Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2022-23

Course Information

Programme	M. Tech. (Mechanical Production Engineering)
Class, Semester	Second Year M. Tech., Sem III
Course Code	5PR601
Course Name	Legal, Financial aspects of industrial project
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/Week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To provide understanding of taxation , profitability and economic decision
2	To make students financially literate so as to undertake industrial projects.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, students will be able to,

CO1	Select and use different financial models in effectively executing industrial projects	Evaluate
CO2	Perform financial analysis of industrial project.	Analyse
CO3	Understand environment and labour laws which regulate the industry	Understand

Course Content

Economic Decision Making

Introduction, Mathematics of Time Value of Money: Compound Interest, Cash Flow Diagram, Uniform Annual Series, Irregular Cash Flows, Cost Comparison: Present Worth Analysis, Annual Cost Analysis, Capitalized Cost Analysis

Taxes and Profitability

Taxes, Profitability Of Investments: Rate of Return, Payback Period, Net Present Worth, Internal Rate of Return, Inflation, Sensitivity and Break-Even Analysis, Uncertainty in Economic Analysis

Factories Act, 1948:

Health, Safety, Provisions relating to Hazardous Processes, Welfare, Working Hours of Adults, Employment of young persons, Annual Leave with wages. The Employees Provident Fund and Miscellaneous Provisions Act, 1952.

Constitution and Labour Laws

labour laws, Equality before law and its application in Labour Laws, Equal pay for equal work; and Article-16 and reservation policies, Articles 19, 21, 23 and 24 and its implications.

Financial Management

Fund and cash flow analysis; working capital requirement and financing, Cost of capital; Capital asset pricing models; Leverages; Investment analysis; Portfolio management; Debt Management; Dividend policy; Concept of financial strategy; Case studies.

Financial Analysis

Cost of project, cost of capital, means of finance, norms and policies of financial Institutions, Government incentives; Estimate of sales, cost of production; Profitability, projection and statements, treatment of depreciation and taxes, pre-operative expenses, projected cash flows, projected balance sheet.

Text Books

1	P.L. Mehta, Managerial Economics Analysis, Problems and cases, S. Chand & Co. Ltd., 2001
2	Dieter G.E., Engineering Design, McGraw-Hill Education 5th edition, 2012.
3	N. Godbole, S. Belapure, "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt. Ltd.
References	
1	Peterson and Lewis: Managerial Economics, 4th Ed., Prentice Hall , 2004
2	R. Drefuss, J. Pila; The Oxford Handbook of Intellectual Property Law, Oxford University Press, 2018.
3	Adv. P. Mali, Cyber Law & Cyber Crimes Simplified, Cyber Infomedia, 2017.
Useful Links	
1	https://nptel.ac.in/courses/110/107/110107144/
2	https://onlinecourses.nptel.ac.in/noc20_mg31/preview
3	https://nptel.ac.in/courses/110/101/110101131/

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1					
CO2		1		1		
CO3			1		2	
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						

Assessment (for Theory Course)
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand				
3	Apply				
4	Analyze				
5	Evaluate				
6	Create				

Total	**20**	**20**	**60**	**100**

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Course Information

Programme	M.Tech. (Mechanical Production Engineering)
Class, Semester	Second Year M. Tech., Sem - III
Course Code	5PR690
Course Name	Dissertation Phase I
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	20 Hrs/Week				
Interaction	-	**Credits: 10**			

Course Objectives

1	To develop the student to apply the knowledge gained to identify problem for research provide the solutions by self-study and interaction with stake holders.
2	Acquire knowledge to tackle real world problems of societal concerns.
3	Impart flexibility to the student to have increased control over his/ her learning.
4	Teachers would serve as mentor/facilitator of inquiry and reflection rather than as an instructor.
5	Enhance student's learning through increased interaction with peers and colleagues.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Search the existing literature and identification of research problem	Analyzing
CO2	Design and develop the solution for complex engineering problem.	Evaluating
CO3	Create the new knowledge in the specialized field	Creating

List of Experiments / Lab Activities

Course Contents:

Students are expected to carry out independent research work on the chosen topic. In this semester it is expected that the student has carried out substantial research work including exhaustive literature survey, formulation of the research problem, development/fabrication of experimental set-up (if any/required) and testing, and analysis of initial results thus obtained. In fourth semester, the students continue their dissertation work. It is expected that the student has completed most of the experimental/computation works and analyzed the results so obtained as proposed in the synopsis. The work should be completed in all respects in this semester. The students are required to submit the dissertation work in the form of report as per the institute rule

Text Books

As per the research topic.

