Dr. Ambedkar Institute of Technology

Ref. No. ....

Date : 07·01·2023

Department of Industrial Engineering and Management

The List of courses having focus on Employability/ Entrepreneurship/ Skill development for the year 2017-18.

SI. No.	Name of the Course	Course Code	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development	Year
1	Industrial Engineering	IM31	Employability	2017
2	Material Science & Metallurgy	IM32	Employability	2017
3	Engineering Thermodynamics	IM33	Employability	2017
4	Mechanics of Materials	IM34	Employability	2017
5	Manufacturing Process - I	IM35	Employability	2017
6	Material Testing Lab	IML36	Skill development	2017
7	Foundry & Forging Lab	IML37	Skill development	2017
8	Industrial Engineering Lab	IML38	Skill development	2017
9	Mechanical Measurements & Metrology	IM41	Employability	2017
10	Theory of Machines	IM42	Employability	2017
11	Manufacturing Process - II	IM43	Employability	2017
12	Fluid Mechanics	IM44	Employability	2017
13	Computer Aided Machine Drawing	IML45	Skill development	2017
14	Mechanical Measurements & Metrology Lab	IML46	Skill development	2017
15	Machine Shop Lab	IML47	Skill development	2017
16	Management and Entrepreneurship	HS03	Entrepreneurship	2017
17	Engineering Economy	IM51	Employability	2017
18	Facilities Planning and Design	IM52	Employability	2017
19	Design of Machine Elements	IM53	Employability	2017
20	Statistics for Engineers	IM54	Employability	2017
21	Advanced Machining Processes	IM552	Employability	2017
22	Marketing Management	IM553	Entrepreneurship	2017
23	Mechanical Lab	IML56	Skill development	2017
24	Statistics Lab	IML57	Skill development	2017
25	Materials Management	IM61	Employability	2017
26	Quality Assurance & Reliability	IM62	Employability	2017

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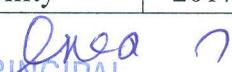BDA Outer Ring Road, Mallathahalli, Bengaluru - 560 056

Ref. No. ....   Date : ....

27	Operations Research	IM63	Employability	2017
28	Simulations Modelling & Analysis	IM64	Employability	2017
29	Computer Integrated Manufacturing	IM65	Employability	2017
30	Composite Materials	IM661	Employability	2017
31	Organisational Behaviour	IM662	Entrepreneurship	2017
32	Maintenance & Safety Engineering	IM663	Employability	2017
33	Quality Engineering Lab	IML67	Skill development	2017
34	Simulation Lab	IML68	Skill development	2017
35	Mini Project	IMP69	Employability	2017
36	Supply Chain Management	IM71	Employability	2017
37	Operations Management	IM72	Employability	2017
38	Financial Accounting & Management	IM73	Employability	2017
39	Project Management	IM74	Employability	2017
40	Lean Manufacturing	IM751	Employability	2017
41	Design of Experiments	IM754	Employability	2017
42	Enterprise Resource Planning Lab	IML76	Skill development	2017
43	Computer Integrated Manufacturing Lab	IML77	Skill development	2017
44	Total Quality Management	IM813	Employability	2017
45	Human Resource Management	IM814	Entrepreneurship	2017
46	Strategic Management	IM821	Entrepreneurship	2017
47	Management Information System	IM825	Employability	2017
48	Seminar	IMS83	Employability	2017
49	Project Work - Phase II	IMP84	Employability	2017

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Ref. No. ....

Date : 07-01-2023

Department of Industrial Engineering and Management

The List of courses having focus on Employability/ Entrepreneurship/ Skill development for the year 2018-19.

SI. No.	Name of the Course	Course Code	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development	Year
1	Industrial Engineering	IM31	Employability	2018
2	Material Science & Metallurgy	IM32	Employability	2018
3	Engineering Thermodynamics	IM33	Employability	2018
4	Mechanics of Materials	IM34	Employability	2018
5	Manufacturing Process - I	IM35	Employability	2018
6	Material Testing Lab	IML36	Skill development	2018
7	Foundry & Forging Lab	IML37	Skill development	2018
8	Industrial Engineering Lab	IML38	Skill development	2018
9	Mechanical Measurements & Metrology	IM41	Employability	2018
10	Theory of Machines	IM42	Employability	2018
11	Manufacturing Process - II	IM43	Employability	2018
12	Fluid Mechanics	IM44	Employability	2018
13	Computer Aided Machine Drawing	IML45	Skill development	2018
14	Mechanical Measurements & Metrology Lab	IML46	Skill development	2018
15	Machine Shop Lab	IML47	Skill development	2018
16	Management and Entrepreneurship	HS03	Entrepreneurship	2018
17	Engineering Economy	IM51	Employability	2018
18	Facilities Planning and Design	IM52	Employability	2018
19	Design of Machine Elements	IM53	Employability	2018
20	Statistics for Engineers	IM54	Employability	2018
21	Advanced Machining Processes	IM552	Employability	2018
22	Marketing Management	IM553	Entrepreneurship	2018
23	Mechanical Lab	IML56	Skill development	2018
24	Statistics Lab	IML57	Skill development	2018
25	Materials Management	IM61	Employability	2018
26	Quality Assurance & Reliability	IM62	Employability	2018

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27	Operations Research	IM63	Employability	2018
28	Simulations Modelling & Analysis	IM64	Employability	2018
29	Computer Integrated Manufacturing	IM65	Employability	2018
30	Composite Materials	IM661	Employability	2018
31	Organisational Behaviour	IM662	Entrepreneurship	2018
32	Maintenance & Safety Engineering	IM663	Employability	2018
33	Quality Engineering Lab	IML67	Skill development	2018
34	Simulation Lab	IML68	Skill development	2018
35	Mini Project	IMP69	Employability	2018
36	Supply Chain Management	IM71	Employability	2018
37	Operations Management	IM72	Employability	2018
38	Financial Accounting & Management	IM73	Employability	2018
39	Project Management	IM74	Employability	2018
40	Lean Manufacturing	IM751	Employability	2018
41	Design of Experiments	IM754	Employability	2018
42	Enterprise Resource Planning Lab	IML76	Skill development	2018
43	Computer Integrated Manufacturing Lab	IML77	Skill development	2018
44	Total Quality Management	IM813	Employability	2018
45	Human Resource Management	IM814	Entrepreneurship	2018
46	Strategic Management	IM821	Entrepreneurship	2018
47	Management Information System	IM825	Employability	2018
48	Seminar	IMS83	Employability	2018
49	Project Work - Phase II	IMP84	Employability	2018

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Ref. No. ....

Date : 07-01-2023

Department of Industrial Engineering and Management

The List of courses having focus on Employability/ Entrepreneurship/ Skill development for the year 2019-20.

SI. No.	Name of the Course	Course Code	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development	Year
1	Mechanical Measurements & Metrology	18IM31	Employability	2019
2	Material Science & Metallurgy	18IM32	Employability	2019
3	Thermal & Fluids Engineering	18IM33	Employability	2019
4	Manufacturing Technology	18IM34	Employability	2019
5	Mechanics of Materials	18IM35	Skill development	2019
6	Python Programming	18IM36	Skill development	2019
7	Mechanical Measurements & Metrology Lab	18IML37	Skill development	2019
8	Manufacturing Technology Lab	18IML38	Employability	2019
9	Theory of Machines	18IM42	Employability	2019
10	Engineering Economy	18IM43	Employability	2019
11	Statistics for Engineers	18IM44	Employability	2019
12	Computer Aided Machine Drawing	18IML45	Skill development	2019
13	Work Study and Ergonomics Lab	18IML46	Skill development	2019
14	Material Testing Lab	18IML47	Skill development	2019
15	Python Programming Lab	18IML48	Skill development	2019
16	Management and Entrepreneurship	HS03	Entrepreneurship	2019
17	Engineering Economy	IM51	Employability	2019
18	Facilities Planning and Design	IM52	Employability	2019
19	Design of Machine Elements	IM53	Employability	2019
20	Statistics for Engineers	IM54	Employability	2019
21	Advanced Machining Processes	IM552	Employability	2019
22	Marketing Management	IM553	Entrepreneurship	2019
23	Mechanical Lab	IML56	Skill development	2019
24	Statistics Lab	IML57	Skill development	2019

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Ref. No. ....   Date : ....

25	Materials Management	IM61	Employability	2019
26	Quality Assurance & Reliability	IM62	Employability	2019
27	Operations Research	IM63	Employability	2019
28	Simulations Modelling & Analysis	IM64	Employability	2019
29	Computer Integrated Manufacturing	IM65	Employability	2019
30	Composite Materials	IM661	Employability	2019
31	Organisational Behaviour	IM662	Entrepreneurship	2019
32	Maintenance & Safety Engineering	IM663	Employability	2019
33	Quality Engineering Lab	IML67	Skill development	2019
34	Simulation Lab	IML68	Skill development	2019
35	Mini Project	IMP69	Employability	2019
36	Supply Chain Management	IM71	Employability	2019
37	Operations Management	IM72	Employability	2019
38	Financial Accounting & Management	IM73	Employability	2019
39	Project Management	IM74	Employability	2019
40	Lean Manufacturing	IM751	Employability	2019
41	Design of Experiments	IM754	Employability	2019
42	Enterprise Resource Planning Lab	IML76	Skill development	2019
43	Computer Integrated Manufacturing Lab	IML77	Skill development	2019
44	Total Quality Management	IM813	Employability	2019
45	Human Resource Management	IM814	Entrepreneurship	2019
46	Strategic Management	IM821	Entrepreneurship	2019
47	Management Information System	IM825	Employability	2019
48	Seminar	IMS83	Employability	2019
49	Project Work - Phase II	IMP84	Employability	2019

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Ph : 23211232, Fax : 080-23217789, E-mail : principal@dr-ait.org, Website : www.dr-ait.org

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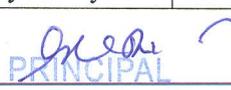BDA Outer Ring Road, Mallathahalli, Bengaluru - 560 056

Ref. No. ....

Date : 07-01-2023

Department of Industrial Engineering and Management

The List of courses having focus on Employability/ Entrepreneurship/ Skill development for the year 2020-21.

Sl. No.	Name of the Course	Course Code	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development	Year
1	Mechanical Measurements & Metrology	18IM31	Employability	2020
2	Material Science & Metallurgy	18IM32	Employability	2020
3	Thermal & Fluids Engineering	18IM33	Employability	2020
4	Manufacturing Technology	18IM34	Employability	2020
5	Mechanics of Materials	18IM35	Skill development	2020
6	Python Programming	18IM36	Skill development	2020
7	Mechanical Measurements & Metrology Lab	18IML37	Skill development	2020
8	Manufacturing Technology Lab	18IML38	Employability	2020
9	Theory of Machines	18IM42	Employability	2020
10	Engineering Economy	18IM43	Employability	2020
11	Statistics for Engineers	18IM44	Employability	2020
12	Computer Aided Machine Drawing	18IML45	Skill development	2020
13	Work Study and Ergonomics Lab	18IML46	Skill development	2020
14	Material Testing Lab	18IML47	Skill development	2020
15	Python Programming Lab	18IML48	Skill development	2020
16	Management & Entrepreneurship	18HS51	Entrepreneurship	2020
17	Operations Research	18IM51	Employability	2020
18	Computer Integrated Manufacturing	18IM52	Employability	2020
19	Design of Machine Elements	18IM53	Employability	2020
20	Quality Assurance and Reliability	18IM54	Employability	2020
21	Advanced Machining Processes	18IM551	Employability	2020
22	Marketing Management	18IM552	Entrepreneurship	2020
23	Rapid Prototyping	18IM553	Employability	2020
24	Quality Engineering Lab	18IML57	Skill development	2020
25	Computer Integrated Manufacturing Lab	18IML58	Skill development	2020
26	Materials Management	18IM61	Employability	2020

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Ref. No. ....   Date : ....

27	Facilities Planning and Design	18IM62	Employability	2020
28	Lean Manufacturing	18IM63	Employability	2020
29	Simulation Modelling and Analysis	18IM64	Employability	2020
30	Composite Materials	18IM653	Employability	2020
31	Organisational Behaviour	18IM654	Entrepreneurship	2020
32	Simulation Lab	18IML67	Skill development	2020
33	Mini Project	18IMP67	Employability	2020
34	Supply Chain Management	IM71	Employability	2020
35	Operations Management	IM72	Employability	2020
36	Financial Accounting & Management	IM73	Employability	2020
37	Project Management	IM74	Employability	2020
38	Lean Manufacturing	IM751	Employability	2020
39	Design of Experiments	IM754	Employability	2020
40	Enterprise Resource Planning Lab	IML76	Skill development	2020
41	Computer Integrated Manufacturing Lab	IML77	Skill development	2020
42	Total Quality Management	IM813	Employability	2020
43	Human Resource Management	IM814	Entrepreneurship	2020
44	Strategic Management	IM821	Entrepreneurship	2020
45	Management Information System	IM825	Employability	2020
46	Seminar	IMS83	Employability	2020
47	Project Work - Phase II	IMP84	Employability	2020

Ref. No. ....

Date : 07-01-2023

Department of Industrial Engineering and Management

The List of courses having focus on Employability/ Entrepreneurship/ Skill development for the year 2021-22.

Sl. No.	Name of the Course	Course Code	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development	Year
1	Mechanical Measurements & Metrology	18IM31	Employability	2021
2	Material Science & Metallurgy	18IM32	Employability	2021
3	Thermal & Fluids Engineering	18IM33	Employability	2021
4	Manufacturing Technology	18IM34	Employability	2021
5	Mechanics of Materials	18IM35	Skill development	2021
6	Python Programming	18IM36	Skill development	2021
7	Mechanical Measurements & Metrology Lab	18IML37	Skill development	2021
8	Manufacturing Technology Lab	18IML38	Employability	2021
9	Theory of Machines	18IM42	Employability	2021
10	Engineering Economy	18IM43	Employability	2021
11	Statistics for Engineers	18IM44	Employability	2021
12	Computer Aided Machine Drawing	18IML45	Skill development	2021
13	Work Study and Ergonomics Lab	18IML46	Skill development	2021
14	Material Testing Lab	18IML47	Skill development	2021
15	Python Programming Lab	18IML48	Skill development	2021
16	Management & Entrepreneurship	18HS51	Entrepreneurship	2021
17	Operations Research	18IM51	Employability	2021
18	Computer Integrated Manufacturing	18IM52	Employability	2021
19	Design of Machine Elements	18IM53	Employability	2021
20	Quality Assurance and Reliability	18IM54	Employability	2021
21	Advanced Machining Processes	18IM551	Employability	2021
22	Marketing Management	18IM552	Entrepreneurship	2021
23	Rapid Prototyping	18IM553	Employability	2021
24	Quality Engineering Lab	18IML57	Skill development	2021

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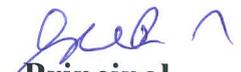BDA Outer Ring Road, Mallathahalli, Bengaluru - 560 056

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25	Computer Integrated Manufacturing Lab	18IML58	Skill development	2021
26	Materials Management	18IM61	Employability	2021
27	Facilities Planning and Design	18IM62	Employability	2021
28	Lean Manufacturing	18IM63	Employability	2021
29	Simulation Modelling and Analysis	18IM64	Employability	2021
30	Composite Materials	18IM653	Employability	2021
31	Organisational Behaviour	18IM654	Entrepreneurship	2021
32	Simulation Lab	18IML67	Skill development	2021
33	Mini Project	18IMP67	Employability	2021
34	Operations Management	18IM71	Employability	2021
35	Supply Chain Management	18IM72	Employability	2021
36	Project Management	18IM731	Employability	2021
37	Human Resource Management	18IM733	Entrepreneurship	2021
38	Strategic Management	18IM742	Entrepreneurship	2021
39	Total Quality Management	18IM744	Employability	2021
40	Statistics Lab	18IML76	Skill development	2021
41	Enterprise Resource Planning and OR Lab	18IML77	Skill development	2021
42	Cost Management of Engineering Projects	18HS71	Employability	2021
43	Project Work Phase - 1	18IMP78	Employability	2021
44	Project Work Phase - II	18IMP81	Employability	2021
45	Technical Seminar	18IMS82	Employability	2021
46	Internship	18IMI83	Employability	2021

BOS Chairman

Principal

Dr. Ambedkar Institute of Technology

Department of Industrial Engineering and Management

The Enclosed Document is Verified and Approved.

