource Management, 3rd Ed, 2010, Excel publishing
3. Aswathapa, Human resource management: Text & cases, 6th edition, 2011
4. C. B. Mamoria and S V Gankar, Dynamics of Industrial Relations in India, 15th Ed, 2015, Himalaya Publishing, 15th edition, 2015
5. P. Subba Rao, Essentials of Human Resource management and Industrial relations, 5th Ed, 2013, Himalaya Publishing
6. Laurie Mullins, Management & Organizational Behavior, Latest Ed, 2016, Pearson Publications

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which, one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**

**Semester VIII (Autonomous)**

**(Academic Year 2022-2023)**

Program: Final Year (Common for All Programs)							Semester: VIII			
Course: Corporate Finance Management							Course Code: DJ19ILO8025			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Objectives:**

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

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

1. Understand Indian finance system.
2. Apply concepts of time value money and risk returns to product, services and business.
3. Understand corporate finance; evaluate and compare performance of multiple firms.
4. Take Investment, finance as well as dividend decisions.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Overview of Indian Financial System:</b> Characteristics, Components and Functions of Financial System. Financial Instruments: Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. Financial Markets: Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market Financial Institutions: Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges	<b>07</b>
<b>2</b>	<b>Overview of Corporate Finance:</b> Objectives of Corporate Finance; Functions of Corporate Finance—Investment Decision, Financing Decision, and Dividend Decision. Financial Ratio Analysis: <b>Overview of Financial Statements:</b> -Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis	<b>09</b>
<b>3</b>	<b>Concepts of Returns and Risks:</b> Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio. <b>Time Value of Money:</b> Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.	<b>07</b>
<b>4</b>	<b>Working Capital Management:</b> Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities. <b>Capital Budgeting:</b> Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value(NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR)	<b>10</b>
<b>5</b>	<b>Capital Structure:</b> Factors Affecting an Entity's Capital Structure; Overview of Capital Structure Theories and Approaches— Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure <b>Dividend Policy:</b> Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches— Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach	<b>09</b>

**Books Recommended:**

*Reference Books:*

1. Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
2. Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.

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

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Consisting **One Class Tests for 25 marks** based on approximately 50% of contents and One case study with presentations for 25 Marks.
2. Total duration allotted for writing test paper is 1 hr.
3. Average of the marks scored in the tests and case study will be considered for final grading.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

Program: Final Year (Common for All Programs)							Semester: VIII			
Course: Logistic and Supply Chain Management							Course Code: DJ19ILO8026			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Objectives:**

1. To acquaint with the concept of key drivers of supply chain performance and their inter-relationships with strategy.
2. To acquaint with the design problems and develop an understanding of information technology in supply chain optimization.
3. To acquaint with the complexity of inter-firm and intra-firm coordination in implementing programs such as e-collaboration, quick response, jointly managed inventories and strategic alliances.

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

1. Demonstrate the functional strategy map of supply chain management.
2. Analyze the determinants of Supply Chain and Transportation networks design.
3. Demonstrate the need of coordination and sourcing decisions in supply chain.
4. Understand pricing, revenue management and role of IT in supply chain.
5. Understand various sustainability aspects of a supply chain.