References

National and International Journals

Useful Links

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	1			1		2
CO2	1		1		2	1
CO3		2				1
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	10	10		20
Apply	10	10	20	40
Analyze	10	5	10	25
Evaluate		5	10	15
Create				
Total Marks	**30**	**30**	**40**	**100**

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Course Information

Programme		M. Tech. (Mechanical Production Engineering)				
Class, Semester		Second Year M. Tech., Sem III				
Course Code		5PR602				
Course Name		Industry Orientation Course				
Desired Requisites:						
Teaching Scheme		**Examination Scheme (Marks)**				
Lecture	-	**LA1**	**LA2**		**ESE**	**Total**
Tutorial	-	30	30		40	100
Practical	-					
Interaction	1 Hr/Week	**Credits: 1**				

Course Objectives	
1	To provide a hands on experience of software in solving complex mechanical engineering problems.
2	To enhance the employability of Production engineering student.

Course Outcomes (CO) with Bloom's Taxonomy Level At the end of the course, students will be able to,		
CO1	Use of the software related to simulation of mechanical system effectively.	Evaluate
CO2	Develop the solution for mechanical engineering problem using software.	Create
CO3		

Course Content

This course is based on computers as a tool to simulate and analyse the mechanical system. In the modern day work environment, the Mechanical Production Engineer should be able to simulate and solve complex problems on computers. The Mechanical Production Engineer must be highly computer literate. The engineer with strong fundamentals in manufacturing Engineering and computer software proficiency is highly in demand from industry. Employability of the student can be enhanced by providing software training of simulation and analysis software in mechanical engineering.

Text Books	
1	Suitable books based on the software selected.

References	
1	Suitable books based on the contents of software selected

Useful Links	
1	As per the need of the software training

CO-PO Mapping

	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1						
CO2						
CO3						

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand				
Apply				
Analyze				
Evaluate				
Create				
Total Marks	**30**	**30**	**40**	**100**

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Course Information					
Programme	M.Tech. (Mechanical Production Engineering)				
Class, Semester	Second Year M. Tech., Sem - III				
Course Code	5PR611				
Course Name	Manufacturing Planning and Control				
Desired Requisites:					
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**TA1**	**TA2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives		
1	Students should get an exposure to the various manufacturing systems and do proper planning and further exercise control for proper execution. Teacher should discuss various case studies. Students should be given some situations and should be asked to do brain storming in groups and give possible solutions.	
Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Perceive the manufacturing systems, the approach to pre planning and required decision making for the same with the help of case studies	Understand
CO2	Perceive about the planning activity, MRP and operations and apply the same for a manufacturing system as a case study	apply
CO3	Study and perceive the international scenario and recent trends	Analyzing

Module	Module Contents	Hours
1	Manufacturing Systems Overview of manufacturing systems and various issues of interest: Assembly Line, Repetitive batch manufacturing, Cellular manufacturing, Flexible Manufacturing Systems, Just in Time, Computer Integrated Manufacturing	5
2	Preplanning and Decision Making Preplanning: Forecasting, Economic analysis, Aggregate planning, Capacity planning Inventory planning. Group Technology, Line balancing.	5
3	Operations Planning Operations planning : MRP (Materials Requirement Planning), MRP II (Manufacturing Resource Planning), Hierarchical planning systems, JIT systems, FMS	4
4	Operations and Control Operation and control: Lot sizing decisions, production scheduling, cost planning and control, productivity planning and control and applications of theory of constraints.	4
5	World class manufacturing Road map to World Class Manufacturing Systems: Ideal Manufacturing, Intelligent Manufacturing and Agile Manufacturing Systems.	4
6	Recent development Applications of recent developments in IT including ERP, e-Business, Enterprise Applications Integration (EAI) and Virtual Manufacturing	4

Text Books	
1	D. D. Bedworth and J. E. Bailey, Integrated Production Control System- Management, Analysis and Design, John Wiley. (1983)
2	E. A. Elsayed and T. O. Boucher, Analysis and Control of Production Systems, Prentice Hall. (1985)
3	M. Pinedo and X. Chao, Operations Scheduling, McGraw Hill, (1999)
4	R. B. Chase, N. J. Aanilano and F. R. Jacobs, Production and Operations Management-Manufacturing and Services, Tata McGraw Hill, Second Edition. (1999)

References	
1	H. Noori and R. Radford, Production and Operations Management, McGraw Hill Inc., (1995)
2	S. Nahmias, Production and Operations Analysis, R. Irwin., (1997)
3	K. Hitomi, Manufacturing Systems Engineering, Viva Books Pvt. Ltd, India., (1996)

Useful Links
https://nptel.ac.in/courses/110/106/110106044/
https://nptel.ac.in/courses/112/107/112107238/
https://nptel.ac.in/courses/110/107/110107141/

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1			3	2		
CO2	3			2		
CO3					3	2
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand	10	5	5	20
3	Apply	10	5	10	25
4	Analyze		10	15	25
5	Evaluate			15	15
6	Create			15	15
Total		**20**	**20**	**60**	**100**

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Course Information					
Programme	M.Tech. (Mechanical Production Engineering)				
Class, Semester	Second Year M. Tech., Sem - III				
Course Code	5PR612				
Course Name	Organizational Behaviour				
Desired Requisites:					
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**TA1**	**TA2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	To understand the implications of individual and group behaviour in organizational context.