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Dr. Ambedkar Institute of Technology
(An Autonomous Institute, Affiliated to VTU, Belgavi)
INDUSTRIAL ENGINEERING & MANAGEMENT
(SCHEME OF TEACHING & EXAMINATION for ACADEMIC YEAR 2018-19 (2017 Batch)

III SEMESTER

Code No.	Course Name	CREDITS				Maximum marks		
		Lecture	Tutorial	Lab	Total	Continuous Internal Evaluation	Semester End Examination	Total
MA31	Engg. Mathematics – III	3	1	0	4	50	50	100
IM31	Industrial Engineering	4	0	0	4	50	50	100
IM32	Materials Science & Metallurgy	3	0	0	3	50	50	100
IM33	Engineering Thermodynamics	3	1	0	4	50	50	100
IM34	Mechanics of Materials	3	1	0	4	50	50	100
IM35	Manufacturing Process- I	3	0	0	3	50	50	100
IML36	Material Testing Lab	0	0	1.5	1	50	50	100
IML37	Foundry and Forging lab	0	0	1.5	1	50	50	100
IML38	Industrial Engineering Lab	0	0	1	1	50	50	100
					25			900

IV SEMESTER

Code No	Course Name	CREDITS				Maximum marks		
		Lecture	Tutorial	Lab	Total	Continuous Internal Evaluation	Semester End Examination	Total
MA 41	Engg. Mathematics – IV	3	1	0	4	50	50	100
IM 41	Mechanical Measurements and Metrology	4	0	0	4	50	50	100
IM 42	Theory of Machines	3	1	0	4	50	50	100
IM 43	Manufacturing Process- II	3	0	0	3	50	50	100
IM 44	Fluid Mechanics	4	0	0	4	50	50	100
IML 45	Computer aided Machine Drawing	2	0	2	4	50	50	100
IML 46	Mechanical Measurements and Metrology Lab	0	0	1	1	50	50	100
IML 47	Machine Shop Lab	0	0	1	1	50	50	100
					25			800

V SEMESTER

Code No.	Course Name	CREDITS				Maximum marks		
		Lecture	Tutorial	Lab	Total	Continuous Internal Evaluation	Semester End Examination	Total
HS03	Management and Entrepreneurship	4	0	0	4	50	50	100
IM51	Engineering Economy	4	0	0	4	50	50	100
IM52	Facilities Planning and Design	3	0	0	3	50	50	100
IM53	Design of Machine Elements	3	1	0	4	50	50	100
IM54	Statistics for Engineers	3	1	0	4	50	50	100
IM55X	*Elective –I (Group- A)	3	0	0	3	50	50	100
IML56	Mechanical Lab	0	0	1	1	50	50	100
IML57	Statistics Lab	0	0	1	1	50	50	100
					24			800

Code No.	* Elective - I (Group – A)	Stream of Specialization
IM 551	Tool Engineering Design	Manufacturing
IM 552	Advanced Material Processing	Manufacturing
IM 553	Marketing Management	Management
IM 554	Value Engineering	Management
IM 555	Data Base Management System	Information System Design

VI Semester

Code No.	Course Name	CREDITS				Maximum marks		
		Lecture	Tutorial	Lab	Total	Continuous Internal Evaluation	Semester End Examination	Total
IM 61	Materials Management	3	0	0	3	50	50	100
IM 62	Quality Assurance & Reliability	4	0	0	4	50	50	100
IM 63	Operations Research	3	1	0	4	50	50	100
IM 64	Simulations Modeling and Analysis	4	0	0	4	50	50	100
IM 65	Computer Integrated Manufacturing	4	0	0	4	50	50	100
IM 66X	*Elective –II (Group- B)	3	0	0	3	50	50	100
IML 67	Quality Engineering Lab	0	0	1	1	50	50	100
IML 68	Simulation Lab	0	0	1	1	50	50	100
IMP 69	Mini Project	0	0	2	2	50	50	100
					26			900

Code No.	* Elective Group – B	Stream of Specialization
IM 661	Composite Materials	Manufacturing
IM 662	Organizational Behavior	Management
IM 663	Maintenance & Safety Engineering	Management
IM 664	Reliability Engineering	Optimization Technique
IM 665	Software Engineering & Management	Information System Design

VII Semester

Code No.	Course Name	CREDITS				Maximum marks		
		Lecture	Tutorial	Lab	Total	Continuous Internal Evaluation	Semester End evaluation	Total
HS 04	**Intellectual Property Rights**	**2**	**0**	**0**	**2**	**50**	**50**	**100**
IM 71	**Supply Chain Management**	**3**	**0**	**0**	**3**	**50**	**50**	**100**
IM 72	**Operations Management**	**4**	**0**	**0**	**4**	**50**	**50**	**100**
IM 73	**Financial Management and Accounting**	**3**	**1**	**0**	**4**	**50**	**50**	**100**
IM 74	**Project Management**	**3**	**0**	**0**	**3**	**50**	**50**	**100**
IM 75X	***Elective Group–III(Group–C)**	**3**	**0**	**0**	**3**	**50**	**50**	**100**
IML 76	**Enterprise Resource Planning Lab**	**0**	**0**	**1.5**	**1.5**	**50**	**50**	**100**
IML 77	**CIM Lab**	**0**	**0**	**1.5**	**1.5**	**50**	**50**	**100**
IML78	**Project Phase – I**	**0**	**0**	**0**	**0**	**00**	**00**	**000**
IME01	**Inter Departmental Elective – I**	**4**	**0**	**0**	**4**	**50**	**50**	**100**
					26			**900**

Inter Department Elective -I	
IME 01	Engineering Economy

*Elective –III (Group C)	
IM751	**Lean Manufacturing**
IM752	**Product Design and Manufacturing**
IM753	**World class management practices**
IM754	**Design of Experiments**
IM755	**Enterprise Resource Planning and E- commerce**

VIII Semester

Code No.	Course Name	CREDITS				Maximum marks		
		Lecture	Tutorial	Lab	Total	Continuous Internal Evaluation	Semester End evaluation	Total
IME 02	**Inter departmental Elective - II**	**4**	**0**	**0**	**4**	**50**	**50**	**100**
IM 81*	***Elective – IV (Group D)**	**3**	**0**	**0**	**3**	**50**	**50**	**100**
IM 82**	****Elective – V (Group E)**	**3**	**0**	**0**	**3**	**50**	**50**	**100**
IM P83	**Subject Seminar**	**0**	**0**	**2**	**2**	**50**	**00**	**50**
IMS84	**Phase _ II Project Work**	**0**	**0**	**12**	**12**	**100**	**100**	**100**
					24			**450**

Inter departmental Elective –II	
IME 02	**Operations research**

** Elective Group – D	
IM 811	**Rapid Prototyping**
IM 812	**Advanced Ergonomics**
IM 813	**Total Quality Management**
IM 814	**Human Resource Management**
IM 815	**Advanced Operations Research**

* Elective Group – E	
IM 821	**Strategic Management**
IM 822	**Technology Management**
IM 823	**Just in Time Manufacturing**
IM 824	**Human Factors Engineering**
IM 825	**Management Information System**

Sub Title: INDUSTRIAL ENGINEERING		
Sub Code : IM31	No of Credits : 4:0:0	No of Lecture hours/week : 04
Exam Duration : 3 hrs	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 52

Objectives:
1. To understand the definition of productivity and the factors affecting productivity. 2. To apply the concept of work study and its related issues. 3. To describe Method study through various charts. 4. To identify work measurement and Time study techniques for better production. 5. To describe the importance and application of ergonomics, man-machine system.

Unit No.	Syllabus Content	No of Hours
1	**PRODUCTIVITY:** Definition, reasons for low productivity, methods to improve productivity, work-study and productivity **HUMAN FACTOR IN WORK-STUDY**: Relationship of work-study man with management, supervisor & workers, qualities of a work-study man.	**07**
2	**METHOD-STUDY:** Definition, objectives, step-by-step procedure, questioning techniques, charts and diagrams for recording data. Like outline process charts, flow process charts, multiple activity charts, two handed process chart, string diagram, travel chart, cycle graph, Chrono-cycle graph,	**10**
3	**MICRO AND MEMO MOTION STUDY:** Charts to record movements at work place – principles of motion economy, Therbligs, and classification of movements, SIMO chart, and micro motion study. Development, definition and installation of the improved method, brief concept about synthetic motion studies	**07**
4	**INTRODUCTION TO WORK MEASUREMENT:** Definition, objective and benefit of work measurement. **Work measurement techniques:** WORK SAMPLING, need, confidence levels, sample size determinations, random observation, and conducting study with the simple problems. **STOP WATCH TIME STUDY:** Time Study, Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information. Rating & standard Rating, standard performance, scale of rating, factors affecting rate of working, allowances and standard time determination. Predetermined Motion Time Study (PMTS) .Method Time Measurement (MTM)	**14**
5	**ERGONOMICS:** Introduction, Areas of study under Ergonomics, System approach to Ergonomics model, Man-Machine System. Components of Man-Machine System and Their functions – Work capabilities of Industrial	**14**

| Worker, Study and Development of Stress in Human body and their consequences. Computer based ergonomics. **DESIGN OF MAN-MACHINE SYSTEM:** Fatigue in industrial workers. Quantitative, qualitative representation and alphanumeric displays. Controls and their design criteria, control types, relation between controls and displays, layouts of panels and machines. Design of work places, influence of climate on human efficiency. Influence of noise, vibration and light. | |

Note 1: Unit 4 and Unit 5 will have internal choice.
Note 2: Two assignments are evaluated for 5 marks: Assignment– 1 from units 1 and 2. Assignment- 2 from units 3, 4 and 5.

Outcome:

After the completion of the above course, students will be able to
1. Describe the concept of productivity and the importance of productivity.
2. Analyze the existing methods of working for a particular job and develop an improved method through questioning technique.
3. Construct the various charts use recording techniques for improving productivity.
4. Provide appropriate allowances for the jobs under analysis.
5. Analyze and calculate the level of risk of the job causing stress, fatigue and musculoskeletal disorders among the employees of an organization.

Cos	Mapping with POs
CO1	PO3,PO6,PO8PO10
CO2	PO3,PO4,PO7,PO10,PO11
CO3	PO3,PO4,PO7,PO10,PO11
CO4	PO6,PO10,PO11
CO5	PO6,PO8,PO10

TEXT BOOKS:
1. **ILO, Introduction to work study** - III Revised Edition, 1981
2. **Motion and Time study** - Ralph M Barnes; John Wiley, 8th Edition, 1985.
3. **Engineered work Measurement** - Wledon, ELBS , 1991

REFERENCES BOOKS:
1. **Human Factors in Engineering Design -** S Sanders and E J McCormick, 6th Edition, Mc Graw Hill
2. **Work Study and Ergonomics** - S Dalela and Sourabh, – Chand Publishers, 3rd edition.
3. **Industrial Engineering Hand book** Maynard

Subject Title	: MATERIAL SCIENCE AND METALLURGY		
Sub Code : IM 32	**No of Credits** : 3:0:0		**No of lecture hours/week : 3**
Exam Duration : 3 Hrs.	**CIE +Assignment + SEE = 45 + 5 + 50 =100**		**Total No. of Contact Hours : 39**

Objective :
1. To classify different materials and state their properties
2. To identify the structure of materials and imperfections with different mechanisms
3. To discuss different types of material testing methods and heat treatment process
4. To describe characteristics and applications of composite and Nano materials process

Unit No	Syllabus	No of Hours
1	**Introduction to Materials**: Ferrous and Non-Ferrous Materials and Alloys, Metals, Production, General Properties, and Applications. **Crystal Structure:** BCC, FCC and HCP Structures, coordination number and atomic packing factors, crystal imperfections -point line and surface imperfections. (Problems) **Atomic Diffusion:** Phenomenon, Flick's I & II laws of diffusion, and Factors affecting diffusion. (Problems) . **Mechanical Behavior of Materials:** Stress-strain diagram showing ductile and brittle behavior of materials, linear and non-linear elastic behavior and properties. **Mechanical Properties of Materials:** Yield Strength, Offset Yield Strength, Ductility, Malleability, Stiffness, Resilience, Rigidity, Ultimate tensile strength and Toughness.	10
2.	**Testing of Materials-** Tensile and Compression testing, **Impact testing-** Izod and Charpy Impact testing. **Fatigue testing**- Fatigue: Types of fatigue loading with examples, Mechanism of fatigue, fatigue properties, fatigue testing and SN diagram **Torsion Testing:** Types of Torsion failure. **Creep:** Description of the phenomenon with examples. Three stages of creep, creep properties, stress relaxation, other related testing methods. **Hardness Testing:** Brinel hardness, Rockwell hardness and Vickers hardness testing of materials, Micro hardness and Nano indentation. **Fracture of Materials:** Fundamentals of fracture, Brittle, Ductile and shear type of fracture (Type I, Type II and Type III). (Problems)	10
3	**Phase Diagram I:** Solid solutions and its types and intermediate phases - Hume Rothery's rule - solidification of metals and alloys, cooling curves, concepts of phase diagrams. Gibbs Phase rule. Coring and segregation as applied to various binary systems, ternary systems. **Phase Diagram II:** Construction of equilibrium diagrams involving complete and partial solubility, Lever rule. Iron-carbon equilibrium diagram description of phases. (Problems)	07
4	**Heat-treatment of steels:** TTT curves, Continuous Cooling Transformation	06

	Curves (CCT) diagrams, bainitic transformation, martensitic transformation. **Annealing and its types.** Normalizing, Hardening, Tempering, Mar tempering, Austempering, Harden ability. **Surface hardening:** Carburizing, Cyaniding, Nitriding, Flame hardening and Induction hardening.	
5	**Advanced Material Processing Technology:** Introduction to Composite material, FRP composites – Fiber types-, properties, Strength and Elastic Modulus of Reinforced Plastics ,Rule of Mixtures and Problems **Matrices:** Matrices type and properties, lamina, laminate. **Introduction, properties and applications-** Metal matrix composites , Ceramic matrix composites, Nano Material, shape memory alloys, High strength alloys, Super alloys. (Problems).	06

Note 1: Unit 1 and Unit 2 will have internal choice.
Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
       Assignment - 2 from units 3, 4 and 5.

Outcome:
After the completion of the above course students will be able to

   4. Distinguish between different materials and their properties
   5. Test materials for impact, fatigue, torsion, creep, hardness and fracture
   6. Construct phase diagrams
   7. Explain different types of heat treatment processes
   8. Discuss advanced material processing technology, characterization techniques.

Cos	Mapping with POs
CO1	PO3,PO6,PO8,PO10
CO2	PO3,PO4,PO7,PO10,PO11
CO3	PO3,PO4,PO7,PO10,PO11
CO4	PO6,PO10,PO11
CO5	PO6,PO8,PO10

Text books:
1. Raghavan V., „Physical Metallurgy - Principles and Practice", 2nd Edition, Prentice - Hall of India, 2007.
2. Avner S.H., „Introduction to Physical Metallurgy", 2nd edition, Tata McGraw Hill, 2008
3. Derek Hull, „Introduction to Dislocations", Pergamon, 2nd Edition, 1981

Reference books:
1. Dieter G. E., „Mechanical Metallurgy", 1st Edition, McGraw Hill Co- Koga, 2002
2. Suryanarayana AVK, „Testing of Metallic Materials", 2nd Edition, BS Publications, 2007.
3. Mein Schwartz., "Composite Materials Handbook", McGraw Hill, 1992
4. Autar K.Kaw, "Mechanics of Composite Materials", CRC Press, 2005.
5. "ASM Hand book on Composites", Volume 21, 2001
6. Vanviack L.H, "Physical Ceramics for Engineers", Addison Wesley Publication, 1964.

7. Schwartz. M. M., „Composite Materials", Prentice Hall, 1977
8. Broutman K. J., Krock R.H., „Modern Composite Materials", Addison Wesly Publishing, 1967
9.. Billmeyer F., „Textbook of Polymer Science", Wiley Interscience, 1994
10. Manufacturing Engineering and Technology, Serope Kalpakjian & Steven R. Schmid.

Subject Title	: ENGINEERING THERMODYNAMICS		
Sub Code : IM33	**No of Credits** : 3:1:0		**No of lecture hours/week : 4**
Exam Duration : 3 Hrs.	**CIE +Assignment + SEE = 45 + 5 + 50 =100**		**Total No. of Contact Hours : 52**

Objective :
1. To understand the basic tools and methodologies for carrying out thermodynamic analysis of engineering systems.
2. Understand the nature and role of the following thermodynamic properties of matter: internal energy, enthalpy, entropy, temperature, pressure and specific volume;
3. Recognize and understand the different forms of energy and restrictions imposed by the first law of thermodynamics on conversion from one form to another;
4. Understand implications of the second law of thermodynamics and limitations placed by the second law on the performance of thermodynamic systems;
5. To understand the working of internal combustion engines and their performance analysis, understanding of air standard cycles and their importance.