**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<p><b>Understanding the Supply Chain:</b> Objective, Importance, Decision Phases, Process Views.</p> <p><b>Achieving Strategic Fit and Scope:</b> Competitive and Supply Chain Strategies, Achieving Strategic Fit, Expanding Strategic Scope, Challenges to Achieving and Maintaining Strategic Fit.</p> <p><b>Supply Chain Drivers and Metrics:</b> Financial Measures of Performance, Drivers of Supply Chain Performance, Framework for Structuring Drivers, Facilities, Inventory, Transportation, Information, Sourcing, Pricing.</p> <p><b>Creating the Responsive Supply Chain:</b> Product push versus demand pull, The Japanese philosophy, The foundations of agility, A route-map to responsiveness.</p>	<b>08</b>
<b>2</b>	<p><b>Designing the Supply Chain and Transportation Networks</b></p> <p><b>Designing Distribution Networks:</b> The Role of Distribution in the Supply Chain, Factors Influencing Distribution Network Design, Design Options for a Distribution Network.</p> <p><b>Network Design in the Supply Chain:</b> The Role of Network Design in the Supply Chain, Factors Influencing Network Design Decisions, Framework for Network Design Decisions, Models for Facility Location and Capacity Allocation.</p> <p><b>Designing Global Supply Chain Networks:</b> The Impact of Globalization on Supply Chain Networks, The Offshoring Decision: Total Cost, Risk Management in Global Supply Chains, Discounted Cash Flows, Evaluating Network Design Decisions Using Decision Trees.</p> <p><b>Transportation in a Supply Chain:</b> The Role of Transportation in a Supply Chain, Modes of Transportation and their Performance Characteristics, Design Options for a Transportation Network, Trade-Offs in Transportation Design, Tailored Transportation.</p>	<b>14</b>
<b>3</b>	<p><b>Coordination in a Supply Chain:</b> Lack of Supply Chain Coordination and the Bullwhip Effect, The Effect on Performance of Lack of Coordination, Obstacles to Coordination in a Supply Chain, Managerial Levers to Achieve Coordination, Continuous Replenishment and Vendor-Managed Inventories, Collaborative Planning, Forecasting, and Replenishment.</p> <p><b>Sourcing Decisions in a Supply Chain:</b> The Role of Sourcing in a Supply Chain, In-House or Outsource, Third- and Fourth-Party Logistics Providers, Using Total Cost to Score and Assess Suppliers, Supplier Selection—Auctions and Negotiations, Contracts, Risk Sharing and Supply Chain Performance, Design Collaboration, The Procurement Process.</p>	<b>07</b>

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**Semester VIII (Autonomous)**

**(Academic Year 2022-2023)**

<b>4</b>	<b>Pricing and Revenue Management in a Supply Chain:</b> The Role of Pricing and Revenue Management in a Supply Chain, Pricing and Revenue Management for Multiple Customer Segments, Pricing and Revenue Management for Perishable Assets, Pricing and Revenue Management for Seasonal Demand, Pricing and Revenue Management for Bulk and Spot Contracts. <b>Information Technology in a Supply Chain:</b> The Role of IT in a Supply Chain, The Supply Chain IT Framework, Customer Relationship Management, Internal Supply Chain Management, Supplier Relationship Management, The Transaction Management Foundation, Managing the supply chain as a network, Seven major business transformations, From 3PL to 4PL. The Future of IT in the Supply Chain.	<b>08</b>
<b>5</b>	<b>Creating a Sustainable Supply Chain:</b> The Role of Triple Bottom Line, Key Metrics for Sustainability, Greenhouse gases and the supply chain, Reducing the transport-intensity of supply chains, Beyond the carbon footprint, Reduce, reuse, recycle, Sustainability and Supply Chain Drivers. <b>Introduction to the Supply Chain of the Future:</b> Emerging Megatrends.	<b>05</b>

**Books Recommended:**

*Reference Books:*

1. Logistics & Supply Chain Management, Martin Christopher, Pearson Education Limited, 2016.
2. Supply Chain Management Strategy, Planning, and Operation, Sunil Chopra and Peter Meindl, Pearson, 2016.
3. Essentials of Supply Chain Management, Michael H. Hugos, Wiley, 2018.
4. Supply Chain Management For Dummies, Daniel Stanton, Wiley, 2020.
5. Global Supply Chain and Operations Management A Decision-Oriented Introduction to the Creation of Value, Dmitry Ivanov, Alexander Tsipoulanis and Jörn Schönberger, Springer International Publishing, 2016.
6. Supply Chain Management, Sinha, McGraw-Hill Education (India) Pvt Limited, 2012.

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which, one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

**Syllabus for Final Year of B.Tech. (Common for All Programs)****Semester VIII (Autonomous)****(Academic Year 2022-2023)**

Program: Final Year (Common for All Programs)							Semester: VIII			
Course: IPR and Patenting							Course Code: DJ19ILO8027			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Objectives:**

1. Understanding, defining and differentiating different types of intellectual properties (IPs)
2. Assessing different IP management (IPM) approaches
3. Exposure to the Legal management of IP and understanding of real life practice of IPM.