2	To understand effect of personality, values, decision making and motivation on organizational behaviour.
3	To know leadership and it'suse in conflict management and negotiations.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Grasp and perceive the concept of Organisational Behaviour and its effect on functioning of the organisation	Understand
CO2	Compare and perceive group behaviour, communication and leadership, and apply the same in conflict management and negotiations.	Apply
CO3	Analysis, through various case studies, the contribution of various human attributes / qualities on performance of organisation	Analyse

Module	**Module Contents**	**Hours**
1	**What is Organizational Behaviour?** Understanding Organizational Behaviour, Effectiveness in organizations, A review of the manager's job, Disciplines, Challenges and opportunities for OB, Basic OB model	4
2	Diversity in Organizations, Attitudes and Job Satisfaction Concept of diversity, Biographical Characteristics, Intellectual and physical abilities, Diversity management strategies, Main components of attitudes, Measure of job satisfaction and Outcomes influenced by job satisfaction	4
3	Emotions and Moods What are Emotions and Moods?, Sources of emotions and moods, Strategies for emotion regulation, Emotional Intelligence, Applications of Emotions and Moods	4
4	Personality and Values, Decision Making, Motivation What is personality?, Factors affecting Personality and behaviour at work place, Values and importance of values, Perception and individual decision making, Factors affecting decision making, Definition of motivation, Maslow's Hierarchy of Needs theory,	5
5	Group behaviour, Communication Need to form groups, Group properties: Roles, Norms, Status, Size, Cohesiveness, and Diversity, Group decision making and techniques, Barriers to effective communication	4
6	Leadership, Conflict Management and Negotiation What is leadership?, Charismatic leadership and transformational leadership, Definition of conflict, Negotiation, Bargaining strategies, Negotiation process, Organizational change, Forces for change, Creating a culture for change	5

Text Books	
1	Robbins, Judge & Sanghi , Organizational Behaviour, Pearson EducationPublication.2013
2	Stephen Robbins, OrganisationalBehaviour, Prentice Hall of India, 2008
3	Udai Pareek,Understanding OrganisationalBehaviour, Oxford University Press,2004

References	
1	L.M.Prasad , Organizational Behaviour, Sultan Chand & Sons, 2014
2	Fred Luthans,Organizational Behaviour, McGraw Hill Book Co., 2010

Useful Links
https://nptel.ac.in/courses/110/105/110105033/
https://nptel.ac.in/courses/110/106/110106145/
https://onlinecourses.nptel.ac.in/noc20_mg51/preview

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1				2		1
CO2					3	2
CO3			2	2		
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						

Assessment
. The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand	10	5		15
3	Apply	10	5	15	30
4	Analyze		10	15	25
5	Evaluate			15	15
6	Create			15	15
Total		**20**	**20**	**60**	**100**

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Course Information					
Programme	M.Tech. (Mechanical Production Engineering)				
Class, Semester	Second Year M. Tech., Sem - III				
Course Code	5PR613				
Course Name	Flexible Manufacturing Systems				
Desired Requisites:					
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**TA1**	**TA2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	To impart the knowledge of the fundamentals of flexible manufacturing systems and other different types of manufacturing systems.

2	To prepare the student for the use of the recent developments in manufacturing such as machining centres and co-ordinate measuring machines, etc.
3	To enable the student for selection of appropriate method of automatic storage systems and cutting tool management techniques

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Classify and distinguish FMS and other manufacturing systems including job-shop and mass production systems.	Understanding
CO2	Explain processing stations and material handling systems used in FMS environments	Analyzing
CO3	Recommend tool management in FMS.	Evaluating

Module	**Module Contents**	**Hours**
1	Introduction: Limitations with conventional manufacturing, Need for FMS Introduction, Definition, Basic Component of FMS, Significance of FMS, General layout and configuration of FMS, Principle Objectives of FMS, Benefits and limitations of FMS, CIM Technology, Hierarchy of CIM.	5
2	Manufacturing Cell: Introduction, Description and Classifications of Cell, Unattended Machining, Cellular versus Flexible Manufacturing: Group Technology: Benefits and Obstacles of Group Technology Affecting Many Areas of a Company.	5
3	Turning and Machining Centres: Introduction, Types ,Construction and Operation Performed on Turning enter, Automated Features and Capabilities of Turning Centres, Pallet and Part Loading and Programming Options in Machining Centres.	4
4	Coordinate Measuring Machines: Introduction, Types, Construction and General Functions of CMM, Operational Cycle Description, CMM Applications, Importance to Flexible Cells and Systems	4
5	Automated Material Movement and Storage System: Introduction, Types of AGV and Limitations, Industrial Robots, Basic components and benefits of Automated Storage and Retrieval Systems, Conveyors and Pallet Flotation System, Queuing Carrousels and Automatic Work Changers,	4
6	Cutting Tools and Tool Management:Introduction, Control of Cutting Tools, Tool Management, Identification and Data Transfer, Tool Monitoring and Fault Detection: FMS Installation and Implementation: FMS Installation, FMS implementation.	4