Unit No.	Syllabus	No of Hours
1	**Fundamental Concepts and Definitions:** Microscopic and Macroscopic approaches. Engineering thermodynamics; definition, some practical applications of engineering thermodynamic. System (Closed system) and Control Volume (open system); Characteristics of system boundary and control surface, examples. Thermodynamic properties; intensive and extensive properties. Thermodynamic state, state point, state diagram, path and process, cyclic and non-cyclic preesses; Thermodynamic equilibrium; diathermic wall, Zeroth law of thermodynamics, **Temperature:** concepts, scales, measurement.	6+4(T)
2	**Work and Heat:** Thermodynamic definition of work; examples, sign convention. Displacement work; at part of a system boundary, at whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Heat; definition, units and sign convention, misconceptions about heat	7+3(T)
3	**First Law of Thermodynamics:** Joules experiments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy, pure substance; definition, two-property rule, Specific heat at constant volume, enthalpy, specific heat constant pressure. Extension of the First law to control volume; steady state-steady flow energy equation, important applications.	12+5(T)
4	**Second Law of Thermodynamics:** Thermal reservoir. Direct heat engine; schematic representation and efficiency. Devices converting work to heat in a theromodynamic cycle; reversed heat engine, schematic representation, coefficients of performace. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clasius statement of Second law of Thermodynamics; Equivalence of the two statements; Reversible and irrevesible	8+3(T)

	processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Corollories of Carnot cycle (only statement).	
5	**Gas power cycle:** Air Standard cycles: Carnot, Otto, Diesel, Dual and Stirling cycles, P-V and T-S diagrams, description, efficiencies and mean effective pressures, Comparision of Otto and Diesel cycles. **I.C.Engine**: Testing of two stroke and four stroke SI and CI engines for performance Related numerical problems, heat balance, and Morse test.	12+5(T)

Note 1: Unit 3 and Unit 5 will have internal choice.
Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
Assignment - 2 from units 3, 4 and 5.

Outcome:
After the completion of the above course students will be able to

1. Represent a thermodynamic system by a control mass or control volume, distinguish the system from its surroundings, and identify work and/or heat interactions between the system and surroundings;
2. Estimate the various thermodynamic properties, work transfer and heat transfer.
3. Analyze the different forms of energy and restrictions imposed by the first law of thermodynamics on conversion from one form to another.
4. Analyze the performance of refrigeration and heat pump systems.
5. Assess the working of internal combustion engines and their performance analysis.

Cos	Mapping with POs
CO1	PO1,PO3
CO2	PO1,PO2
CO3	PO3,PO4
CO4	PO2,PO3, PO4
CO5	PO3,PO4,PO6

Text books:

1. **Engineering Thermodynamics**, P. K. Nag, Mcgraw Hill Education, 5th Edition, 2013
2. **A Textbook of Engineering Thermodynamics**, R. K. Rajput, Laxmi Publications, Fifth Edition, 2016
3. **Basic Thermodynamics**, Swati B. V., Venkanna B. K, PHI, 1st Edition , 2010
4. **Basic Thermodynamics,** T R Seetharam, Interline Publishing Pvt Ltd, 2007

Reference books:
1. **Fundamentals of Thermodynamics,** G.J. Van Wylen and R.E. Sonntag, Wiley India Pvt. Ltd, 1st edition, 2010.
2. **Thermodynamics: An Engineering Approach**, Yunus A. Cengel, Michael A. Boles, McGraw Hill Education, 8 Edition, 2015

Subject Title	: MECHANICS OF MATERIALS		
Sub Code : IM34	**No of Credits : 3:1:0**		**No of lecture hours/week : 4**
Exam Duration : 3 Hrs.	**CIE +Assignment + SEE = 45 + 5 + 50 =100**		**Total No. of Contact Hours : 52**

Objective:
1. To apply the fundamentals of strength of materials as related to concepts of stress, strain, bending, torsion, stability, and deflection of deformable bodies to applications concerning bars, shafts, beams, columns, and pressure vessels.
2. To discuss the fundamentals of applying equilibrium, compatibility of deformations, and force-deformation relationships in solving problems.
3. To equip with the proficiency in calculating stresses and strains in bars and beams subjected to axial forces and torsional, bending moments,
4. To analyze external and internal forces and moments; calculating deflections of beams; calculating angles of twist of shafts etc.

Unit No	Syllabus	No of Hours
1	**Simple Stress and Strain:** Introduction, Stress, strain, mechanical properties of materials, Linear elasticity, Hooke's Law and Poisson's ratio, Stress-Strain relation - behaviour in tension for Mild steel, cast iron and non ferrous metals. Extension/ Shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular), Elongation due to self weight, Principle of super position. **Stress in Composite Section:** Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses (including compound bars).	12+5(T)
2	**Thick and Thin Cylinder** Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume). Thick cylinders Lame's equation (compound cylinders not included).	7+3(T)
3	**Bending Moment and Shear Force in Beams**: Introduction, Types of beams, loads and reactions, shear forces and bending moments, rate of loading, sign conventions, relationship between shear force and bending moments. Shear force and bending moment diagrams for different beams subjected to concentrated loads, uniformly distributed load, (UDL) uniformly varying load (UVL) and couple for different types of beams.	8+3(T)
4	**Bending and Shear Stresses in Beams**: Introduction, Theory of simple bending, assumptions in simple bending. Bending stress equation, relationship between bending stress, radius of curvature, relationship between bending moment and radius of curvature. Moment carrying capacity of a section. Shearing stresses in beams, shear stress across rectangular, circular, symmetrical I and T sections. (Composite beams not included).	12+5(T)
5	**Torsion of Circular Shafts**: Introduction. Pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts. Power transmitted by solid and hollow circular shafts.	8+2(T)

Note 1: Unit 1 and Unit 4 will have internal choice.

Note 2: **Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.**
Assignment - 2 from units 3, 4 and 5.

Outcome:
After the completion of the above course students will be able to

1. Analyze two dimensional basic stress, strain, and effect of temperature on the axially loaded members
2. Interpret the effect of pressure on thin and thick cylinders
3. Evaluate the basic design of mechanical part under shear and bending and torsional load of different cross section of beams and column.

Cos	Mapping with POs
CO1	PO1,PO3,PO4,PO12
CO2	PO1,PO3,PO4,PO12
CO3	PO1,PO3,PO4,PO12

Text books:

1. **."Strength of Materials",** S.S.Bhavikatti, Vikas publications House -1 Pvt. Ltd., 2nd Ed., 2006
2. **"Strength of Materials",** S.S. Rattan, Tata McGraw Hill, 2009
3. " Strength of Materials", Surya Patnayak Elsevier publication Ist Edition 2003
4. **"Mechanics of materials",** B C Punmiaand & Ashok kumar Jain Laxmi Publication 2001

Reference books:

1. **"Engineering Mechanics of Solids**", Egor.P. Popov, Pearson Edu. India, 2nd, Edison, 1998
2. **"Mechanics of materials",** in S.I. Units, Ferdinand Beer & ussell Johnson, TATA Mc GrawHill- 2003
3. **"Mechanics of Materials",** James M. Gero and Barry J. Goodno Cengage learning 8th edition 2014.
4. **" Mechanics of Materials"** William F R ley and Loven W zachery wiley india publication 2018

Sub Title : **MANUFACTURING PROCESS- I**		
Sub Code: IM 35	**No. of Credits:3 =3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : **3 hours**	**CIE +Assignment + SEE =** **45 + 5 + 50 =100**	**Total No. of Contact Hours : 39**

Course objectives:
1. Outline the importance of manufacturing processes and their industrial applications
2. Describe the concept of metal casting.
3. Define the principles of welding technology.

Unit No	Syllabus	No of Hours
1	**Introduction:** Concept of Manufacturing process and its importance. Classification of Manufacturing processes. Introduction to Casting process & steps involved. Varieties of components produced by casting process. Advantages Limitations and application of casting process. **Patterns:** Definition, functions, Materials used for pattern, Classification of patterns, various pattern allowances and their importance. , BIS color coding of Patterns. **Sand Moulding:** Types of base sand, requirement of base sand. Moulding sand mixture ingredients (base sand, binder & additives) for different sand mixtures. Method used for sand moulding, such as Green sand, dry sand and skin dried moulds. **Binder**: Definition, Types of binder used in moulding sand. **Additives**: Need, Types of additives used. **Cores:** Definition, Need, Types. Method of making cores, Binders used, core sand moulding. **Concept of Gating & Risering.** Principle and types.	10
2	**Moulding Machines**: Jolt type, Squeeze type, Jolt & Squeeze type and Sand slinger. **Special moulding Process:** Study of important moulding processes, Nobake moulds, Flaskless moulds, Sweep mould, CO_2 mould, Shell mould, Investment mould. **Metal moulds**: Gravity die-casting, Pressure die casting, Centrifugal casting, Squeeze Casting, Slush casting, Thixocasting and Continuous Casting Processes. **Melting Furnaces:** Classification of furnaces. Constructional features & working principle of coke fired, oil fired and Gas fired pit furnace, Resistance furnace, Coreless Induction furnace, Electric Arc Furnace, Cupola furnace. **Defects In Castings -** Causes and remedies, cleaning and inspection of casting-fettling operations, Non-destructive testing, X-ray radiography, Dye penetrate test, ultrasonic test and magnetic particle inspection.	10
3	**Welding process:** Definition, Principles, Classification, Application, Advantages & limitations of welding. **Arc Welding**: Principle, Metal Arc welding (**MAW**), Flux Shielded Metal Arc Welding (**FSMAW**), Tungsten Inert Gas Welding (**TIG & MIG**) Submerged Arc Welding (**SAW**) and Atomic Hydrogen Welding processes. (**AHW**)	6

4	**Gas Welding**: Principle, Oxy – Acetylene welding, Chemical Reaction in Gas welding, Flame characteristics. Gastorch construction & working. Forward and backward welding. **Principles of soldering & brazing:** Parameters involved & Mechanism. Different Types of Soldering & Brazing Methods.	8
5	**Advanced Joining Methods:** Resistance welding - principles, Seam welding, Butt-welding, Spot welding and projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and Electron beam welding. **Metallurgical Aspect of Welding -** Solidification and Structure of welds, Heat affected zone, residual stress	5

Note 1: SEE Question paper contains total seven Questions and student should answer any one question from Unit I and Unit II and student shall answer total five questions.

Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
Assignment - 2 from units 3, 4 and 5.

Outcome:
After the completion of the above course students will be able to

1. Describe the primary manufacturing processes and industrial applications in different sectors.
2. Explain the concepts of sand moulding methods and metal melting process and also testing of casting and to produce defect free products.
3. Classify different metal joining methods through welding technologies.
4. Define principles and process of gas welding and soldering & brazing.
5. Express advanced joining methods through special welding process and also study the metallurgical aspects of welding.

Cos	Mapping with POs
CO1	PO1,PO2,PO3,PO7,P11
CO2	PO2,PO4,PO6,PO7,PO8,P11
CO3	PO2,PO4,PO6,PO7,PO8,P11
CO4	PO2,PO4,PO6,PO7,PO8,P11
CO5	PO1, PO2, PO2, PO7, PO8, P11.

Text books:
1. Hajra Choudhury, "Elements of Workshop Technology, Vol. I and II", Media Promotors Pvt Ltd., Mumbai, 2001. 2. S.Gowri, P.Hariharan, and A.Suresh Babu, "Manufacturing Technology 1", Pearson Education, 2008. 3. Nadkarni S.V. "Modern Arc Welding Technology", 1st Edition, IBH Publishing, 2005 4. Kearns W. H, "Welding Hand Book (Welding Processes) " Volume II and III, 7th Edition, AWS, 1984 5.Swadesh Kumar Singh, "A Text Book on Production Engineering", 3rd edition, Made Easy Publication, 2016, ISBN– 978-93-5147-217-9

Reference Books:
1. Roy A Lindberg, Process and Materials of Manufacturing, 4th Ed. Pearson Edu. 2006.
2. SeropeKalpakjian, Steuen. R. Sechmid "Manufacturing Technology",Pearson Education Asia, 5th Ed. 2006.
3.. P N Rao, Manufacturing Technology – "Foundry, Forming, and Welding", 4th edition, McGraw Hill Education (India) Private Limited, 2013, ISBN-13: 978-1-25-9606257-5 and ISBN-10: 1-25-906257-0
4. Mikell P. Groover, "Fundamentals of modern manufacturing: materials, processes and systems", JOHN WILEY & SONS, INC., 4th Edition, 2010, ISBN: 978-0470-467002
 5. G.S Sawhney, "Manufacturing Science – I, Forming, Casting and Welding", 2015, I.K. International Publishing House Pvt. Ltd. ISBN: 978-93-82332-53

Subject Title	: MATERIAL TESTING LAB		
Sub Code	: IML36	No of Credits : 0:0:1	No. of Hrs / Week : 3
Exam Duration : 3 Hrs.		CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 13

Objective
1. To learn and demonstrate the basic principles in the area of strength and mechanics of materials through a series of experiments. 2. To provide hands on experience in measuring loads, deflection and strains.

Expt. No	Description
1	Preparation of specimen for Metallographic examination of different engineering materials. Identification of microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites. **(Only Demonstration)**
2	Heat treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of heat-treated samples. **(Only Demonstration)**
3	To study the wear characteristics of ferrous, non-ferrous and composite materials for different parameters. **(Only Demonstration)**

4	Non-destructive test experiments like, **(Only Demonstration)**
	    (a). Ultrasonic flaw detection
	    (b). Magnetic crack detection
	    (c). Dye penetration testing. To study the defects of Cast and Welded specimens.

5	Tensile, shear and compression tests of metallic and non metallic specimens using Universal Testing Machine
6	Torsion Test
7	Bending Test on metallic and nonmetallic specimens.
8	Izod and Charpy Tests on M.S, C.I Specimen.
9	Brinell, Rockwell and Vickers's Hardness test.

Outcome:

After the completion of the above course students will be able to use
   1. Demonstrate the Nondestructive testing methods
   2. Experiment and compute loads, deflection, strains and hardness and various other parameters using basic material testing equipment's.
   3. Evaluate the strengths of metallic specimens using UTM

Cos	Mapping with POs
CO1	PO3,PO12
CO2	PO1,PO2,PO6,PO12
CO3	PO1,PO2,PO6,PO12

Scheme of Examination:		
Two question (one from 1,2,3 and 4 and one from 5 , 6, 7, 8, 9) :		15 +25 Marks
Viva -Voice:	:	10 Marks
Total	:	50 Marks

Subject Title	: **FOUNDRY AND FORGING LAB**	
Sub Code : **IML37**	**No of Credits : 0: 0:1.5= 1**	**No. of Hrs / Week : 3**
Exam Duration : 3 Hrs.	**CIE +Assignment + SEE = 50 + 50 =100**	**Total No. of Contact Hours : 13**

Objective:
1.To demonstrate the importance of sand properties in preparing moulds
2.To give hands on practice in preparing moulds using 2 box, split pattern and cores
3.To give hands on practice in preparing forging models using open – hearth furnace

Testing of Moulding sand and Core sand	
Preparation of sand specimens and conduction of the following tests:	
1	Compression, Shear and Tensile tests on Universal Sand Testing Machine.
2	Permeability test
3	Core hardness & Mould hardness tests.
4	Sieve Analysis to find Grain Finest number of Base Sand
5	Clay content determination in Base Sand
Foundry Practice	
1	Use of foundry tools and other equipments.
2	Preparation of moulds using two moulding boxes using patterns or without patterns. (Split pattern, Match plate pattern and Core boxes).
3	Preparation of one casting (Aluminum or cast iron-Demonstration only)
Forging Operations	
1	Calculation of length of the raw material requted to do the model.
2	Preparing minimum three forged models involving upsetting, drawing and bending operations.
3	Out of these three models, at least one model is to be prepared by using Power Hammer

Outcome:
After the completion of the above course students will be able to
1. The students will be able to utilize foundry and forging tools for various applications
2. Will be able to develop different foundry & forging models
3. Will be able to determine different properties of sand

COs	Mapping with POs
CO1	PO3,PO5
CO2	PO2,PO9,PO12
CO3	PO2,PO3

Scheme of Examination:
One question is to be set from Testing of Molding sand and Core sand : 10 marks
One question is to be set from either Foundry or Forging : 30 marks

Viva-Voce	:	10 marks.
Total	**:**	**50 marks.**

Subject Title	: INDUSTRIAL ENGINEERING LABORATORY		
Sub Code	**: IML38**	**No. of Credits:1**	**No. of lecture hours/week : 3**
Exam Duration : 3 hrs	**CIE +Assignment + SEE =** **45 + 5 + 50 =100**		**Total No. of Contact Hours : 13**

Objectives:
1. To apply the basic fundamental concepts of Industrial engineering to small industrial experimental problems.
2. To construct various charts using recording techniques.
3. Application and development of different plant layouts.
4. Analysis and practice of performance rating experiments.
5. To test the statistical parameters by regression and correlation.

	PART – A (METHOD STUDY)
1	Recording Techniques**:** Preparing the following charts and diagrams (Minimum 3 Charts) - Outline process chart, Multiple Activity Chart, Flow process chart and Flow diagram, String diagram.
2	Experiments on the Application of principle of motion economy, Two handed process chart.
3	Exercises on conducting method study for assembling simple components and office work.
4	Development of Layout plans using SLP technique.
	PART – B (WORK MEASUREMENT)
1	Rating practice using: walking simulator, pin board assembly, dealing a deck of cards and marble collection activity
2	Determining the standard time for simple operations using stopwatch time study
3	Exercises on estimating standard time using PMTS.
4	Measurement of parameters (heart beat rate, calorie consumption) using walking simulator
5	Measurement of parameters (heart beat rate, calorie consumption, revolutions per minute) using ergometer
6	Effect of Noise, Light, Heat on human efficiency in work environments.