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

1. Recognize the crucial role of IP for the purposes of product and technology development.
2. Understand how and when to file a patent
3. Apply the knowledge to understand the entire ecosystem
4. Derive value from IP and leverage its value in new product and service development

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Concept of Intellectual Property Law</b> Idea/Expression dichotomy, Introduction and the need for intellectual property right (IPR), Intellectual Property laws, IPR in India: Genesis and development, IPR abroad, Major International Instruments concerning Intellectual Property Rights: Paris Convention, the Berne Convention, the Universal Copyright Convention, the WIPO Convention, the Patent Cooperation Treaty, the TRIPS Agreement, incentive theory, types of IPR, India's New National IP Policy, 2016, Govt. Schemes in IPR IP	<b>06</b>
<b>2</b>	<b>Patents and Trademarks</b> Elements of Patentability: Novelty, Non Obviousness, Industrial Application, Non Patentable Subject Matter, Registration Procedure, Rights and Duties of Patentee, Assignment and licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties, Patent office and Appellate Board, Case study of existing patents related to software, healthcare, devices Concept of Trademarks, Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks), Non Registrable Trademarks, Registration of Trademarks, Rights of holder and assignment and licensing of marks, Infringement, Remedies & Penalties, Trademarks registry and appellate board	<b>12</b>
<b>3</b>	<b>Copyrights and Design</b> Copyrights: Nature, Subject matter: original literary, dramatic, musical, artistic works, cinematograph films and sound recordings, Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright, Infringement, Remedies & Penalties, Related Rights, distinction between related rights and copyrights Design: meaning and concept of novel and original, procedure for registration, effect of registration and term of protection	<b>10</b>
<b>4</b>	<b>GI, PVP and LDP</b> Geographical indication: meaning, difference between GI and trademarks, procedure for registration, effect of registration and term of protection Plant variety protection: meaning, benefit sharing, farmers' rights, procedure for registration, effect of registration and term of protection Layout Design protection: meaning, procedure for registration, effect of registration, term of protection	<b>08</b>
<b>5</b>	<b>Beyond IP</b> Introduction to Competition Law: concept of competition, relationship and Interaction between IPR and competition law, IP and competition issues, Technology transfer agreements. EU experience with IP and Competition Law, Indian Competition Act and IPR protection, IPR issues in merger and acquisition, harmonization of IP protection and competition Law in India	<b>06</b>

**Books Recommended:**

*Reference Books:*

1. Feroz Ali, The Law of Patents, LexisNexis
2. Ronald D. Slusky, Invention Analysis and Claiming – A Patent Lawyer's Guide, Second Edition, American Bar Association, 2012.
3. Feroz Ali, The Touchstone Effect – The Impact of Pre-grant Opposition on Patents, LexisNexis, 2009.

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**Semester VIII (Autonomous)**

**(Academic Year 2022-2023)**

4. Innovation and entrepreneurship by Drucker. F. Peter, Harper business, (2006).
5. Intellectual Property Rights, Deborah. E. Bouchoux, Cengage Learning.
6. Intellectual Property Rights– Unleashmy The Knowledge Economy, Prabuddha Ganguli, Tate Mc Graw Hill Publishing Company Ltd.,
7. The Design of Business- by Martin Roger, Harvard Business Publishing (2009)

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which, one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

Program: Final Year (Common for All Programs)							Semester: VIII			
Course: Digital Marketing Management							Course Code: DJ19ILO8028			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Objectives:**

1. To explain the evolution of digital marketing and outline the underlying technology and frameworks within which digital marketing operates.
2. To understand digital marketing business models elucidating on the six core digital value elements and how they can be used to generate customer value.
3. To understand the key concepts of developing strategy for digital business and the emerging business structures.
4. To plan the digital marketing strategy roadmap, its four key stages and their elements and understand the 6S Digital Marketing Implementation Stages.
5. To understand digital marketing planning & operations setup.
6. To explain the implementation of search campaigns which include Search Engine Marketing (SEM) and Search Engine Optimization (SEO) concepts.
7. To explain upcoming digital marketing concepts including Big Data and Internet of Things (IoT), Small and Medium Businesses (SMB), B2B marketing and Social, Local and Mobile (SoLoMo) concept.