Text Books	
1	William W Luggen, "Flexible Manufacturing Cells and System" Prentice Hall of Inc New Jersey, 1991
2	Reza A Maleki "Flexible Manufacturing system" Prentice Hall of Inc New Jersey, 1991

References	
1	John E Lenz "Flexible Manufacturing" marcel Dekker Inc New York ,1989
2	Groover, M.P "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India Pvt.Ltd. New Delhi 2009

Useful Links
https://nptel.ac.in/courses/110/106/110106044/
https://nptel.ac.in/courses/112/104/112104188/
https://onlinecourses.nptel.ac.in/noc19_me45/preview

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1		2	2			
CO2			2		2	
CO3				2		2
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand	10	5		15
3	Apply	10	5	15	30
4	Analyze		10	15	25
5	Evaluate			15	15
6	Create			15	15
Total		**20**	**20**	**60**	**100**

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Course Information	
Programme	M.Tech. (Mechanical Production Engineering)
Class, Semester	Second Year M. Tech., Sem - III
Course Code	5PR614
Course Name	Digital Manufacturing and Industry 4.0
Desired Requisites:	

Teaching Scheme		Examination Scheme (Marks)			
Lecture	2 Hrs/week	**TA1**	**TA2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	To illustrate the knowledge to students on various concepts of digital manufacturing and industry 4.0
2	To evolve towards interdisciplinary approach, to incorporate communication and information technologies.

3	To develop skills, those allow students to adopt skills related to digital manufacturing and industry 4.0

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Illustrate concepts of digital manufacturing and industry 4.0	Analyzing
CO2	Recommend the communication and information technologies	Evaluating
CO3	Produce programs for small part of digital manufacturing.	Creating

Module	**Module Contents**	**Hours**
1	The Various Industrial Revolutions, Digitalisation and the Networked Economy, Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0, The Journey so far: Developments in USA, Europe, China and other countries, Comparison of Industry 4.0 Factory and Today's Factory.	5
2	Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services, Smart Manufacturing, Smart Devices and Products, Smart Logistics, Smart Cities.	5
3	Cyberphysical Systems, Robotic Automation and Collaborative Robots, Support System for Industry 4.0, Mobile Computing, Related Disciplines, Cyber Security	4
4	Resource-based view of a firm, Data as a new resource for organizations, , Cloud Computing Basics, Cloud Computing and Industry 4.0	4
5	Industry 4.0 laboratories, IIoT case studies.	4
6	Opportunities and Challenges, Future of Works and Skills for Workers in the Industry 4.0 Era, Strategies for competing in an Industry 4.0 world.	4

Text Books	
1	Lane Thames, Dirk Schaefer, "Cyber security for Industry 4.0: Analysis for Design and Manufacturing", Springer Series in Advanced Manufacturing by Publisher: Springer; 1st ed. 2017 edition (May 6, 2017)
2	Tessaleno Devezas, Askar Sarygulov, "Industry 4.0: Entrepreneurship and Structural Change in the New Digital Landscape" by Publisher: Springer; 1st ed. 2017 edition (March 2, 2017)

References	
1	Klaus Schwab, "The Fourth Industrial Revolution"by Publisher: Crown Business (January 3, 2017).
2	Luan Casagrande, Vilson Gruber and Roderval Marcelino, "IoT and the Industry 4.0: Principles and Educational Applications", Publisher: Scholars' Press (October 7, 2016).

Useful Links
https://nptel.ac.in/courses/106/105/106105195/
https://onlinecourses.nptel.ac.in/noc20_cs69/preview
https://nptel.ac.in/courses/110/106/110106146/

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1			1			
CO2			3			1
CO3					3	
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand	10	5		15
3	Apply	10	5	15	30
4	Analyze		10	15	25
5	Evaluate			15	15
6	Create			15	15
Total		**20**	**20**	**60**	**100**

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Course Information					
Programme	M.Tech. (Mechanical Production Engineering)				
Class, Semester	Second Year M. Tech., Sem - III				
Course Code	5PR651				
Course Name	Activity Based Elective Lab 2: Manufacturing Planning and Control Lab				
Desired Requisites:					
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/Week				
Interaction	-	**Credits: 1**			

Course Objectives	
1	To provide advanced knowledge and expertise in order to produce creative and imaginative engineers with a strong scientific acumen.
2	To develop ability through hands-on experience for implementing modern methods, techniques and best practices in manufacturing
3	To make aware about current scenario and facilitate with modern trends which are tending towards their own area of interest