Outcome:
After undergoing the machine shop practice will be able to
1. Use basic fundamental concepts of Industrial engineering to practical applications.
2. Construct various charts and diagrams for manufacturing activities to minimize the delays and unnecessary activities.
3. Draw and develop different plant layouts for feasibility check.
4. Perform rating experiments for good observation.
5. Test the statistical parameters by regression and correlation.

Cos	Mapping with POs
CO1	PO1,PO9,PO12
CO2	PO1,PO2,PO5,PO12
CO3	PO2,PO3,PO5,PO6,PO7,PO12
CO4	PO1,PO3,PO4,PO12
CO5	PO1,PO2,PO4,PO6,PO12

Scheme of Examination:

ONE question from Part A	20 Marks
ONE question from Part B	20 Marks
Viva –Voce	10 Marks
Total	**50 Mark**

Subject Title	: ENGINEERING METROLOGY AND MESUREMENTS		
Sub Code : IM41	**No of Credits** : 3:1:0		**No of lecture hours/week : 4**
Exam Duration : 4 Hrs.	**CIE +Assignment + SEE =** **45 + 5 + 50 =100**		**Total No. of Contact Hours : 52**

Course Objectives:
1. To define Measurement standards.
2. To describe the calibration procedure of different instruments.
3. To classify various types and use of gauges, projectors, comparators and transducers

Unit No	Syllabus	No of Hours
1	**Measurements and measurement systems:** Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, Mechanical Transducers: Spiral springs, Torsion Bars, Diaphragms & Bellows, Electrical Transducer: Resistive Transducer, Electronic Transducer, advantages of each transduce	09
2	**Measurement of force, torque and pressure:** Principle, analytical balance, platform balance, proving ring. Torque measurement, Prony brake, hydraulic dynamometer. Pressure measurements, principle, use of elastic members, , Mcloed gauge, **Temperature and strain measurement:** Resistance thermometers, thermocouple, law of thermo couple, materials used for construction, Total radiation pyrometer, Optical Pyrometer, Strain measurement, Mechanical strain gauge, preparation and mounting of strain gauges, gauge factor, Basic Wheatstone resistance bridge and methods of strain measurement (Deflection method and null method).	10
3	**Standards of measurement:** Definition and Objectives of metrology, Standards of length-International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M-81, M-112), Numerical problems on building of slip gauges.	7

4	**System of Limits, Fits, Tolerance and Gauging:** Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS919-1963), geometrical tolerance, positional-tolerances, hole basis system, shaft basis system, classification of gauges, brief concept of design of gauges (Taylor's principles), Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge material, simple problems on limits & fits	13
5	**Comparators and Angular measurement:** Introduction to comparators, characteristics, classification of comparators, mechanical comparators-Johnson Mikrokator, dial indicator, optical comparator-principle, Zeiss ultra optimeter, electric comparator-principles, LVDT,. Angular measurements, bevel protractor, sine principle and use of sine bars, sine centre, use of angle gauges (numerical on building of angles). **Interferometer and screw thread, gear measurement:** Interferometer, interferemetry, autocollimator. Optical flats. Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, best size wire.	13

Note 1: **Unit 4 and Unit 5 will have internal choice.**
Note 2: **Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.**
Assignment - 2 from units 3, 4 and 5.

Course Outcome:
After the completion of the above course students will be able to

1. Define and classify Measurements and measurement systems

2. Distinguish and sketch different measurement of force, torque, pressure and temperature, strain measuring instruments.

3. Define standards of measurement and solve problems on building of slip gauges.

4. Illustrate and define Indian Standards, principles of limits of size and tolerances and solve problems on limits and fits.

5. Classify comparators and determine gear parameters and solve problems on building of angles.

Cos	Mapping with POs
CO1	PO2,PO3,PO5,PO12
CO2	PO1,PO2,PO7,PO12
CO3	PO1,PO2,PO7,PO12
CO4	PO1,PO2,PO7,PO12
CO5	PO1,PO2,PO7,PO12

TEXT BOOKS:
1. **Mechanical Measurements,** Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. **Engineering Metrology,** R.K. Jain, Khanna Publishers, 1994.
3. **Mechanical Measurements,** R.K. Jain

REFERENCE BOOKS:
1. **Engineering Metrology,** I.C. Gupta, Dhapat Rai Publications, Delhi.
2. **Industrial Instrumentation,** Alsutko, Jerry. D. Faulk, Thompson Asia Pvt. Ltd.2002.
3. **Measurement Systems Applications and Design,** Ernest O. Doblin, McGraw Hill Book Co.

Subject Title	: THEORY OF MACHINES		
Sub Code	: IM42	No of Credits: 3:1:0	No of lecture hours/week : 4
Exam Duration : 3 Hrs.	CIE +Assignment + SEE = 45 + 5 + 50 =100		Total No. of Contact Hours : 52

Objective:
1. To define the layout of linkages in the assembly of a system/machine
2. To identify various principles involved in assessing the displacement, velocity and acceleration at any point in a link of a mechanism
3. To analyze the motion resulting from a specified set of linkages in a mechanism.
4. To illustrate the design and application of gears
5. To evaluate the design and application of cams

Unit No	Syllabus	No of Hours
1	**Introduction:** Definitions Link or element, kinematic pairs, Degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, Structure, Mobility of Mechanism, Inversion, Machine. **Kinematic Chains and Inversions**: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.	8+2(T)
2	**Mechanisms:** Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Straight-line motion mechanisms Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms -Geneva wheel mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph.	8+3(T)
3	**Spur Gears:** Gear terminology, law of gearing, Characteristics of involute action, Path of contact. Arc of contact, Contact ratio of spur, helical, bevel and worm gears, Interference in involute gears. Methods of avoiding interference, Back lash. Comparison of involute and cycloidal teeth.	7+3(T)
4	**Gear Trains:** Simple gear trains, Compound gear trains for large speed reduction, Epicyclical gear trains, Algebraic and tabular methods of finding velocity ratio of epicycle gear trains(Simple Problems with tabular column method only). Tooth load and torque calculations in epicyclic gear trains. **Velocity Analysis by Instantaneous Center Method:** Definition, Kennedy's Theorem, Determination of linear and angular velocity using instantaneous center method	12+5(T)
5	**Klein's Construction**: Analysis of velocity and acceleration of single slider crank mechanism. **Cams:** Types of cams, Types of followers. Displacement, Velocity and, Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-face follower, Disc cam with oscillating roller follower. Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.	12+5(T)

Note1: Graphical Solutions may be obtained either on the Graph Sheets or on the Answer Book itself

Note 2: The question paper should contain five questions, i.e., one question from each unit and from Unit IV and Unit V can have two question in each but, student should answer any one from Unit IV and Unit V.

Outcome:
After the completion of the above course students will be able to

1. Discuss the common mechanisms used in machines and everyday life.
2. Calculate mobility (number of degrees-of-freedom) and enumerate rigid links and types of joints within mechanisms.
3. Analyze the complete (translational and rotational) mechanism velocity and acceleration graphically.
4. Classify gear mechanism and analyse gear train, and interpret gear standards and specification in design.
5. Explain cam mechanism and cam motion profiles, and calculi the velocity and acceleration of cam.

Cos	Mapping with POs
CO1	PO1,PO2,PO3
CO2	PO1,PO2,PO3
CO3	PO1,PO2,PO3
CO4	PO2,PO3,PO5,PO8,PO9,PO12
CO5	PO2,PO3,PO5,PO8,PO9,PO12

TEXT BOOKS:
1. **"Theory of Machines",** Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 3rd edition -2009.
2. **"Theory of Machines",** Sadhu Singh, Pearson Education (Singapore) Pvt. Ltd, Indian Branch New Delhi, 2nd Edi. 2006
3. **"Theory of mechanisms and machine" Amithaba Gose and Asok kumar malik Third edition, east west press, 2006**

REFERENCE BOOKS:
1. **"Theory of Machines & Mechanisms**", J.J. Uicker, , G.R. Pennock, J.E. Shigley. OXFORD 3rd Ed. 2009.
2. **Mechanism and Machine theory**, Ambakar. A G ,PHI learning 2007
3. **Theory of machine,** Joseph Edward Shigley, OXFORD PRESS.

Sub Title : MANUFACTURING PROCESS- II		
Sub Code: IM 43	**No. of Credits:3 =3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : **3 hours**	**CIE +Assignment + SEE =** **45 + 5 + 50 =100**	**Total No. of Contact Hours :** **39**

Course objectives:
 1. Basic concepts of Metal cutting and cutting tool parameters.
 2. Importance of conventional and semiautomatic machining processes.
 3. Two and three axis machine tools and chip less machining process.

Unit No	Syllabus	No of Hours
1	**Theory of Metal Cutting**: Single point cutting tool nomenclature geometry. Rake angle, Mechanics of Chip Formation, Types of Chips. Marchant's Circle analysis of cutting force to determine various forces in cutting zone, problems on Merchant's analysis. Shear angle relationship, General Tool Wear and Geometry of tool wear, Tool failure, and Tool life. Effects of cutting parameters on tool life. Tool Failure Criteria, Taylor's Tool Life equation. Problems on tool life evaluation.	10
2.	**Cutting Tool Materials:** Desired properties and types of different cutting tool materials- Heat generation in metal cutting operation, factors affecting heat generation. **Cutting fluids:** Desired properties, types and selection **Machinability:** Concepts of Machinability and its improvement	05
3	**Production Lathes:** Classification, constructional features of Engine Lathe, Turret and Capstan type of lathe advantages and applications. **Drilling Machines**: Classification, applications, constructional features, drilling. Types of drill & drill bit nomenclature- Drill materials Problems on calculation of machining time, reaming operation.	05
4	**Shaping Machine** Classifications, constructional features, specifications, driving mechanisms- Crank and slotted lever, whit worth quick return and Hydraulic mechanism. Tool & work holding devices Problems on calculation of machining time. **Planing Machine**: Classifications, constructional features, driving mechanisms, planing operations. Tool and work holding devices. Problems on calculation of machining time.	10
5	**Milling machines**: Classification, constructional features, specifications, milling cutters nomenclature, various milling operations, up milling and down milling concepts. Purpose of indexing, indexing methods. **Grinding machines:** Types of Abrasives, Bonding process, classification, constructional features of surface, cylindrical and centreless grinding machines, honing, lapping, super finishing, polishing and buffing operations.	09

Note 1: SEE Question paper contains total seven Questions and student should answer any one question from Unit I and Unit IV and student shall answer total five questions.

Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
Assignment - 2 from units 3, 4 and 5.

Outcome:

After the completion of the above course students will be able to
  1. Determine various secondary manufacturing processes and metal cutting theory and its applications.
  2. Illustrate the characteristics of cutting tool materials.
  3. Learns the principles and concepts of two axis machining process.
  4. Generalize the concepts of shaping and planning machines.
  5. Explain the principles and concepts of three axis machine tool and chip less machining process.

Cos	Mapping with POs
CO1	PO1, PO3, PO4, PO5, PO8, PO11.
CO2	PO3, PO4, PO5, PO8, PO11.
CO3	PO3, PO4, PO5, PO8, PO11.
CO4	PO3, PO4, PO5, PO8, PO11.
CO5	PO1, PO3, PO4, PO5, PO11.

TEXT BOOKS:
1. **Workshop Technology,** Hajra Choudhry, Vol-II, Media Promoters & Publishers Pvt. Ltd. 2004 2. **Production Technology,** R.K.Jain, Khanna Publications, 2003. 3. **Production Technology,** HMT, Tata McGraw Hill, 2001. 4. **A text book of Manufacturing Technology**, Rajput R.K, Lakshmi Publications, 20074.

REFERENCE BOOKS:
1. Amitabha Ghosh and Mallik, **Manufacturing Science**, affiliated East West Press, 2003. 2. G. Boothroyd, **Fundamental Machining and Machine Tools,** McGraw Hill, 2000 3. P.N. Rao "Manufacturing Technology", Metal Cutting and Machine Tools, Tata McGraw – Hill, New Delhi, 2003. 4. P.C. Sharma, "A Text Book of Production Engineering", S.Chand and Company Ltd, Fourth Edition, 1993. 5. Milton C.Shaw, "Metal Cutting Principles", Oxford University Press, 2nd Edition, 2005. 6. Philip F.Ostwald and Jairo Munoz, "Manufacturing Processes and systems", John Wiley and Sons, 9th Edition, 2002

Subject Title : FLUID MECHANICS		
Sub Code : IM44	No of Credits : 4:0:0	No of lecture hours/week : 4
Exam Duration : 3 Hrs.	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 52

Objectives:
1. Understand the basic concepts of fluid mechanics and recognize the various types of fluid flow problems encountered in practice. 2. Determine the basic properties of fluids and understand the continuum approximation. 3. Determine viscosity and the consequences of the frictional effects it causes in fluid flow. 4. Illustrate the different velocity and flow rate measurement techniques

Unit No	Syllabus	No of Hours
1	**Properties of Fluids:** Introduction, Properties of fluids, viscosity, thermodynamic properties, surface tension, capillarity, vapour pressure and cavitations	8
2	**Fluid Statics:** Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressures, simple manometers and differential manometers. Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces, curved surface submerged in liquid.	10
3	**Buoyancy and Fluid Kinematics:** Buoyancy, center of buoyancy, metacentre and metacentric height, conditions of equilibrium of floating and submerged bodies, determination of Metacentric height experimentally and theoretically. **Kinematics:** Types of fluid flow, continuity equation in 2D and 3D (Cartesian Co-ordinates only, velocity and acceleration, velocity potential function and stream function.	12
4	**Fluid Dynamics:** Introduction equation of motion, Euler's equation of motion, Bernoulli's equation from first principles and from Euler's equation, limitations of Bernoulli's equation. **Fluid Flow Measurements:** Venturimeter, orificemeter, pitot-tube.	12
5	**Flow through pipes:** Minor losses through pipes. Darey's and Chezy's equation for loss of head due to friction in pipes. HGL and TEL	10

Note 1: SEE Question paper contains total seven Questions and student should answer any one question from Unit 3 and Unit 4 and student shall answer total five questions.
Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
        Assignment - 2 from units 3, 4 and 5.

Course Outcomes:
After the completion of the above course students will be able to

    CO1: Estimate the various properties of fluids.
    CO2: Determine the forces exerted by a fluid at rest on plane or curved submerged surface.
    CO3: Recognize the various types of flow.
    CO4: Apply Bernoulli equation to solve a variety of fluid flow problems.
    CO5: Determine the flow through pipes considering major and minor losses.

Cos	Mapping with POs
CO1	PO1,PO3
CO2	PO3,PO4
CO3	PO3,PO4
CO4	PO1,PO2,PO3
CO5	PO3,PO4,PO5

Text books:
1. **A Textbook of Fluid Mechanics and Hydraulic Machines** by Dr. R.K Bansal, Lakshmi Publications, 2004.
2. **Fluid Mechanics & Hydraulic With Computer Applications,** Jagdish Lal**,** Metropolitan Book Co-Ltd. 2008.

Reference books:
1. **Fluid Mechanics** (SI Units), Yunus A. Cingel John M.Oimbala. Tata MaGrawHill, 2006.
2. **Fluid Mechanics** by John F.Douglas, Janul and M.Gasiosek and John A.Swaffield, Pearson Education Asia, 5th ed., 2006
3. **Fluid Mechanics and Fluid Power Engineering**, Kumar.D.S, Kataria and Sons., 2004
4. **Fluid Mechanics** -. Merle C. Potter, Elaine P.Scott. Cengage learning

Subject Title	: **COMPUTER AIDED MACHINE DRAWING**		
Sub Code	: **IML45**	**No of Credits : 2 : 0 : 2**	**No. of Hrs / Week : 4**
Exam Duration : 3 Hrs.	**CIE +Assignment + SEE = 50 + 50 =100**		**Total No. of Contact Hours : 13**

Objective:
1. To visualize an object and convert it into a drawing.
2. To train the students to use commercial solid modeling software package
3. To explain the basic concept and to draw the views of section of solids, orthographic projections and threaded fasteners
4. To gain knowledge of conventional representation of mechanical Components
5. This course will give an insight to design, creation of an assembly and detailed drawing of machine components

Unit No	Syllabus	No of Hours
1	**Introduction:** Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap. **Sections of Solids:** Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on, axis inclinations, spheres and hollow solids). True shape of sections. **Orthographic Views:** Conversion of pictorial views into orthographic projections. of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions. Precedence of lines.	8
2	**Geometric Dimensions and Tolerances:** Drafting, tolerance and geometrical symbols used in machine drawing. **Fasteners:** Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) **Riveted Joints:** Single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets).	08
3	Assembly Drawings(Part drawings should be given) 1. Screw jack (Bottle type) 2. Machine vice 3. Plummer block 4. I.C. Engine connecting rod	18

Note 1: SEE Question paper contains total six Questions (two questions from each unit) and student should answer any one question from Unit I and Unit II and III (student shall answer total 3 questions).

Course Outcomes:

After the completion of the above course students will have the

1. Ability to use standard software tools to create part assemblies
2. Ability to create fully constrained solid models that can be quickly modified using standard software tools
3. Ability to identify and explain standard features in solid modeling including protrusion, revolution, cutouts and patterns.
4. Ability to use standard software tools to create engineering drawings to describe the geometries and dimensions of parts
5. Ability to create computer aided drawings by interpreting and applying drafting standards.