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

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

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<p><b>Introduction to Digital Marketing</b>  Emergence of Digital Marketing as a tool, media consumption drivers for new marketing environment, applications and benefits of digital marketing.</p> <p><b>Digital Marketing Framework</b>  Delivering enhanced customer value, market opportunity analysis and digital services development, ASCOR framework, critical success factors for digital marketing.</p> <p><b>Digital Marketing Models Creation</b>  Factors impacting digital marketplace, value chain digitization, business models.</p> <p><b>The Consumer for Digital Marketing</b>  Consumer behavior on the internet, evolution of consumer behavior models, managing consumer demand, integrated marketing communications (IMC), impact of digital channels on IMC.</p>	<b>08</b>
<b>2</b>	<p><b>Digital marketing Strategy Development</b>  Elements of assessment phase, macro-micro environmental analysis, marketing situation analysis.</p> <p><b>Digital Marketing Internal Assessment and Objectives Planning</b>  Analyzing present offerings mix, marketing mix, core competencies analysis and internal resource mapping. Digital presence analysis, digital marketing objectives development and review.</p> <p><b>Digital Marketing Strategy Definition</b>  Understanding digital business strategy and structures, consumer development strategy, offering mix for Digital, digital pricing models, managing promotional channels and developing the extended Ps- People, process, programs and performance.</p> <p><b>Digital marketing Strategy Roadmap</b>  Developing digital marketing strategy roadmap, the 6s digital marketing implementation strategy, marketing across the product life cycle.</p>	<b>13</b>
<b>3</b>	<p><b>Digital Marketing Planning and Setup</b>  Understanding digital media planning terminology and stages, steps to creating marketing communications strategy, introduction to search marketing, display marketing, social media marketing.</p> <p><b>Digital Marketing Operations Setup</b>  Basics of lead generation and conversion marketing, website content development and management, elements of user experience, web usability and evaluation.</p>	<b>08</b>
<b>4</b>	<p><b>Digital marketing Execution</b>  Basic elements of digital campaign management, search execution, display execution, social media execution, content marketing.</p> <p><b>Digital marketing Execution Elements</b>  Digital revenue generation models, managing service delivery and payments, managing digital implementation challenges like e commerce, internal &amp; external and consumer specific challenges.</p>	<b>08</b>

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<b>5</b>	<b>Digital Business – Present and Future</b> Digital Marketing – Global Landscape, digital marketing overview – global spend, advertising spend, and technology/tools landscape. Data technologies (Big data and IOT) impacting marketing, segment based digital marketing and SoLoMo – the next level of hyperlocal marketing.	<b>05</b>
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**Books Recommended:**

*Reference Books:*

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia, Pearson Education Limited,
2. Digital Marketing by Seema Gupta- McGraw Hill Education.
3. Digital Marketing Excellence: Planning, Optimizing and Integrating Online Marketing by Dave Chaffey and P. R. Smith, 5<sup>th</sup> edition, Taylor & Francis.
4. Digital Marketing: Strategy, Implementation and Practice- 6<sup>th</sup> edition by Dave Chaffey Fiona Ellis-Chadwick, Pearson Education Limited,
5. Digital marketing by Vandana Ahuja, Oxford University Press.
6. The Art of Digital Marketing by Ian Dodson, John Wiley & Sons.

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which, one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.



**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

Program: Final Year (Common for All Programs)							Semester: VIII			
Course: Environmental Management							Course Code: DJ19ILO8029			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	100
				75			25	25	25	
				Laboratory Examination			Term work			
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Pre-requisite:** Knowledge of environmental science.

**Objectives:**

1. Understand and identify environmental issues relevant to India and global concerns
2. Learn concepts of ecology
3. Familiarise environment related legislations
4. Understand Environmental Auditing Procedures.