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Validate technological solutions to defined problems.	Applying
CO2	Acquire knowledge developed by scholarly predecessors and critically assess the relevant technological issues.	Analyzing
CO3	Create skills towards research oriented fields	Creating

Course Content
Creation of prototype/ apparatus/ small equipment/experimental set up/ innovation of existing product/ analysis or simulation of a process/ experimental verification of principles in thrust areas of Manufacturing Planning and Control.
Text Books
As per the course details
References
As per the course details
Useful Links
https://www.youtube.com/channel/UCiTvTUsvKuwvSlCHCvGiJVg
https://www.youtube.com/watch?v=kNz-TM4zPkE&list=PLbTLRuAivTCR0YVCNxSTPI9lgccanmZLG
https://www.youtube.com/watch?v=j9y0gfN9WMg&list=PL5873EDBDFB69BAD8
https://www.youtube.com/watch?v=VL_noGr8zUE&list=PLWCl4kZYUWbDNhExmBxA08ZdSylfRyW29

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1			1			2
CO2				2	1	
CO3	1					1
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	15	10		25

Apply	15	10	20	45
Analyze		10	10	20
Evaluate			10	10
Create				
Total Marks	**30**	**30**	**40**	**100**

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Course Information

Programme	M.Tech. (Mechanical Production Engineering)
Class, Semester	Second Year M. Tech., Sem - III
Course Code	5PR652
Course Name	Activity Based Elective Lab 2: Organizational Behavior Lab
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/Week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To provide advanced knowledge and expertise in order to produce creative and imaginative engineers with a strong scientific acumen.
2	To develop ability through hands-on experience for implementing modern methods, techniques and best practices in manufacturing
3	To make aware about current scenario and facilitate with modern trends which are tending towards their own area of interest

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Validate technological solutions to defined problems.	Applying
CO2	Acquire knowledge developed by scholarly predecessors and critically assess the relevant technological issues.	Analyzing
CO3	Create skills towards research oriented fields	Creating

Course Content

Creation of prototype/ apparatus/ small equipment/experimental set up/ innovation of existing product/ analysis or simulation of a process/ experimental verification of principles in thrust areas of Organizational Behaviour.

Text Books

As per the course details

References

As per the course details

Useful Links

https://www.youtube.com/channel/UCiTvTUsvKuwvSlCHCvGiJVg
https://www.youtube.com/watch?v=kNz-TM4zPkE&list=PLbTLRuAivTCR0YVCNxSTPI9lgccanmZLG
https://www.youtube.com/watch?v=j9y0gfN9WMg&list=PL5873EDBDFB69BAD8
https://www.youtube.com/watch?v=VL_noGr8zUE&list=PLWCl4kZYUWbDNhExmBxA08ZdSylfRyW29

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1			1			2
CO2				2	1	
CO3	1					1
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	15	10		25
Apply	15	10	20	45
Analyze		10	10	20
Evaluate			10	10
Create				
Total Marks	**30**	**30**	**40**	**100**

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Course Information

Programme	M.Tech. (Mechanical Production Engineering)
Class, Semester	Second Year M. Tech., Sem - III
Course Code	5PR653
Course Name	Activity Based Elective Lab 2: Flexible Manufacturing System Lab
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/Week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To provide advanced knowledge and expertise in order to produce creative and imaginative engineers with a strong scientific acumen.
2	To develop ability through hands-on experience for implementing modern methods, techniques and best practices in manufacturing
3	To make aware about current scenario and facilitate with modern trends which are tending towards their own area of interest

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Validate technological solutions to defined problems.	Applying
CO2	Acquire knowledge developed by scholarly predecessors and critically assess the relevant technological issues.	Analyzing
CO3	Create skills towards research oriented fields	Creating

Course Content

Creation of prototype/ apparatus/ small equipment/experimental set up/ innovation of existing product/ analysis or simulation of a process/ experimental verification of principles in thrust areas of Flexible Manufacturing System.

Text Books

As per the course details

References

As per the course details

Useful Links

https://www.youtube.com/channel/UCiTvTUsvKuwvSlCHCvGiJVg

https://www.youtube.com/watch?v=kNz-TM4zPkE&list=PLbTLRuAivTCR0YVCNxSTPI9lgccanmZLG

https://www.youtube.com/watch?v=j9y0gfN9WMg&list=PL5873EDBDFB69BAD8

https://www.youtube.com/watch?v=VL_noGr8zUE&list=PLWCl4kZYUWbDNhExmBxA08ZdSylfRyW29

CO-PO Mapping

	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1			1			2
CO2				2	1	

CO3	1					1
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	15	10		25
Apply	15	10	20	45
Analyze		10	10	20
Evaluate			10	10
Create				
Total Marks	**30**	**30**	**40**	**100**

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Course Information	
Programme	M.Tech. (Mechanical Production Engineering)
Class, Semester	Second Year M. Tech., Sem - III
Course Code	5PR654
Course Name	Activity Based Elective Lab 2: Digital Manufacturing and Industry 4.0
Desired Requisites:	
Teaching Scheme	**Examination Scheme (Marks)**