Cos	Mapping with POs
CO1	PO2,PO11
CO2	PO2,PO11
CO3	PO2,PO3,PO11
CO4	PO2,PO3,PO11
CO5	PO2,PO3,PO11

Text books:

1. **'Machine Drawing'**, K.R. Gopala Krishna, Subhash Publication
2. **'Machine Drawing'**, N.D.Bhat & V.M.Panchal

Scheme of Examination:

ONE question from Unit 1	10 Marks
ONE question from Unit 2	10 Marks
ONE question from Unit 3	30 Marks
Total	**50 Mark**

Reference books:

1. **'A Primer on Computer Aided Machine Drawing - 2007'**, Published by VTU, Belgaum.

Suitable Softwares Used: Solid Edge

Subject Title	: ENGINEERING METROLOGY & MEASUREMENT LAB	
Sub Code : IML46	**No of Credits : 0:0:1**	**No. of Hrs / Week : 3**
Exam Duration : 3 Hrs.	**CIE +Assignment + SEE = 50 + 50 =100**	**Total No. of Contact Hours : 13**

Objective:
1. To study the Measurement standards available and to apply.
2. To study and learn the calibration procedure for different instruments.
3. To provide hands on experience and to study the various types of gauges, projectors, comparators and transducers.
4. To know and learn the applications of different measuring instruments used in manufacturing / production industries for inspection and calibration.

	MECHANICAL MEASUREMENTS
1	Calibration of Pressure Gauge
2	Calibration of Thermocouple
3	Calibration of LVDT
4	Calibration of Load cell
5	Determination of modulus of elasticity of a mild steel specimen using strain gauges
	METROLOGY
1	Measurements using Optical profile Projector and Toolmaker Microscope.
2	Measurement of straightness using Autocollimator, measurement of angle using Sine Center / Sine bar / bevel protractor

3	Measurement of cutting tool forces using
	        Lathe tool Dynamometer
	        Drill tool Dynamometer.

4	Measurement of Screw threads Parameters using Two wire or Three-wire method.
5	Measurement of surface roughness using Talysurf. Linear measurements using Mechanical Comparator, Electronic comparator.
6	Measurement of gear tooth profile using gear tooth vernier /Gear tooth micrometer
7	Calibration of Micrometer using slip gauges
8	Measurement using Optical Flats

Outcome:
After the completion of the above course students will be able to
1. Will be able to demonstrate standard operational procedures of different measuring instruments
2. Able to Calibrate Precision Instruments
3. Able to identify the different operating and instrument errors for calibration
4. Able to plot and interpret the operation characteristic and learning curves and also can give remedies/ suggestions for improvement that can be error free instrument.

Cos	Mapping with POs
CO1	PO1, PO3, PO4
CO2	PO1, PO2, PO12
CO3	PO5, PO12
CO4	PO4, PO5, PO12

Scheme of Examination:

ONE question from Mechanical Measurements	20 Marks
ONE question from Metrology	20 Marks
Viva –Voce	10 Marks
Total	**50 Marks**

Subject Title	: **MACHINE SHOP LABORATORY**	
Sub Code : IML47	**No of Credits** : 0:0:1	**No. of Hrs / Week : 3**
Exam Duration : 3 Hrs.	**CIE +Assignment + SEE = 50 + 50 =100**	**Total No. of Contact Hours : 13**

Objective:
1. To provide hands on experience and to understand the concepts and importance of widely used machining processes.
2. To understand the basic concepts of Metal cutting and cutting tool parameters.

1	Preparation of three models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.
2	Cutting of V Groove/ dovetail / Rectangular groove using a shaper.
3	Cutting of Gear Teeth using Milling Machine.

Outcome:
After undergoing the machine shop practice will be able to
1. Gain hands on experience on lathe tool and other machines.
2. Demonstrate the principles of different types of conventional machining processes
3. Determine the gear cutting using standard formulae

Cos	Mapping with POs
CO1	PO1,PO2
CO2	PO2,PO3
CO3	PO1,PO2

Scheme of Examination:
One Model from Lathe operations   30 marks
One Model from Shaping/Milling machine 10 marks
Viva – Voce   10 marks
Total   **50 marks**
Note: For CIE, 25 marks for Workshop diary and 25 marks for internal test.

V SEMESTER

Code No.	Course Name	CREDITS				Maximum marks		
		Lecture	Tutorial	Lab	Total	Continuous Internal Evaluation	Semester End Examination	Total
HS03	Management and Entrepreneurship	4	0	0	4	50	50	100
IM51	Engineering Economy	4	0	0	4	50	50	100
IM52	Facilities Planning and Design	3	0	0	3	50	50	100
IM53	Design of Machine Elements	3	1	0	4	50	50	100
IM54	Statistics for Engineers	3	1	0	4	50	50	100
IM55X	*Elective –I (Group- A)	3	0	0	3	50	50	100
IML56	Mechanical Lab	0	0	1	1	50	50	100
IML57	Statistics Lab	0	0	1	1	50	50	100
					24			800

Code No.	* Elective - I (Group – A)	Stream of Specialization
IM 551	Tool Engineering Design	Manufacturing
IM 552	Advanced Material Processing	Manufacturing
IM 553	Marketing Management	Management
IM 554	Value Engineering	Management
IM 555	Data Base Management System	Information System Design

VI Semester

Code No.	Course Name	Lecture				Tutorial		
		Lecture	Tutorial	Lab	Total	Continuous Internal Evaluation	Semester End Examination	Total
IM 61	Materials Management	3	0	0	3	50	50	100
IM 62	Quality Assurance & Reliability	4	0	0	4	50	50	100
IM 63	Operations Research	3	1	0	4	50	50	100
IM 64	Simulations Modeling and Analysis	4	0	0	4	50	50	100
IM 65	Computer Integrated Manufacturing	4	0	0	4	50	50	100
IM 66X	*Elective –II (Group- B)	3	0	0	3	50	50	100
IML 67	Quality Engineering Lab	0	0	1	1	50	50	100
IML 68	Simulation Lab	0	0	1	1	50	50	100
IMP 69	Mini Project	0	0	2	2	50	50	100
					26			900

Code No.	* Elective Group – B	Stream of Specialization
IM 661	Composite Materials	Manufacturing
IM 662	Organizational Behavior	Management
IM 663	Maintenance & Safety Engineering	Management
IM 664	Reliability Engineering	Optimization Technique
IM 665	Software Engineering & Management	Information System Design

VII Semester

Code No.	Course Name	CREDITS				Maximum marks		
		Lecture	Tutorial	Lab	Total	Continuous Internal Evaluation	Semester End evaluation	Total
HS 04	Intellectual Property Rights	2	0	0	2	50	50	100
IM 71	Supply Chain Management	3	0	0	3	50	50	100
IM 72	Operations Management	4	0	0	4	50	50	100
IM 73	Financial Management and Accounting	3	1	0	4	50	50	100
IM 74	Project Management	3	0	0	3	50	50	100
IM 75X	*Elective Group–III(Group–C)	3	0	0	3	50	50	100
IML 76	Enterprise Resource Planning Lab	0	0	1.5	1.5	50	50	100
IML 77	CIM Lab	0	0	1.5	1.5	50	50	100
IML78	Project Phase – I	0	0	0	0	00	00	000
IME01	Inter Departmental Elective – I	4	0	0	4	50	50	100
					26			900

Inter Department Elective -I	
IME 01	Engineering Economy

*Elective –III (Group C)	
IM751	Lean Manufacturing
IM752	Product Design and Manufacturing
IM753	World class management practices
IM754	Design of Experiments
IM755	Enterprise Resource Planning and E- commerce

VIII Semester

Code No.	Course Name	CREDITS				Maximum marks		
		Lecture	Tutorial	Lab	Total	Continuous Internal Evaluation	Semester End evaluation	Total
IME 02	Inter departmental Elective - II	4	0	0	4	50	50	100
IM 81*	*Elective – IV (Group D)	3	0	0	3	50	50	100
IM 82**	**Elective – V (Group E)	3	0	0	3	50	50	100
IM P83	Subject Seminar	0	0	2	2	50	00	50
IMS84	Phase _ II Project Work	0	0	12	12	100	100	100
					24			450

Inter departmental Elective –II	
IME 02	Operations research

** Elective Group – D	
IM 811	Rapid Prototyping
IM 812	Advanced Ergonomics
IM 813	Total Quality Management
IM 814	Human Resource Management
IM 815	Advanced Operations Research

* Elective Group – E	
IM 821	Strategic Management
IM 822	Technology Management
IM 823	Just in Time Manufacturing
IM 824	Human Factors Engineering
IM 825	Management Information System

Electives and Stream of Specialization from V semester to VIII semester

Stream of Specialization	Electives				
	V SEM	VI SEM	VII SEM	VIII SEM	
	Group A	Group B	Group C	Group D	Group E
Manufacturing	Tool Engineering Design	Composite Materials	Lean Manufacturing	Rapid Prototyping	Just in Time Manufacturing
	Advanced Material Processing	--	Product Design and Manufacturing	Advanced Ergonomics	--
Management	Marketing Management	Organizational Behavior	World class management practices	Total Quality Management	Strategic Management
	Value Engineering	Maintenance & Safety Engineering	Design of Experiments	Human Resource Management	Technology Management
	--	--	--	--	--
	--	--	--	--	Human Factors Engineering
Information System	Data Base Management System	Software Engineering & Management	Enterprise Resource Planning & E-commerce	--	Management Information System
	--	--	--	--	--
Optimization Technique	--	Reliability Engineering	--	Advanced Operations Research	

V Semester IEM

Sub Title : MANAGEMENT & ENTREPRENEURSHIP		
Sub Code :HS 03	No. of Credits:4=4 : 0 : 0 (L-T-P)	No. of lecture hours/week : 4
Exam Duration : 3 hrs	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 52

COURSE OBJECTIVES:
1. Explain the concepts of management and develop managerial skills. 2. Outline the entrepreneurial process and appreciate the qualities of an entrepreneur. 3. Determine the activities involved in establishing a business venture.

Unit No.	Syllabus Content	No of Hours
1	**MANAGEMENT:** Introduction-meaning-nature andcharacteristics of management, scope and functional area of management, management as a science or art of profession, management and administration roles of management, levels of management, Development of management thought - Early management approaches, Modern management approaches.	08
2	**PLANNING, ORGANIZING, DIRECTING AND CONTROLLING:** **PLANNING:** Meaning and Nature, Types of Plans and Steps in Planning process. **ORGANIZING:** as a Managerial function – Nature and purpose of organization, principles of organization, types of organization. Departmentation, Committees, Centralization Vs Decentralization of authority and responsibility span of control, MBO and MBE; Staffing: Nature and importance of staffing, process of selection and recruitment, types of interviews. Decision Making Process. **DIRECTING:** Meaning and nature of directing, leadership styles – Autocratic, Democratic, Charismatic, Laissez faire and Participative. Leadership theories – Trait, Behavioural and Contingency. Team Building & Group Dynamics – Introduction to Motivation theories – Maslow, Herzberg, Carrot & Stick &Mcgregor's Theory of X & Y. Communication – meaning and importance, types. **CO-ORDINATION:** Meaning and importance of Co-ordination **CONTROLLING:** Meaning and steps in controlling-Essentials of a sound control system-Types of control, Method of establishing control (in brief)	10
3	**ENTREPRENEUR**: Meaning, evolution of the concept, functions of an Entrepreneur, types of entrepreneur, Entrepreneur – an emerging class. Stages in Entrepreneurial process, Role of Entrepreneurs in economic development, Entrepreneurship-its barriers. Reasons for success and failure of an entrepreneur, Entrepreneurial Life Cycle, Areas of entrepreneurship in Indian context, Difference between Entrepreneur & Manager	10

4	**SMALL SCALE INDUSTRY**: Ancillary Industry and Tiny Industry , Definition:, Characteristics; Need and rationale: Objectives, Scope and role of SSI in economic Development, Advantages of SSI, problems of SSI, Steps to start an SSI,Government Policy towards SSI; Introduction to GATT/ WTO/ LPG. Forms of ownership. **SUPPORTING AGENCIES OF GOVERNMENT FOR SSI:** Meaning, Nature of support; Objectives, functions. **INSTITUTIONAL SUPPORT:** Different Schemes, TECKSOK, KIADB, KSSIDC, DIC Single Window agency SISI NSIC SIDBI, KSFC. Sources of financing an enterprise- long term and short term.	**12**
5	**PREPARATION OF PROJECT:** Meaning, Project identification, Project selection, Project Report - Need and Significance of Project, Contents: formulation:, Network Analysis Errors of project report, Project Appraisal, Feasibility Study-Market Feasibility Study, Technical Feasibility Study, Financial Feasibility Study, Social Feasibility Study. Project Management-Importance.	**12**

Note 1: **Unit 2 and Unit 4 will have internal choice.**
Note 2: **Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.**
   Assignment - 2 from units 3, 4 and 5.

COURSE OUTCOMES:
By the end of the course students will be able to
- Analyze the importance of management concepts.
- Describe the importance of entrepreneurship in emerging India.
- Interpret the start, install and manage a new business

Cos	Mapping with POs
CO1	PO4,PO5
CO2	PO5,PO7,PO11,PO12
CO3	PO4,PO7,PO10,PO11,PO12

TEXT BOOKS:	
• Entrepreneurship and management - Shashi k Gupta- Kalyani publishers, Latest edition. • Dynamics of Entrepreneurial Development and Management-Vasant Desai- Himalaya Publishing House. • Principles of Management – PC Tripathi, and P N Reddy – Tata MacGraw Hill.	

REFERENCE BOOKS:	
• Entrepreneurship Development – Poornima M Charanthimath Pearson Education 2006 • Entrepreneurship and Management- S Nagendra and V S Manjunath- Pearson Publicat 4 /e, 2009. • Organizational behaviour, Stephen P Robbins, Timothy A. Judge, Neharika Vohra, Pearson, 14/e, 2012. • Financial Management- Shashi k Gupta- Kalyani publishers, Latest edition.	

Sub Title : ENGINEERING ECONOMY		
Sub Code : IM51	**No. of Credits:4=4 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hrs	**CIE +Assignment + SEE =** **45 + 5 + 50 =100**	**Total No. of Contact Hours :** **52**

Objective :
1. To Prepare Students to analyze cost or Revenue Data 2. To apply engineering economic decision making to realistic problems. 3. To justify or reject alternatives or Projects on an Economic basis 4. To Define the Replacement analysis as part of maintenance aspects for better decision making 5. To Define estimation and costing of the manufactured products as part of financial aspect for profit maximization or minimization of losses in the business

Unit No.	Syllabus Content	No of Hours
1	**INTRODUCTION:** Engineering Decision- Makers, Engineering and Economics, Problem solving and Decision making, Intuition and Analysis, Tactics and Strategy. Interest and Interest factors: Interest rate, simple interest, Compound interest, Cash- flow diagrams, Exercises and Discussion.	08
2	**PRESENT WORTH COMPARISON:** Conditions for present worth comparisons, Basic Present worth comparisons, Present worth equivalence, Net Present worth, Assets with unequal lives, infinite lives, Future worth comparison, Pay – back comparison, Exercises, Discussions and problems. Equivalent annual worth comparisons: Equivalent Annual Worth Comparison methods, Situations for Equivalent Annual Worth Comparison, Consideration of asset life, Comparison of assets with equal and unequal lives, Use of sinking fund method, Annuity contract for guaranteed income, Exercises, Problems.	14
3	**RATE OF RETURN CALCULATIONS:** Rate of return, Minimum acceptable rate of return, IRR, IRR misconceptions, Cost of capital concepts, replacement models. **Depreciation**: Causes of Depreciation, Basic methods of computing depreciation charges**.** Structural analysis of alternatives: Identifying and Defining alternatives, IRR analysis of mutually exclusive alternatives, Capital Budget view point, Ranking criteria.	14
4	**REPLACEMENT ANALYSIS:** Introduction, reasons for replacement**,** Individual Replacement of machinery or equipment with/without value of money, Group Replacement Policies, Problems. **EFFECTS OF INFLATION:** Causes, consequences and control of inflation. After tax actual cash flow comparisons, Lease/ Buy decisions.	07
5	**ESTIMATING & COSTING:** Components of costs such as Direct Material Cost, Direct Labour Cost, Fixed, Over – Heads, Factory Costs, Administrative – Over Heads, First Cost, Marginal Cost, Selling price, Estimation for simple components. Break-even analysis: Basic Concepts Linear & non-linear break	09

even analysis.	

Note 1: **Unit 2 and Unit 3 will have internal choice.**
Note 2: **Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.**
Assignment - 2 from units 3, 4 and 5.