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

1. Identify Environmental issues and get familiarized to the concept of Ecosystem and environmental management.
2. Know policies and legal aspects and understand EM system standards.
3. Understand Environment Impact assessment.
4. Understand Environment Auditing procedures.
5. Describe Environmental management Techniques

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Principles of Environmental management (EM):</b> Introduction of EM, Definition, Ecosystem concept, Participants in EM, Ethics and the environment, International Environmental Movement, Environmental issues relevant to India.	<b>08</b>
<b>2</b>	<b>Policy and Legal Aspects of EM:</b> - Introduction to various Environmental Policies, Indian and International Environmental laws and legislation. <b>EM system Standards:</b> - Core Elements, Benefits, Certification Body Assessment & Documentation for EMS, ISO- 14000 Standards.	<b>10</b>
<b>3</b>	<b>Environmental Impact Assessment (EIA) :-</b> Purpose, steps, hierarchy of EIA, Environmental Impact Statement and Impact Indicators, Evolution of IA in India and worldwide. Preliminary stages of EIA, Impact, Prediction, Evaluation and Mitigation.	<b>10</b>
<b>4</b>	<b>Environmental Auditing (EA):-</b> Objectives, Scope and Types of EA, Audit Methodology, Elements of Audit Process, Auditing of EMS.	<b>06</b>
<b>5</b>	<b>Environmental Management Techniques:</b> - Environmental Monitoring and Modelling, Environmental technology Assessment and Environmental Risk Assessment, Eco-mapping.	<b>08</b>

**Books Recommended:**

*Text Books:*

1. Environmental Management, T V Ramachandra and Vijay Kulkarni, TERI Press
2. Environmental Management: Principles and Practice, C J Barrow, Routledge Publishers London, 1999

*Reference Books:*

1. A Handbook of Environmental Management Edited by Jon C. Lovett and David G. Ockwell, Edward Elgar Publishing
2. Indian Standard Environmental Management Systems — Requirements with Guidance for Use, Bureau Of Indian Standards, February 2005
3. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Macmillan India, 2000
4. Introduction to Environmental Management, Mary K Theodore and Louise Theodore, CRC Press
5. Environment and Ecology, Majid Hussain, 3<sup>rd</sup> Ed. Access Publishing.2015

**Evaluation Scheme:**

**Semester End Examination (A):**

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

***Continuous Assessment (B):***

***Theory:***

1. Two term tests of 25 marks each will be conducted during the semester out of which, one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**

**Semester VIII (Autonomous)**

**(Academic Year 2022-2023)**

Program: Final Year (Common for All Programs)							Semester: VIII			
Course: Labour and Corporate Law							Course Code: DJ19ILO8030			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	--	--	--	--	

**Objectives:**

1. To understand the development and judicial setup of Labour Laws.
2. To learn the laws relating to Industrial Disputes, Social Security and Working conditions.
3. To analyse the laws related to corporate governance in different settings.
4. To develop awareness of legal principles involved in economic relationships and business transactions.
5. To develop an understanding of free enterprise system and legal safeguards of the same.

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

1. Illustrate the role of trade union in the industrial setup.
2. Understand the important causes, impact of industrial disputes and settlement procedures.
3. To provide in-depth understanding of corporate social responsibility.
4. Apply concepts, principles and theories to understand simple business laws.
5. Analyse the principle of international business and strategies adopted by firms to expand globally

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

<b>Detailed Syllabus (Unit wise)</b>		
<b>Unit</b>	<b>Description</b>	<b>Duration in Hours</b>
<b>1</b>	<b>Trade Unions and Collective Bargaining:</b> Trade Unionism in India, Definition of Trade Union and Trade Dispute, General and Political Funds of Trade Union, Civil and Criminal Immunities of Registered Trade Unions, Recognition of Trade Union, Collective Bargaining	9
<b>2</b>	<b>Industrial Dispute and Instruments of Economic Coercion:</b> Industrial Dispute and Individual Dispute, Settlement of Industrial Dispute. Concept of strike – Gherao, Bandh and Lock-out, Types of Strike Rights to Strike and Lock-out	8
<b>3</b>	<b>Formation of a Company and Corporate governance:</b> Company and Other Forms of Business Organizations, Different Kinds of Company: One Person Company, Foreign Company. Kinds of Company Meetings and Procedure Powers, Duties and Kinds of Director: Independent Director, Women Director Different Prevention of Oppression and Mismanagement Investor Protection, Insider Trading, Corporate Fraud.	9
<b>4</b>	<b>Corporate Social Responsibility and Corporate Liquidation:</b> Evolution of Corporate Social Responsibility, Corporate Criminal liability, Corporate Environmental Liability Different Types of Winding up of Company, Role of Courts in Winding up of Company Merger and Acquisition of Company, Cross Border Merger, Takeover Code: Role of SEBI	8
<b>5</b>	<b>Case Studies on</b> A) Labour law B) Labour relations C) Corporate laws D) Securities laws	8