Lecture	-	LA1	LA2	ESE	Total
Tutorial	-	30	30	40	100
Practical	2 Hrs/Week				
Interaction	-	Credits: 1			

Course Objectives	
1	To provide advanced knowledge and expertise in order to produce creative and imaginative engineers with a strong scientific acumen.
2	To develop ability through hands-on experience for implementing modern methods, techniques and best practices in manufacturing
3	To make aware about current scenario and facilitate with modern trends which are tending towards their own area of interest

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Validate technological solutions to defined problems.	Applying
CO2	Acquire knowledge developed by scholarly predecessors and critically assess the relevant technological issues.	Analyzing
CO3	Create skills towards research oriented fields	Creating

Course Content

Creation of prototype/ apparatus/ small equipment/experimental set up/ innovation of existing product/ analysis or simulation of a process/ experimental verification of principles in thrust areas of Digital Manufacturing and Industry 4.0.

Text Books

As per the course details

References

As per the course details

Useful Links

https://www.youtube.com/channel/UCiTvTUsvKuwvSlCHCvGiJVg

https://www.youtube.com/watch?v=kNz-TM4zPkE&list=PLbTLRuAivTCR0YVCNxSTPI9lgccanmZLG

https://www.youtube.com/watch?v=j9y0gfN9WMg&list=PL5873EDBDFB69BAD8

https://www.youtube.com/watch?v=VL_noGr8zUE&list=PLWCl4kZYUWbDNhExmBxA08ZdSylfRyW29

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1			1			2
CO2				2	1	
CO3	1					1

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks

LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	15	10		25
Apply	15	10	20	45
Analyze		10	10	20
Evaluate			10	10
Create				
Total Marks	**30**	**30**	**40**	**100**

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Course Information

Programme	M.Tech. (Mechanical Production Engineering)
Class, Semester	Second Year M. Tech., Sem - IV
Course Code	5PR691
Course Name	Dissertation Phase II
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	24 Hrs/Week				
Interaction	-	**Credits: 12**			

Course Objectives

1	To develop the student to apply the knowledge gained to identify problem for research provide the solutions by self-study and interaction with stake holders.
2	Acquire knowledge to tackle real world problems of societal concerns.
3	Impart flexibility to the student to have increased control over his/ her learning.
4	Teachers would serve as mentor/facilitator of inquiry and reflection rather than as an instructor.
5	Enhance student's learning through increased interaction with peers and colleagues.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Search the existing literature and identification of research problem	Analyzing
CO2	Design and develop the solution for complex engineering problem.	Evaluating
CO3	Create the new knowledge in the specialized field	Creating

List of Experiments / Lab Activities

Course Contents:

Students are expected to carry out independent research work on the chosen topic. In this semester it is expected that the student has carried out substantial research work including exhaustive literature survey, formulation of the research problem, development/fabrication of experimental set-up (if any/required) and testing, and analysis of initial results thus obtained. In fourth semester, the students continue their dissertation work. It is expected that the student has completed most of the experimental/computation works and analysed the results so obtained as proposed in the synopsis. The work should be completed in all respects in this semester. The students are required to submit the dissertation work in the form of report as per the institute rule.

Text Books

As per the research topic

References

National and International Journals

Useful Links

CO-PO Mapping

	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	1			1		2
CO2	1		1		2	2
CO3		2				2
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand				
Apply				
Analyze	15	15	15	**45**
Evaluate	15	15	15	**45**
Create			10	**10**
Total Marks	**30**	**30**	**40**	**100**

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Course Information	
Programme	M. Tech. (Mechanical Production Engineering)
Class, Semester	Second Year M. Tech., Sem IV
Course Code	5PR671
Course Name	Techno-Socio Activity

Desired Requisites:		

Teaching Scheme		Examination Scheme (Marks)			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	-				
Interaction	1 hr/week	**Credits: -1**			

Course Objectives	
1	To record student performance in co-curricular and extra-curricular activities over four years will be considered.
2	To encourage the students to participate in activities that help develop leadership skills, team integrity, coordination skills, Time management, Communications skills, Interviewing skills etc.
3	To highlight importance of social responsibility.

Course Outcomes (CO) with Bloom's Taxonomy Level At the end of the course, students will be able to,		
CO1	Notice an improvement in his/her understanding and presentation skills.	Apply
CO2	Understand and value the importance of working in a diversified team.	Analyze
CO3	Demonstrate the soft skills like presentation skills, technical report writing etc.	Evaluate

Course Contents

The guide will be mentoring a given student batch for the duration of two years. The students shall submit proof of their achievements in various extra and co-curricular activities related to technical, cultural and social causes from first year to second year. The faculty will evaluate the students' performance at the end of 4th semester, based on the rubrics provided by the department from time to time.