Outcome:
By the end of the course students will be able to
1. Perform and evaluate present worth, future worth and Annual worth analyses on one of more economic alternatives.
2. Assess the payback period and capitalized Cost on one or more economic alternatives.
3. Carry out and estimate the benefit/cost, life cycle.
4. Interpret breakeven analyses on one or more economic alternatives

Cos	Mapping with POs
CO1	PO2,PO4,PO5,PO7,PO11
CO2	PO4,PO5,PO6,PO7,PO11,PO12
CO3	PO4,PO6,PO7,PO11,PO12
CO4	PO6,PO7,PO11,PO12

TEXT BOOKS:
Engineering economics - RIGGS J.L. McGraw Hill, 2015.
Engineering economy - PAUL DEGARMO, Macmillan Pub, Co. 2006.
Engineering Economy - Naidu, Babu and Rajendra –, New Age International Pvt. Ltd. - 2006
REFERENCE BOOKS:
Financial Management - I M PANDAY, Vikas Publishing House 2016.
Engineering economy - THUESENH.G. PHI, 9th edition, 2012
Engineering Economics – Tara Chand, 9th ediction, 2012

Sub Title :	FACILITIES PLANNING AND DESIGN	
Sub Code : IM52	No. of Credits: 3= 3 : 0 : 0 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 39

Objectives:
1. Explain the concepts of plant layout, layout planning and designing efficient facilities
2. Solve location and layout problems by considering the entire manufacturing and/or service systems within their supply chains.
3. Assess the role of facilities planning in reducing costs and increasing productivity and service level through selection of better material handling.
4. Elaborate on the concepts of computer-aided layout designs better facility design.

Unit No.	Syllabus Content	No of Hours
1	**PLANT LOCATION:** Factors influencing plant location, Theories of plant location and location economics. Location models: Selection of site by Break even analysis, Factor Rating method, Centre of gravity method (problems) **Plant layout**-Objectives of plant layout, Principles of plant layout, types of plant layout, and their merits and demerits **PLANT DESIGN:** Layout procedures: Immer, Nadler, Muther, Apple and Reed's approaches, systematic layout planning.	10
2	**MATERIAL HANDLING:** Objectives and principles of Material handling, Unit load concept, Material handling equipments, Selection of material handling equipments, Production line balancing.	06
3	**COMPUTERIZED LAYOUT PLANNING:** CRAFT, COFAD, PLANET, CORELAP, ALDEP	05
4	**SPACE DETERMINATION AND AREA ALLOCATION:** Factors for consideration in space planning, receiving, storage, production, shipping, tool room and tool crib, other auxiliary service actions, Establishing total space requirement, area allocation factors to be considered, expansion, flexibility, aisles column, area allocation procedure, the plot plan. **CONSTRUCTION OF THE LAYOUT:** Methods of constructing the layout, evaluation of layout, efficiency indices.	10
5	**QUANTITATIVE APPROACHES TO FACILITIES PLANNING:** Deterministic models single and multi-facility location models, Location allocation problems – quadratic assignment problem, Warehouse layout models, Evaluation, selection and implementation of facilities plan.	08

Note 1: **Unit 1 and Unit 4 will have internal choice.**
Note 2: **Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.**
      Assignment - 2 from units 3, 4 and 5.

Outcomes:
By the end of the course students will be able to

By the end of the course students will be able to
1. Solve facility location problems and prepare a facilities layout for the efficient flow of materials through a facility
2. Analyze material handling systems through different material handling equipment and material handling principles used in the warehousing, manufacturing
3. Plan the layout and evaluate facilities related problems using different layout planning algorithms
4. Identify activity, relationships and space requirements for various departments
5. Evaluate and select facilities plan

Cos	Mapping with POs
CO1	PO3,PO4
CO2	PO3,PO6
CO3	PO5,PO6
CO4	PO4,PO7
CO5	PO3,PO4,PO7

TEXT BOOKS:
1. Plant Layout and Material handling - James M Apple, 2nd Edition, John, Wiely and Sons
2. Facility layout and Location- Francies R L and White J A, Mc Graw Hill 2nd edition

REFERENCE BOOKS:
1. Practical layout- Muther Richard, Mc Graw Hill-1955.
2. Facilities Design, Sunderesh Heragu, PWS Publishing Company, ISBN-0-534-95183.
3. Plant Layout Design - James M Moore, Mac Millon Co.1962 LCCCN61- 5204.

Sub Title : DESIGN OF MACHINE ELEMENTS		
Sub Code : IM53	No. of Credits:4=3 : 1 : 0 (L-T-P)	No. of lecture hours/week : 4
Exam Duration : 3 hrs	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 52

Objective:
1. Explain the basic components of machinery.
2. Select and size the components and achieve design goals in the construction of mechanical systems
3. Choose the design parameters from Data Hand book to solve the design issues.
4. Define the design issues in various engineering components.
5. Determine the stress developed due to various types of loads.

Unit No.	Syllabus Content	No of Hours
1	**Design for Static Strength**: static loads, static strength and factor of safety. Theories of failure: Maximum Normal Stress Theory, Maximum Shear Stress Theory, Distortion energy theory. Failure of Brittle & Ductile materials. Stress concentration. Determination of stress concentration factor.	9+7(T)
2	**Design for Fatigue Strength**: Fatigue strength, S-N Diagram, low cycle and high cycle fatigue. Endurance limit. Modifying factors: Load, Size and Surface finish effects. Fatigue stress concentration factor. Combined study and Fluctuating stresses. Goodman and Soderberg Relationship. Stresses due to combined loading.	7+4(T)
3	**Design of Springs:** Types of springs, stresses in coiled springs of circular and non-circular cross sections, tension and compression springs, stresses in leaf springs.	7+4(T)
4	**Design of Mechanical joints:** Types of riveted joints, rivet materials, failures of riveted joints (Problems on longitudinal joint only). Types of welded joints, Strength of butt and fillet welds, Eccentrically loaded welds, Design of cotter and knuckle joints.	9+6(T)
5	**Design of Gears:** Design of spur gear, Lewis equation, form factor, stresses in gear tooth, dynamic and wear load.	7+5(T)

Note 1: Unit 1 and Unit 4 will have internal choice.
Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
       Assignment - 2 from units 3, 4 and 5.

Outcome:
By the end of the course students will be able to
1. Illustrate how the static and dynamic strength parameters affect the material and to know the concepts of factor of safety.
2. Conduct a failure analysis for the design of mechanical components subjected to cyclic

load
3. Calculate the stress distribution for axial, shear forces and bending moments and torques in spring and joints using the "strength of materials" approach.
4. Explain the gear type and design the spur gear

Cos	Mapping with POs
CO1	PO1,PO3,PO4,PO9
CO2	PO1,PO3,PO4,PO9
CO3	PO1,PO3,PO4,PO9
CO4	PO1,PO3,PO9

TEXT BOOKS:
1. Joseph Edward Shigley – **Mechanical Engineering Design**, Tata McGraw Hill, New Delhi, 1986.
2. VL. Maleev and Hartman **– Machine Design**, CBS Publishers and Distributors, Delhi, 1983.
3. V. B. Bahandari **– Design of Machine Elements**, Tata McGraw Hill, New Delhi, 2000.
4. C.S Sharma and Kamlesh purohit- Design of machine Elements, PHI learning Eastern economy edition.2009

REFERENCE BOOKS:
1. Robert. L. Norton – Machine Design, Pearson Education Asia, New Delhi, 2001.
2. Hall, Holowinko, Laughlin – Theory and Problems of Machine Design, Schaums Outline Series, 2002.
3. N. C. Pandey and C. S. Shah – Elements of Machine Design, 2002 – Chorotar Publishing house.

Sub Title : STATISTICS FOR ENGINEERS		
Sub Code : IM54	No. of Credits:4=3 : 1 : 0 (L-T-P)	No. of lecture hours/week : 4
Exam Duration : 3 hrs	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 52

Objective:
1. Apply the basic fundamental concepts of Statistics to engineering problems and the importance of Data summary and Display.
2. Evaluate the application of discrete probability distribution to various manufacturing problems.
3. Calculate Continuous probability distribution to various manufacturing problems.
4. Explain the hypothesis to random experiments of manufacturing processes.
5. Test the statistical parameters by regression and correlation. and test for variance

Unit No.	Syllabus Content	No of Hours
1	**THE ROLE OF STATISTICS IN ENGINEERING (DATA SUMMARY AND PRESENTATION):** Statistical Thinking, Collecting data, Statistical Modeling Frame work, measure of central tendency and variance, Importance of Data summary and Display, Tabular and Graphical display	08
2	**DISCRETE RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS:** Discrete Random variables, Probability distributions and Probability mass functions, Cumulative distribution functions, Mean and Variance of a discrete random variable, Discrete uniform distribution, Binominal distribution, Hyper Geometric distribution, Poisson distribution and their Applications.	08+ 02(T)
3	**CONTINUOUS RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS:** Continuous random variables, Probability distributions and probability density functions, cumulative distribution functions, Mean and Variance of a continuous random variable, uniform distribution, Normal distribution, Normal approximation to Binominal and Poisson distribution, Exponential distribution and their Applications.	08+ 02(T)
4	**ESTIMATION THEORY:** Statistical Inference, Random sampling, Properties of Estimators, Sampling distribution, Sampling distribution of mean, variance and proportion. Introduction to confidence intervals. **STATISTICAL INFERENCE FOR A SINGLE SAMPLE AND TWO SAMPLES:** Hypothesis testing, Inference on the mean of a population (variance known and unknown), Inference on the variance of a normal population, Inference on a population proportion. Testing for Goodness of	10+ 02(T)

	Fit, Inference for a difference in Means, Variances known, Inference for a difference in means of two normal distributions, Variances unknown, Inference on the Variances of two normal populations, Inference on two population proportions.	
5	**SIMPLE LINEAR REGRESSIONS AND CORRELATION:** Simple Linear Regression, Properties of Least square Estimators and Estimation of variances, Common abuses of regression, Prediction of new observations, Assessing the adequacy of regression model, Transformations to a straight line, Introduction to multiple regression (no problems), Correlation. **DESIGN OF EXPERIMENTS:** Strategy of experimentation, completely randomized single - factor experiment, Tests on individual treatment means, the random effects model, the randomized complete block design, one way analysis of variance and two way analysis of variance.	10+2(T)

Note 1: Unit 2 and Unit 4 will have internal choice.
Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
Assignment - 2 from units 3, 4 and 5.

Outcome:

By the end of the course students will be able to
    1. Apply the statistical data in the form of Tabular and Graphical display.
    2. Identify discrete type of probability and solve the various engineering problems.
    3. Solve Continuous type of probability and solve the various engineering problems
    4. Estimate the hypothesis and give inference to random experiments.
    5. Evaluate the statistical parameters by estimation.

Cos	Mapping with POs
CO1	PO1,PO2,PO12
CO2	PO1,PO2,PO3,PO12
CO3	PO1,PO2,PO3,PO12
CO4	PO1,PO2,PO3,PO4,PO12
CO5	PO1,PO2,PO3,PO5,PO9,PO12

TEXT BOOKS:
    1. **Applied statistics and Probability for Engineers** – Douglas C Montgomery, George C Runger, 2nd Edn, John Wiley and Sons, ISBN-0-471-17027-5
    2. **Statistics for Management -** Richard I Levin, David S Rubin, 6th Edn, Prentice Hall India, ISBN-81-203-0893-X
REFERENCE BOOKS:
    1. **Probability and Statistics in Engineering** - William W Hines, Douglas C Montgomery, 2nd Edn, John Wiley and Sons
    2. **Business Statistics for Management and Economics** - Daniel, Terrell, 6th Edn, Houghton Mifflin Company, ISBN-0-395-62835-0
    3. **Probability and Statistics** - Walpole & Mayer, MacMillan Publishing Company, 1989.

Sub Title : Advanced Materials Processing		
Sub Code: IM 552	**No. of Credits:3 =3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours : 39**

Course objectives:
• Explain the basic concepts of Advanced Machining Process.   • Determine the factors influencing process parameters and their performance and applications.

Unit No.	Syllabus Content	No of Hours
1.	**INTRODUCTION TO ADVANCED MACHINNG PROCESS-** Introduction to advanced machining, Need for advanced machining process, Comparison between traditional and non-traditional machining, general classification of advanced machining processes, classification based on nature of energy employed in machining, selection of advanced machining processes, Specific advantages, limitations and applications of non-traditional machining processes.	04
2	**ULTRASONIC MACHINIG PROCESS, ABRASIVE JET MACHINING PROCESS AND WATER JET MACHINING (WJM):** **UltraSonic Machinig Process:** Working Principles – equipment used and operations of Ultrasonic Machining, -USM Process parameters-Amplitude and frequency and vibration, Effect of grain diameter, Effect of applied static load, Effect of slurry and tool and work material Applications, Advantages and Limitiations of USM **Abrasive Jet Machining Process:** AJM Variables and accuracy- carrier Gas Type of abrasive, Size of abrasive grain, velocity of the abrasive jet, Mean No. abrasive particles per unit volume of the carrier gas, Work material, standoff distance (SOD), shape of cut & surface finish**,** Nozzle wear, accuracy & surface finish.Applications, advantages & Limitations of AJM. **Water Jet Machining (WJM):** Equipment & process, Operation, applications, advantages and limitations of WJM	12
3	**ELECTRIC DISCHARGE MACHINING PROCESS (EDM)-** Introduction, mechanism of metal removal, EDM equipmen, dielectric medium- its functions & desirable Properties, electrode feed control system. Flushing types; pressure flushing, suction flushing, side flushing, pulsed flushing. EDM process parameters: Spark frequency, current & spark gap, surface finish, Heat Affected Zone. Advantages, limitations & applications of EDM.	06
4	**ELCETRO CHEMICAL AND CHEMICAL MACHINING PROCESS:** Introduction, Principle of electro chemical machining: ECM equipment, elements of ECM operation, Chemistry of ECM. Electrolytes functions and properties – MRR, accuracy, surface finish and Process Parameters. Electrochemical grinding and electrochemical honing process. Advantages,	12

	disadvantages and application of ECG, ECH. **CHEMICAL MACHINING (CHM)** Elements of the process: Resists (maskants), Etchants. Types of chemical machining process-chemical blanking process, chemical milling process. Process characteristics of CHM: material removal rate, accuracy, surface finish, advantages, limitations and applications of chemical machining process.	
5	**LASER BEAM MACHINING (LBM), ELECTRON BEAM MACHINING (EBM) AND PLASMA ARC MACHINING (PAM)** Introduction, Principle, equipment and mechanism of metal removal, applications, advantages and limitations. **Hybrid Manufactureing Process** and **Additive Manufactring Process** (Introduction aspcects only	05

Outcome:

By the end of the course students will be able to
1. Explain the modern manufacturing process and define the concepts of non-conventional machining process.
2. Describe the working principle, process parameters and variables in mechanical energy based machining process.
3. Define the concepts of electrical energy based metal removal process.
4. Illustrate the process of chemical and electro chemical machining.
5. Explain the machining process of thermal energy based machine tools.

Note 1: SEE Question paper contains total seven Questions and student should answer any one question from Unit II and Unit IV and student shall answer total five question.
Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
          Assignment - 2 from units 3, 4 and 5.

Cos	Mapping with POs
CO1	PO1, P03, PO8, P10, P11.
CO2	PO1, P03, PO5, PO8, P10, P11.
CO3	PO2, PO5, P010, P11.
CO4	PO1, P03, PO8, P10, P11.
CO5	PO1, P03, PO5, PO8, P10, P11.

TEXT BOOKS:
1. Modern machining process - PANDEY AND SHAH, TATA Mc Graw Hill 2000.
2. New technology - BHATTACHARAYA 2000
REFERENCE BOOKS:
1. **Production Technology**, by HMT TATA McGraw Hill 2001.
2. **Modern Machining Process** - ADITYAN 2002.
3. **Thermal Metal cutting processes** - B G Ranganath - I K International Publishing house Pvt. Ltd,
4. **Fundamentals of Machining and Machine Tools** - R.K.Singal - I K International Publishing

house Pvt Ltd,
5. **Wohlers Report 2001-**Terry Wohlers, Wohlers Associates, 2008.

Sub Title :	MARKETING MANAGEMENT	
Sub Code : IM 553	No. of Credits:3=3: 0 : 0 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 39

Objectives:
1. Explain the place and contribution of marketing to the business enterprise.
2. Describe the major types of consumer buying behavior
3. Assess and apply their strengths in marketing.
4. Model ethical and professional behavior.