**Books Recommended:**

*Reference Books:*

1. Surya Narayan Misra, An Introduction to Labour and Industrial Law, Allahabad Law Agency, 1978
2. Indian Law Institute, Cases and Materials on Labour Law and Labour Relations
3. P.L. Malik, Industrial Law, Eastern Book Company, 2013
4. S.C. Srivastava, Industrial Relations and Labour Law, Vikas Publishing House, New Delhi
5. C.A. Kamal Garg, Bharat's Corporate and Allied Laws, 2013.
6. Institute of Company Secretaries of India, Companies Act 2013, CCH Wolter Kluwer Business, 2013
7. Saleem Sheikh & William Rees, Corporate Governance & Corporate Control, Cavendish Publishing Ltd., 1995
8. Taxmann, A Comparative Study of Companies Act 2013 and Companies Act 1956

**Evaluation Scheme:**

**Semester End Examination (A):**

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.

**Syllabus for Final Year of B.Tech. (Common for All Programs)**  
**Semester VIII (Autonomous)**  
**(Academic Year 2022-2023)**

2. Total duration allotted for writing the paper is 3 hrs.

***Continuous Assessment (B):***

***Theory:***

1. Two term tests of 25 marks each will be conducted during the semester out of which, one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

Program: Final Year Mechanical Engineering							Semester: VIII			
Course: Project - II							Course Code: DJ19MEP804			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				--			--	--	--	--
				Laboratory Examination			Term work		Total Term work	200
--	12	--	6	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				--	--	100	--	100	--	

**Pre-requisite:** Knowledge of mechanical &/or inter-disciplinary subjects, concepts & analytical software.

**Objectives:**

1. To acquaint with the process of undertaking literature survey/industrial visit and identifying the problem
2. To familiarize the process of solving the problem in a group
3. To acquaint with the process of applying basic engineering fundamental in the domain of practical applications
4. To inculcate the process of research

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

1. Apply basic engineering fundamentals in the domain of practical applications.
2. Identify, formulate and analyse the engineering problems based on literature review.
3. Attempt a problem solution with systematic approach and ethics.
4. Correlate the theoretical and experimental / simulations results and draw the proper inferences.
5. Develop the habit of working in a team and communicate efficiently with engineering community and society.
6. Recognize the need for lifelong learning activities to cope up with technological changes.

**Syllabus for Final Year of B. Tech. Program in Mechanical Engineering:  
Semester VIII (Autonomous)  
(Academic Year 2022-2023)**

**Project-II**

1. To proceed with the project work on the basis of outcomes of literature review. Project can be undertaken on any subject addressing Mechanical &/or inter-disciplinary concepts.
2. Research and development projects on problems of practical and theoretical interest should be encouraged.
3. Students must develop clarity on objectives/scope of project after analysing their project problem statement.
4. Students must be guided to think critically and arrive at relevant solutions towards their project technical challenges.
5. Students must make an effort to validate their experimental data with analytical/software simulations, if applicable.
6. Students must work together as a Team and share responsibilities.
7. Student has to submit a progress report every 15 days to the internal guide and internal guide has to keep track on the progress of the project and also has to maintain attendance report. This progress report along with a synopsis report can be used for awarding term work marks.
8. In case of industry projects, regular monitoring by internal guide will be preferred.

**Guidelines for Assessment of Project - II**

Project - II should be assessed based on following points:

1. Problem Definition & Methodology
2. Implementation of project solution
3. Project management skills
4. Demonstration of project work
5. Presentation of project work
6. Thesis writing/Technical paper presentation

Project II should be assessed through Project thesis/report & a presentation by the student project group to a panel of Internal and External Examiner approved by the Head of Department.