Text Books	
1	Not applicable

References	
1	Not applicable

Useful Links	
1	Not applicable

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1		2				
CO2		2				
CO3		2				

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand				
Apply	15	15	15	**45**
Analyze	15	15	15	**45**
Evaluate			10	**10**
Create				
Total Marks	**30**	**30**	**40**	**100**

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Course Information

Programme	M.Tech. (Mechanical Production Engineering)
Class, Semester	Second Year M. Tech., Sem - IV
Course Code	5PR621
Course Name	Manufacturing of Non-Metallic Products
Desired Requisites:	
Teaching Scheme	**Examination Scheme (Marks)**

Lecture	3 Hrs/week	TA1	TA2	ESE	Total
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	Credits: 3			

Course Objectives	
1	To impart the knowledge of non-metals and determine their applications. .
2	To prepare the student for selecting manufacturing methods for non-metallic products.
3	To develop the student for the use of common processing methods for the plastics.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Classify different types of non-metals and their processing.	Applying
CO2	Study the effects of various processing techniques on the properties of Non-Metals.	Analyzing
CO3	Discuss the processing of ceramic materials, plastic materials, synthesis techniques for thermoset, thermoplastic, crystalline, amorphous materials, and additive manufacturing of non-metals.	Evaluating

Module	Module Contents	Hours
I	Introduction, Reinforcements, glass fibers, boron fibers, carbon fibers, organic fibers, ceramic fibers, non-oxide fibers.	7
II	Polymer matrix composites, processing, interfaces, structure, properties and applications of PMC'S, Recycling. Metal matrix composite, types, metallic matrices, processing, interfaces, structures, properties and application.	8
III	Ceramic matrix composites, processing, interfaces, structure, properties and applications. Carbon-carbon composites, processing, interfaces, structure, properties and applications.	8
IV	Processing of plastics, blow moulding, thermoforming, rotational moulding, injection moulding, multi material injection molding, calendaring process, and fabrication process.	7
V	Introduction to ceramics, processing of ceramics, pressing, blowing, drawing, tape casting, slip casting, extrusion, compaction.	5
VI	Additive manufacturing of non-metals, fused deposition modeling, stereolithography, binder jetting, ceramic printing.	7

Text Books	
1	Krishan K Chawla, "Composite Material: Science and Engineering", Publisher Springer/BSP Books, Second Edition, 2006.
2	Rees Rawlings, Frank Matthews, "Composite Materials" Springer, New edition, 1999.
3	Crawford, R. J. Crawford, "Plastics Engineering" Butterworth-Heinemann, Third Edition, 1998.

References	
1	John Wanberg, "Composite Materials: Fabrication Handbook", Wolfgang Publications, Third Edition, 2012.
2	Steven L. Donaldson, Daniel B. Miracle, Scott D. Henry, "ASM Handbook", Volume 21: Composites, Revised edition, 2001.

Useful Links	
1	https://nptel.ac.in/courses/112/107/112107086/
2	https://nptel.ac.in/courses/112/107/112107221/
3	https://nptel.ac.in/courses/112/104/112104221/

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1						1
CO2					1	
CO3			2			
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand	10	5		15
3	Apply	10	5	15	30
4	Analyze		10	15	25
5	Evaluate			15	15
6	Create			15	15
Total		**20**	**20**	**60**	**100**

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Course Information					
Programme	M.Tech. (Mechanical Production Engineering)				
Class, Semester	Second Year M. Tech., Sem - IV				
Course Code	5PR622				
Course Name	Modeling and Simulation in Manufacturing				
Desired Requisites:					
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**TA1**	**TA2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			
Course Objectives					

1	To provide the knowledge of different modeling systems employed in manufacturing and engineering enterprises.
2	To impart the recent knowledge in the broader field of simulation techniques.
3	To provide information over aspects of discrete event system simulation with particular emphasis on applications in manufacturing, services and computing.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Apply the knowledge of different modeling techniques.	Applying
CO2	Evaluate the alternative models for the different types of events and encounter the suitable model for the particular event.	Evaluating
CO3	Propose/create innovative applications/solutions by the application of modeling and simulation techniques in the arena of manufacturing engineering.	Creating

Module	**Module Contents**	**Hours**
I	**Introduction** Introduction to Simulation, Concept of system, model and simulation, Components of discrete event simulation Advantages and disadvantages of simulation.	6
II	**Concepts of Simulation** Statistical models in simulation, Probability distribution functions, Estimation of statistical parameters.	7
III	**Queueing System Simulation** Characteristic of a queueing system, Simulation of single server queueing system Internet, Generation of Random number and Random number Varieties, Testing of random numbers	6
IV	**Input Modeling** Input modeling: Estimation of parameters, Fit tests of distributions.	7
V	**Output Data Analysis** Output data analysis for single system: Statistical analysis for terminating and nonterminating simulations, Comparing alternative system configurations.	6
VI	**Validation of models** Verification, validation and credibility of simulation models, Simulation of manufacturing and material handling systems, Monte Carlo simulation, Case studies.	7

Text Books	
1	Banks, J. and Carson, J. S., "Discrete Event System Simulation", Prentice Hall, 2009.
2	Averill, M. L., and Kelton, W.D., "Simulation, Modeling and Analysis", McGraw Hill, 2006.
3	Jerry Banks, "Handbook of Simulation: Principles, Methodology, Advances, Applications, and Practices", EMP, 1998.