Unit No.	Syllabus Content	No of Hours
1	**INTRODUCTION:** Importance of marketing, scope of marketing, Definition of Marketing, What is marketed? ,Elements of marketing, Philosophies of Marketing, The Marketing concept, Marketing mix, 4 Cs and 4 As of Marketing, 7 Ps of Marketing, **Market Oriented Strategic Planning :** Value in Marketing, the 5 Cs of marketing analysis, customer value , satisfaction and retention, Value delivery process, Market oriented strategic Planning , strategic intent, Igor Ansoff's product mix expansion grid. **CONSUMER MARKETS AND BUYING BEHAVIOR**: Characteristics affecting consumer behaviour, Types of buying decisions, Buying decision process, Classification of consumer products, Market segmentation.	08
2	**MARKETING INFORMATION SYSTEMS AND RESEARCH:** Components of marketing information system–benefits & uses marketing research system, marketing research procedure, measurement of market demand. **MARKETING OF INDUSTRIAL GOODS:** Nature and importance of the Industrial market, classification of industrial products, participants in the industrial buying process, major factors influencing industrial buying behavior, characteristics of industrial market demand. Determinants of industrial market demand Buying power of Industrial users, buying motives of Industrials users, the industrial buying process, buying patterns of industrial users	08
3	**PRODUCT PLANNING AND DEVELOPMENT:** Product meaning, Goods & services, Product mix, levels of products, product life cycle, managing the product in product life cycle, types of new product, test marketing a new product, portfolio analysis.	07
4	**BRANDING, LABELLING AND PACKAGING:** Branding, Reasons for branding, functions of branding, features and types of brands, kinds of brand name. **LABELLING:** Types, functions, advantages and disadvantages **PACKAGING:** Meaning, growth of packaging, function of packaging, kinds of packaging.	10

5	**PRICING:** Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for price determination, kinds of pricing, pricing strategies and decisions. **DISTRIBUTION:** Marketing channels – functions, types of channels of distribution, number of channel levels. Physical distribution – importance, total systems concept, strategy, use of physical distribution.	
5	**ADVERTISING AND SALES PROMOTION:** Objectives of advertisement function of advertising, classification of advertisement copy, advertisement media – kinds of media, advantages of advertising. Objectives of sales promotion, advantages sales promotion. **PERSONAL SELLING:** Objectives of personal selling, establishing the Sales force objectives, sales – force strategy, sales force structure and size, salesmanship, qualities of good salesman, types of salesman, major steps in effective selling.	**06**

Note 1: **Unit 2 and Unit 4 will have internal choice.**
Note 2: **Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.**
Assignment - 2 from units 3, 4 and 5.

Outcomes:
1. Identify market and appropriate segmentation criteria to discover promising market niches
2. Describing the benefits and the emerging trends of marketing research.
3. Analyze marketing decisions in marketing of Industrial goods
4. Apply knowledge of key marketing concepts in new product development an integrated manner.
5. Identify the roles of advertising, sales promotion and branding,

Cos	Mapping with POs
CO1	PO8
CO2	PO3,PO8,PO10,PO11
CO3	PO5,PO8,PO11
CO4	PO6,PO7,PO10,PO11
CO5	PO6,PO7,PO10,PO11

TEXT BOOKS:
1. **Principles of Marketing** - Philip Kotler , Prentice – Hall. 11th Edn.
2. **Marketing Management -** Philip Kotler , Prentice – Hall. 12th Edn.
3. **Marketing Management** - Michael R Czinkota, , 2nd Edition, Vikas Publishing House, ISBN 981-240-366-3
4. **Marketing Management** – An Indian perspective – Prof. Vijay Prakash Anand

REFERENCE BOOKS:
1. **Fundamentals of Marketing -** Wiliam J Stanton, McGraw Hill, 1994
2. **Marketing Management** - S.A Sherlaker,", 1999.
3. **Rajagopal, Marketing Management Text& Cases** - Vikas Publishing House, ISBN 81-259-0773-4

Subject Title	: MECHANICAL LAB		
Sub Code	: IML56	No. of Credits:1=0 : 0 : 1 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100		Total No. of Contact Hours : 36

Objective:
1. To determine the flashpoint, fire point, and viscosity of lubricating oils. 2. The find calorific value of solid and gaseous fuels. 3. To test the IC Engine parameters. 4. To calibrate orifices and a pipes. 5. To test the performance of pumps.

PART – A Individual Experiments	
1	Determination of Flash point and Fire point of lubricating oil using Abel Pensky Martins Apparatus
2	Determination of Calorific value of solid and gaseous fuels.
3	Determination of Viscosity of a lubricating oil using Redwoods and Say bolts – Viscometers.
PART – B Group experiments	
1	Performance Tests on Four stroke Petrol and Diesel Engines, Calculations of IP, BP, Thermal efficiencies, SFC, FP and heat balance sheet
2	Performance Test on Four strokes Petrol - Calculations of IP, BP, Thermal efficiencies, SFC.
3	Calibration of Venturi meter, Flow through pipes.
4	Performance test on centrifugal and reciprocating pumps

Outcome:

By the end of the course students will be able to
   1. Determine the flashpoint, fire point, and viscosity of lubricating oils.
   2. Find calorific value of solid and gaseous fuels.
   3. Demonstrate in a better way how to improve efficiency of an engine.
   4. Calculate the flow parameters of orifices, pipes and pumps

Cos	Mapping with POs
CO1	PO1,PO2, PO3
CO2	PO1,PO2, PO3
CO3	PO2,PO3,PO8,PO10
CO4	PO2,PO3,PO10

Sub Title : STATISTICS LAB		
Sub Code : IML57	No. of Credits: 1= 0 : 0 : 1 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 36

Objective:
1. Explain and apply the basic fundamental concepts of Statistics to engineering problems and the importance of Data summary and Display.   2. Application of probability distributions to various manufacturing problems.   3. Application of hypothesis to random experiments of manufacturing processes.   4. Test the statistical parameters by regression and correlation.   5. Design an engineering problem as random experiment to solve and test for variance.

Unit No.	Syllabus content	Hrs
1	1. Determining basic statistics (Mean, Median, Mode, and Standard deviation, Range, Harmonic Mean, Geometric Mean, Variance and Coefficient of variation) for the given quality characteristic and interpreting it. 2. Representing the data in graphical forms: Line graph, Bar graph, Pie Chart, Stem and leaf plot, Histogram, Pareto Chart. 3. Construction of Scatter diagram for the given variables and interpretation of different forms of scatter diagrams. 4. Conduction of regression analysis for two variables using least squares method and fitting a straight line. 5. Conduction of multiple regression analysis for the given variables.	15
2	1. Interval estimation and hypothesis testing on mean of a normal distribution. 2. Interval estimation and hypothesis testing on difference in means of two normal distributions. 3. Hypothesis testing on variance of a normal population. 4. Hypothesis testing on variances of two normal populations. 5. Hypothesis testing on a single population proportion. 6. Fitting an appropriate distribution (normal distribution) for the given variable quality characteristic 7.Conduct One way and two way ANOVA Analysis for the given problem 8.Design of experiments using CATAPULT	21

Outcome:
By the end of the course students will be able to   1. Apply the statistical data in the form of Tabular and Graphical display.   2. Identify discrete type of probability and solve the various engineering problems.   3. Solve Continuous type of probability and solve the various engineering problems   4. Estimate the hypothesis and give inference to random experiments.   5. Evaluate the statistical parameters by estimation.

Cos	Mapping with POs
CO1	PO1,PO2,PO3,PO6,PO7,PO11,PO12
CO2	PO1,PO2,PO3,PO6,PO7,PO11,PO12
CO3	PO1,PO2,PO3,PO6,PO7,PO11,PO12
CO4	PO1,PO2,PO3,PO6,PO7,PO11,PO12

Scheme of Examination:

ONE question from Unit -1: 15 marks
ONE question from Unit -1: 25 marks
Viva-Voce   : 10 marks

Suggested software:
1. Statistical Packages : SYSTAT / MINITAB / SPSS and such others

Subject Title	: INDUSTRIAL ENGINEERING LAB	
Sub Code : **IML58**	**No. of Credits:1=1 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hrs	**CIE +Assignment + SEE =** **45 + 5 + 50 =100**	**Total No. of Contact Hours : 36**

Objectives:
1. Explain and apply the basic fundamental concepts of Industrial engineering to small industrial experimental problems.
2. Construct various charts using recording techniques.
3. Application and development of different plant layouts.
4. Analysis and practice of performance rating experiments.
5. Test the statistical parameters by regression and correlation.

PART – A (METHOD STUDY)	
1	Recording Techniques**:** Preparing the following charts and diagrams (Minimum 3 Charts) - Outline process chart, Multiple Activity Chart, Flow process chart and Flow diagram, String diagram.
2	Experiments on the Application of principle of motion economy, Two handed process chart.
3	Exercises on conducting method study for assembling simple components and office work.
4	Development of Layout plans using SLP technique.
PART – B (WORK MEASUREMENT)	
1	Rating practice using: walking simulator, pin board assembly, dealing a deck of cards and marble collection activity
2	Determining the standard time for simple operations using stopwatch time study
3	Exercises on estimating standard time using PMTS.
4	Measurement of parameters (heart beat rate, calorie consumption) using walking simulator
5	Measurement of parameters (heart beat rate, calorie consumption, revolutions per minute) using ergometer
6	Effect of Noise, Light, Heat on human efficiency in work environments.

Outcome:
By the end of the course students will be able to.
1. Apply basic fundamental concepts of Industrial engineering to practical applications.
2. Construct and interpret various charts and diagrams for manufacturing activities to minimize the delays and unnecessary activities.
3. Develop and construct different plant layouts for feasibility check.
4. Experiment with performance rating activities.
5. Evaluate the statistical parameters by regression and correlation.

Cos	Mapping with POs
CO1	PO1,PO9,PO12
CO2	PO1,PO2,PO5,PO12
CO3	PO2,PO3,PO5,PO6,PO7,PO12
CO4	PO1,PO3,PO4,PO12
CO5	PO1,PO2,PO4,PO6,PO12

Scheme of Examination:

ONE question from Part A	20 Marks
ONE question from Part B	20 Marks
Viva –Voce	10 Marks
Total	**50 Mark**

VI Semester IEM

Sub Title : MATERIALS MANAGEMENT		
Sub Code : IM61	No. of Credits:3=3 : 0 : 0 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 39

Objective:
1. Define the concepts of modern materials management and aims to increase profitability.
2. Explain the purchasing principles and relationships with vendors.
3. Define the Application of different systems of codification and analysis of stores management and selective control techniques.
4. Determine basic concepts of Inventory management and their applications to industry.
5. Develop inventory models for different manufacturing situations along with price breaks.

Unit No.	Syllabus Content	No of Hours
1	**Introduction:** Importance of Materials Management – Definition, scope, organization for Materials Management, Objectives of materials management, an overview of system concepts, Benefits of an integrated system approach. **Materials Planning:** Making the materials plan work, the materials cycle and flow control system, Materials budget.	07
2	**Purchasing:** Purchasing Principles, Procedures and Practices, Fundamental Objectives of Purchasing**,** Scope, Preparation of forms and records for purchasing, Methods of Purchasing, reciprocity, Cost-Plus Contracts, Hedging, Sources of Supply and Supplier Selection, Legal Aspects of Purchasing, Law of Agency, Law of Contract, Vendor-Vendee Relations, Vendor Development, Vendor Rating.	10
3	**Stores Management and Operation:** Storage System, Stores Location and Layout, Development of Storing, Centralization and Decentralization of Stores. The Systems classification and Codification of Materials, ABC, FSND, VED analysis.Case studies on ABC Analysis	07
4	**Inventory Management: :** Definition of inventory, Need of inventory and its management, functions of inventory management, types of inventories, inventory control, cost elements, Economic Order Quantity, Max - Min system. Inventories and demand uncertainty.	05
5	**Deterministic Inventory models**: Dynamic inventory models, Instantaneous and finite rate of replenishment with and without shortage. Models with Price breaks & quantity discounts, (Numerical Exercises on EOQ) Determining safety stock. Q-system & P-system.	10

Note 1: Unit 2 and Unit 5 will have internal choice.
Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
Assignment - 2 from units 3, 4 and 5.

Outcome:
By the end of the course students will be able to. 1. Explain the concepts and Importance of Integrated Materials Management 2. Elaborate about the concepts of purchasing, types, objectives, procedure including vendor rating. 3. Design and layout for a stores, do codification, use selective control techniques to stock the items in stores. 4. Explain the basic concepts on inventory, inventory costs, EOQ. 5. Use the inventory models in practical applications.

Cos	Mapping with POs
CO1	PO3,PO9,PO10
CO2	PO4,PO8,PO9,PO12
CO3	PO3,PO4,PO9
CO4	PO2,PO3,PO4
CO5	PO2,PO3,PO4,PO9,PO11

TEXT BOOK:
1. Materials Management, P. Gopalakrishnan, PHI Pvt. Ltd, New Delhi, 2002 2. Materials Management, A.K. Datta., PHI Pvt. Ltd, New Delhi, 2001. 3. Operations Research, Kanti Swaroop, S Chand & Co. 2003
REFERENCE BOOK:
1. Handbook of Materials Management, P. Gopalakrishnan, PHI Pvt. Ltd, New Delhi, 2002. 2. Operations Research, Taha, McMillan, 4th edtion. 3. Gupta and hira, problems on operations reasearch

Sub Title	: QUALITY ASSURANCE AND RELIABILITY	
Sub Code : IM62	No. of Credits:4=4 : 0 : 0 (L-T-P)	No. of lecture hours/week : 4
Exam Duration : 3 hrs	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 52

Objectives:
1. To explain and define the basic concepts of Quality, Quality Assurance and discuss the ISO series. 2. To introduce the Statistical process control and process capability. 3. Application of control charts for variables and attributes. 4. To determine the customer's and producer's risk using sampling distribution. 5. To explain and define the concepts of failure models and reliability of the system.

Unit No.	Syllabus Content	No of Hours
1	**INTRODUCTION:** Definition of Quality, Quality function, Dimensions of Quality, Quality Engineering terminology, Brief history of quality methodology, Statistical methods for quality improvement, Quality costs – four categories costs and hidden costs. Brief discussion on sporadic and chronic quality problems. Introduction to Seven QC tools. **QUALITY ASSURANCE**: Definition and concept of quality assurance, departmental assurance activities. Quality audit concept, audit approach etc. structuring the audit program, planning and performing audit activities, audit reporting, ingredients of a quality program. ISO Series.(BIS standards/ ISO 9000 series stds)	08
2	**STATISTICAL PROCESS CONTROL:** Introduction to statistical process control – chance and assignable causes variation. Basic principles of control charts, choice of control limits, sample size and sampling frequency, rational subgroups. Analysis of patterns of control charts. Case Studies on application of SPC. Process capability – Basic definition, standardized formula, relation to product tolerance and six sigma concept of process capability. **CONTROL CHARTS FOR VARIABLES:** Control charts for X bar and Range, Statistical basis of the charts, Development and use of X bar R charts, Interpretation of charts for X bar and Standard Deviation (S), Development and use of X bar S control charts with Variable sample size, Control charts for individual measurements, cumulative-sum chart, moving-range charts.	12+(3T)
3	**CONTROL CHARTS FOR ATTRIBUTES:** Controls chart for fraction non- conforming (defectives) development and operation of control chart, brief discussion on variable sample size.	08

	Control chart for non-conformities (defects) – development and operation of control chart for constant sample size and variable sample size. Choice between variables and attributes control charts. Guidelines for implementing control charts.	
4	**SAMPLING INSPECTION:** Concept of accepting sampling, economics of inspection, Acceptance plans – single, double and multiple sampling. Operating characteristic curves – construction and use. Determinations of average outgoing quality, average outgoing quality level, average total inspection, producer risk and consumer risk. **USE OF PUBLISHED SAMPLING PLANS:** Gauge Repeatability & Reproducibility & Measurement system analysis.	12+(3T)
5	**RELIABILITY AND LIFE TESTING:** Failure models of components, definition of reliability, MTTF, MTBF, MTTR, Failure rate, common failure rate curve, types of failure, reliability evaluation in simple cases of exponential failures in series, paralleled and series-parallel device configurations, Redundancy and improvement factors evaluations.	06

Note 1: Unit 2 and Unit 4 will have internal choice.
Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
Assignment - 2 from units 3, 4 and 5.

Outcomes:
1. Able to identify the Quality products using dimensions of quality and be Aware of Quality Assurance and relate the ISO series   2. Can determine six sigma and process capability and construct control charts for variables.   3. Can determine control limits and construct control charts for attributes.   4. Can evaluate the acceptance criteria using sampling distribution.   5. Can Explain and evaluate the failure models and reliability of the system.

Cos	Mapping with POs
CO1	PO3,PO5,PO6,PO7,PO8,PO9,PO12
CO2	PO1,PO2,PO3,PO5,PO8,PO9,PO12
CO3	PO1,PO2,PO3,PO5,PO8,PO9,PO12
CO4	PO1,PO2,PO3,PO5,PO8,PO9,PO12
CO5	PO1,PO2,PO3,PO5,PO8,PO9,PO12

TEXT BOOKS

1. **Introduction to statistical Quality Control -** D C Montgomery 3rd Edition, John Wiley and Sons.
2. **Statistical Quality Control** - Grant and Leavenworth, McGraw Hill,   6th Edition

REFERENCE BOOKS

1. **The QS9000 Documentation Toolkit** -Janet L Novak and Kathleen C Bosheers," Prenctice Hall PTR, 2nd Edition
2. **ISO 9000 a Manual for Total Quality Management** - Suresh Dalela and Saurabh, S Chand and Co. 1st Edition
3. **Total Quality Management** – NVR Naidu, KM Babu and G. Rajendra – New Age International Pvt. Ltd – 2006
4. **Quality Planning & Analysis** - J M Juran, Frank M Gryna; Tata McGraw Hill, 3rd edition

Sub Title	: OPERATIONS RESEARCH	
Sub Code	: IM63	No. of Credits:4=3 : 1 : 0 (L-T-P)	No. of lecture hours/week : 4
Exam Duration : 3 hrs	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 52

Objectives:
1. To Define and formulate the LPP for different product types with constraints.
2. Application of graphical, Simplex and Big M and Duality technique.
3. To Define and discuss the Transportation methods to find optimum cost.
4. To explain and Define the concepts of queuing and Game theory.
5. Determine the Critical path and its duration, different types of floats using PERT/CPM.