References	
1	B. K. Choi, D. H. Kang, "Modeling and Simulation of Discrete Event Systems", Wiley, 2013.
2	Sanjay K. Bose, "An Introduction to Queueing Systems", Springer Science & Business Media, Dec 2013.
3	Ding Geng Chen, John Dean Chen, "Monte-Carlo Simulation-Based Statistical Modeling", ICSA Book Series in Statistics, 2017.

Useful Links
https://nptel.ac.in/courses/112/107/112107220/
https://onlinecourses.nptel.ac.in/noc20_me37/preview
https://nptel.ac.in/courses/103/107/103107096/

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	1			3		
CO2					2	
CO3						3
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						

Assessment
. The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand	10	5		15
3	Apply	10	5	15	30
4	Analyze		10	15	25
5	Evaluate			15	15
6	Create			15	15
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2022-23

Course Information					
Programme	M.Tech. (Mechanical Production Engineering)				
Class, Semester	Second Year M. Tech., Sem - IV				
Course Code	5PR623				
Course Name	Material Handling Systems				
Desired Requisites:					
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**TA1**	**TA2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To develop a holistic, integrated approach to improve the material handling system considering the existing production system with constrains.
2	To provide the necessary inputs to students to make them capable to develop all the elements of selected material handling system.

3	To prepare the student for recommending the tailor made MHS for a particular application.	
Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Analyze material flows in plants and warehouses.	Analyzing
CO2	Recommend the material handling systems as per the requirement of production system.	Evaluating
CO3	Design and develop material handling equipment's.	Creating

Module	Module Contents	Hours
1	Plant Layout and Material Handling Principle Plant Layout: Need for layout planning, Layout objectives and Determinants, Types of Layout, Computer Aided Plant Layout Planning: CRAFT, ALDEP, and CORELAP. Material Handling objective, benefits of better handling, relationship between layout and material handling, principles of Material Handling, Unit load concept, Material Handling Types, Equipment selection and Applications.	7
2	Mechanized Assembly Principles and operating characteristics of part feeders such as vibratory bowl feeder, Reciprocating tube hopper feeder, Centrifugal hopper feeder, Center board hopper feeder, Orientation of parts : In bowl and out bowl tooling, different types of Escapement, Transfer Systems and Indexing Mechanism.	7
3	Material Transport and Storage System Industrial trucks: non-powered and powered industrial trucks, AGVS: Types, Vehicle guidance technology, traffic and safety, Monorail and other rail guided vehicles, types of cranes, hoists and elevators.	6
4	Conveyors Types and Storage System Belt conveyors, Slat conveyors, Gravity conveyors, Apron, escalators, pneumatic conveyors, screw conveyors, vibrating conveyor, Analysis of material transport system. Automated Storage system, AS/RS System, Carousel storage system, WIP storage system.	7
5	Packaging and Economic Analysis of Material Handling Packaging: Functions, materials, palletizing, packaging equipment. Economic Analysis of material handling equipment: Factors in material handling selection, break event analysis, equipment operating cost per unit distance, work volume analysis – illustrative problems, productivity / indicator ratios.	6
6	Industrial applications Lean-based material handling, Advanced material handling equipment, Design of MHS for industries like Foundries, Forging industries, Assembly plants etc. (with plant layout and cost estimation)	6

Text Books

1	Jon R. Immer, "Material Handling", Mc-Graw Hill Company, 1950
2	Sharma, S. C., "Materials Management and Materials Handling"Khanna Publishers., 2004.
3	Dr.K.C.Arora, Vikas .V.Shinde," Aspects of Materials Handling", Laxmi Publishers, 2007.

References

1	K.H.E. Kroemer, Karl Kroemer,"Ergonomics Design for Materials Handling systems", CRC Press, 1997.
2	Raymond A. Kulwiec, "Materials handling – Handbook", A Wiley – Inderscience publication" 1984.
3	Apple, J. M., "Plant Layout and material handling system design", John Wiley & Sons, 1995.

Useful Links

https://nptel.ac.in/courses/112/107/112107142/
https://nptel.ac.in/courses/112/107/112107143/
https://nptel.ac.in/courses/112/103/112103293/

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1			2		3	
CO2	2			2		
CO3		2				2
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Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand	10	5	5	20
3	Apply	10	5	10	25
4	Analyze		10	15	25
5	Evaluate			15	15
6	Create			15	15
Total		**20**	**20**	**60**	**100**