Unit No.	Syllabus Content	No of Hours
1	**INTRODUCTION:** OR Methodology, Definition of OR, Application of OR to Engineering and Managerial Problems, Features of OR models, Limitation of OR. Models of OR. **LINEAR PROGRAMMING I:** Definition, Mathematical formulation, Standard form, solution space, Solution – Feasible, basic feasible, Optimal, Infeasible, Multiple, Optimal, Redundancy, Degeneracy, Graphical Method.	08
2	**LINEAR PROGRAMMING II:** Simplex method, variants of simplex algorithm – Artificial (Big-M method) basis techniques, Duality, Economic interpretation of Dual, Solution of LPP using duality concept, Dual simplex method. Application problems	10+(2T)
3	**TRANSPORTATION PROBLEM:** Formulation of transportation model, Basic feasible solution using different methods (North-West corner, Least Cost, Vogel's Approximation Method) Optimality Methods. Unbalanced transportation problem, Degeneracy in transportation problems, Variants in Transportation Problems, Applications of Transportation problems. **ASSIGNMENT PROBLEM:** Formulation of the Assignment problem, unbalanced assignment problem **TRAVELING SALESMAN PROBLEM**	10+(2T)
4	**QUEUING THEORY:** Queuing system and their characteristics, The M/M/I Queuing system, Steady state performance analyzing of M/M/1 queuing model. M/M/K/ Model. **GAME THEORY:** Formulations of games, Two persons zero sum game, games with and without saddle point, graphical solutions (2xn, mx2 game), and dominance property. Solution of game through LPP.	8+(2T)
5	**PROJECT MANAGEMENT USING NETWORK ANALYSIS:** Network construction, determination of critical path and duration, CPM Structured approach, Calculations of schedules and floats, PERT-Estimation of project duration and variance.	8+(2T)

Note 1: **Unit 2 and Unit 3 will have internal choice.**
Note 2: **Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.**
Assignment - 2 from units 3, 4 and 5.

Outcomes:
1. Can formulate the LPP using constraints and solve by graphical method.
2. Able to determine the optimum solution using Simplex method.
3. Can find out the optimum transportation and assignment cost.
4. Can identify and apply different queuing model to service and arrival pattern problems and solve the game problems by graphical method and dominance property rule.
5. Able to determine the Critical path and its duration using PERT/CPM.

Cos	Mapping with POs
CO1	PO1,PO2,PO3,PO4,PO5,PO12
CO2	PO1,PO2,PO3,PO4,PO5,PO11,PO12
CO3	PO1,PO2,PO3,PO4,PO5,PO11,PO12
CO4	PO1,PO2,PO3,PO4,PO5,PO7
CO5	PO1,PO2,PO3,PO4,PO5,PO7,PO10,PO11

TEXT BOOKS:
1. **Operation Research and Introduction -**Taha H A, Prentice Hall of India, 6th edition, 1999
2. **Principles of Operations Research -**Philips, Ravindran and Soleberg- – Theory and Practice, PHI, 2nd Edition, 2007
3. **Operations Research -**S.D. Sharma – Kedarnath, Ramnath &Co, 1996

REFERENCE BOOKS:
1. **Introduction to Operation Research -**Hiller and Libermann, McGraw Hill 5th edn,
2. **Operations Research Theory and Application -**J K Sharma, Pearson Education Pvt Ltd ,4th Edn, 2009 ISBN-0333-92394-4

Sub Title : SIMULATION MODELLING AND ANALYSIS		
Sub Code : IM64	**No. of Credits: 4 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hrs	**CIE +Assignment + SEE =** **45 + 5 + 50 =100**	**Total No. of Contact Hours :** **52**

Objectives:
1. Demonstrate the major capabilities and commonly encountered limitations of discrete-event simulation for modeling systems that industrial engineers commonly encounter. 2. Be able to build and run simple discrete-event simulation models in practical situations 3. Illustrate the main assumptions underlying these models; and Explain what can happen when these assumptions do not hold. 4. Be able to communicate the results of the modeling process to management and other non-specialist users of engineering analysis.

Unit No.	Syllabus Content	No of Hours
1	**Introduction To Simulation:** Simulation, advantages & disadvantages, Areas of application, System environment, Components of a system, Model of a system, Types of models, Monte carlo simulation and Steps in a simulation study.	6
2	**Simulation Examples:** Simulation of Queuing systems, Simulation of Inventory Systems. **General Principles:** Concepts in discrete - events simulation, event scheduling / Time advance algorithm	14
3	**Random Numbers:** Properties, Generations methods, Tests for Random number- Frequency test, Runs test, Auto correlation test, Gap test, Poker test	8
4	**Introduction To Probability Distributions:** Weibull and triangular distribution and their applications. **Random Variate Generation:** Inverse Transform Technique- Exponential, Uniform, Weibull, Triangular distributions, Direct transformation for Normal and log normal Distributions, convolution methods- Erlang distribution, Acceptance – Rejection Techniques – Poisson Distribution, Gamma Distribution.	10
5	**Analysis Of Simulation Data:** Input Modeling: Data collection, Identification and distribution with data, parameter estimation, Goodness of fit tests, Selection of input models without data. Verification and Validation of Model – Model Building, Verification, Calibration and Validation of Models **Output Analysis:** Stochastic Nature of output data, Measures of Performance and their estimation.	14

Note 1: Unit 2 and Unit 5 will have internal choice.
Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
       Assignment - 2 from units 3, 4 and 5.

Outcomes:
After completion of the course the student will be able to

1. Illustrate basic concepts in modeling and simulation (M&S).
2. Classify various simulation models and give practical examples for each category.
3. Construct a model for a given set of data and motivate its validity.
4. Generate and test random number variates and apply them to develop simulation models.
5. Fit statistical distributions to input data, obtain parameter estimation and goodness of fit.

Cos	Mapping with POs
CO1	PO1,PO2
CO2	PO2,PO3,PO4
CO3	PO4,PO6
CO4	PO4,PO5,PO6
CO5	PO1,PO2,PO4

TEXT BOOKS:
1.Discrete Event system Simulation – Jerry Banks, John S Carson, II, Berry L Nelson, David M Nicol, III Edition, Pearson Education, Asia, ISBN - 81- 7808 – 505 - 4.
2.Systems Simulation with Digital Computer – Narsingh Deo; PHI Publication (EEE), ISBN – 0-87692-028-8
3.Simulation Modelling & Analysis – Averill M Law, W David Kelton; McGraw Hill International Editions – Industrial Engineering series, ISBN – 0-07-100803-9.

Sub Title : COMPUTER INTEGRATED MANUFACTURING		
Sub Code : IM65	No. of Credits:4 =4 : 0 : 0 (L-T-P)	No. of lecture hours/week : 4
Exam Duration : 3 hrs	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 52

Objectives:

1. To study on automating the system, the use of computers in design and manufacturing.
2. To define basic concepts of geometric modeling techniques, Design and exchange of data.
3. To explain modern concepts of manufacturing using NC, CNC and DNC.
4. To express basic concepts of programming for drilling, milling and turning operations.
5. To outline basic concepts of industrial robotics and its applications to industries.

Unit No.	Syllabus Content	No of Hours
1	**Introduction**: Automation definition, Types, Automation Strategies, organization and information processing in manufacturing. Fundamentals of CAD and CAM, product cycle and CAD/CAM, Design process, Applications of computers in design, creating the manufacturing database, Advantages & Disadvantages of CAD and CAM.	9
2	**Introduction to computer graphics:** Color CRT raster scan monitors, computer input devices, hard copy devices. Software Configuration of a Graphics System, Functions of a Graphics Package, Construction of Geometry, Wire-Frame, Surface and Solid Modeling. Desirable modeling facilities. Geometric 2D and 3D transformations.	9
3	**Numerical control machines:** Introduction- basic components of an NC system-the NC procedure- NC coordinate system, NC motion control system, Applications of NC System, Advantages and limitations of NC Machines. **Computer controls in NC:** Problems with conventional NC, CNC system, Functions and advantages of CNC System. Components of DNC system, Functions and advantages of DNC System. **Computerized Manufacturing Planning System:** Computer Aided Process Planning, retrieval types, Generative type. **Group Technology**: Part families, part classification and coding, cellular manufacturing, Applications of GT.	13
4	**CNC Programming**: Manual part programming, Methods, Preparatory Functions, Miscellaneous Functions, Program Number, Tool Length Compensation, Canned Cycles, Cutter Radius Compensation, Drilling and milling exercises. Turning Center programming: Axes System, General Programming Functions, Motion Commands, Exercises.	14

5	**CNC Machine Tools:** Overview of CNC machining centers, CNC turning centers Tool presetting, ATC.	
5	**Introduction to Robotics**: Introduction, Robot configuration, Robot motions, End effectors, Robot Sensors, Robot applications. Programming the robots, Robot-Programming Languages.	**7**

Note 1: Unit 3 and Unit 4 will have internal choice.
Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
   Assignment - 2 from units 3, 4 and 5.

Outcomes:
1. Summarize the role of CAD/CAM in modern design and manufacturing
2. Create and analyze the capabilities of Computer Aided Designing Systems for designing mechanical parts and elements in 2D and 3D dimensions.
3. Compare and distinguish between the modern concepts of manufacturing using NC, CNC and DNC.
4. Compile and illustrate manual part program to carryout drilling, milling, and turning operations on CNC machine tools.
5. To demonstrate the concepts of industrial robotics and its applications to industries

TEXT BOOKS:
1. Mikel P. Groover and Emory W. Zimmers - **CAD/CAM**, Jr Pearson Education Inc, 2017.
2. P.N. Rao **– CAD/CAM Principles and Applications**, TMH, New Delhi - 2017.
REFERENCE BOOKS:
1. Newman and Sproull – **Principles of Interactive Computer Graphics**, Tata McGraw Hill, 1995.
2. Ibrahim Zeid –**CAD/CAM**, Tata McGraw Hill, 2016.
3. P. N. Rao, N. K. Tewari and T. K. Kundra – **Computer Aided Manufacturing**, Tata McGraw Hill, 2016.

Cos	Mapping with POs
CO1	PO5,PO6,PO7
CO2	PO3,PO4,PO5
CO3	PO3,PO5
CO4	PO3,PO5,PO6,PO7
CO5	PO3,PO5,PO6,PO7

Elective – II (Group-B)

Sub Title : COMPOSITE MATERIALS		
Sub Code : IM 661	**No. of Credits:3= 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hrs	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours : 39**

Objectives:
1. To introduce composite materials and its different types. 2. To explain the advanced methods of the manufacturing of composite material and different fabrication techniques.

Unit No	Syllabus	No of Hours
1	**Introduction To Composite Materials:** Definition-Classification and characteristics of composite materials- fibrous composites, laminated composites and particulate composites	06
2	**FIBER REINFORCED PLASTIC PROCESSING:** **Primary and secondary manufacturing of composites** – Layup and curing, fabricating process-open and closed mould process-hand layup techniques-structural laminate bag molding, Autoclave Molding filament Winding, Pultrusion, Compression Molding, RTM, RIM, SRIM, machining, drilling and routing.	08
3	**FIBER REINFORCED PLASTIC PROCESSING:** Production procedures for bag molding- filament winding, pultrusion, pulforming, thermo-forming, injection, injection molding, liquid injection molding, blow molding.	06
4	**FABRICATION OF COMPOSITES:** Cutting, machining, drilling, mechanical fasteners and adhesive bonding, joining, computer aided design and manufacturing, tooling, fabrication equipment.	08
5	**METAL MATRIX COMPOSITES (MMC'S):** Reinforcement materials, types, characteristics, and selection base metals selection-Need for production MMC's and its application. **CERAMIC MATRIX COMPOSITES** – Manufacturing routes and application	09

Note 1: **Unit 2 and Unit 5 will have internal choice.**
Note 2: **Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.**
Assignment - 2 from units 3, 4 and 5.

Outcome:
1. Students are able to explain the different concepts of manufacturing of fiber reinforced composites. 2. Laminate design for different combinations of plies with different orientations of the fiber.

3. To Explain the machining of composite materials
4. <mark>To Explain the Manufacturing routes and application of Metal matrix and Ceramic matrix composites</mark>

Cos	Mapping with POs
CO1	PO3,PO8,PO10
CO2	PO3,PO8,PO10
CO3	PO3
CO4	PO3,PO8,PO10

TEXT BOOKS:
1. .Mein Schwartz., "Composite Materials Handbook", McGraw Hill, 1992
2. Autar K.Kaw, "Mechanics of Composite Materials", CRC Press, 2005.
3. Gibson, R.F., "Principles of Composite Material Mechanics", McGraw-Hill, 1994, 2nd
Edition - CRC press in progress.
4. Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw-Hill, 1998.

REFERENCE **BOOK:**
1. "ASM Hand book on Composites", Volume 21, 2001
2. Vanviack L.H, "Physical Ceramics for Engineers", Addison Wesley Publication, 1964.
3. Issac M. Daniel and OriIshai, "Engineering Mechanics of Composite Materials", Oxford University Press, 2006, First Indian Edition, 2007.
4. Mallick, P.K., Fiber,"Reinforced Composites: Materials, Manufacturing and Design", Maneel Dekker Inc, 1993.
5. Halpin, J.C., "Primer on Composite Materials, Analysis", Techomic Publishing Co., 1984.
6. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York, 1990.
7. Mallick, P.K. and Newman, S., "Composite Materials Technology: Processes and Properties", Hansen Publisher, Munish, 1990.

Sub Title : ORGANIZATIONAL BEHAVIOUR		
Sub Code : IM 662	No. of Credits:3 =3 : 0 : 0 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 39

Objectives:
1. To introduce the scope and importance of Organization behavior.
2. To Explain and study the different behaviors in organizations.
3. To develop motivation and leadership power.
4. To introduce the dynamics of Organization behavior.

Unit No.	Syllabus Content	No of Hours
1	**FOCUS & PURPOSE:** Definition, need and importance of organizational Behaviour- Nature and Scope- Framework- Organizational Behaviour models.	6
2	**INDIVIDUAL BEHAVIOUR:** Personality-types, factors influencing personality, theories, Defining, types of Definers, the Defining process, Defining theories, Organizational Behaviour modification, Misbehavior, types, Management Intervention, Emotions, Emotional labour, Emotional Intelligence, Theories. Attitudes, Characteristics, Components, Formation, Measurement, Values. Perception, Importance, Factors influencing perception, Interpersonal perception, Impression Management, Motivation- Importance Types, Effects on work Behaviour.	10
3	**GROUP BEHAVIOUR:** Organization structure, formation, groups in organization, influence, group dynamics, emergence of informal leader and working norms, group decision making techniques, team building, interpersonal relations, communication, control.	10
4	**MOTIVATION:** Maslow's hierarchy of needs, DouglaMcGregor Theory X &Theory Y, Chris Argyris pattern A & pattern B, Motivation Hygiene theory, Motivation and Satisfaction. **LEADERSHIP AND POWER:** Meaning, importance, leadership style, theories, leaders Vs managers, sources of power, power centers, power and politics.	6
5	**DYNAMICS OF ORGANIZATIONAL BEHAVIOUR:** Organizational culture and climate, factors affecting organizational climate-importance, job satisfaction, determinants, measurements, influence on behavior. organizational change, importance, stability Vs change, proactive vs reaction change, the change process, resistance to change, managing change, stress work, stressors, prevention and management of stress, balancing work and life. Organizational development, characteristics, objectives, organizational effectiveness.	7

Note 1: **Unit 2 and Unit 5 will have internal choice.**
Note 2: **Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.**
        Assignment - 2 from units 3, 4 and 5.

Outcomes:
1. Able to Develop and cultivate good organizational behaviour among others
2. Able to Motivate and develop inter personal perception
3. Able to develop groups and group dynamics and decision making techniques.
4. Able to recognize and defend motivational theories and leadership styles, power and politics
5. Able to Explain and recall dynamics of organizational behavior

Cos	Mapping with POs
CO1	PO5,PO6,PO12
CO2	PO5,PO6,PO7.PO8,PO10,PO12
CO3	PO6,PO7,PO8,PO9,PO10,PO12
CO4	P05,PO6,PO7,PO8,PO9,PO10,PO12
CO5	PO3,PO5,PO6,PO7,PO8,PO9,PO12

TEXT BOOKS:
1. Organizational Behaviour, Stephen P Robbins, 15thEdn, 2015 Pearson Education Publications, ISBN–81–7808–561-5
2. Management of Organizational Behavious, Paul Henry and Kenneth H. Blanchard, Prentice Hall of India, 1996.
3. Organizational Behaviour – Fred Luthans, 9thEdn, McGraw Hill International Edition, ISBN–0–07– 20412–1
REFERENCE BOOKS:
1. OrganisationBehaviour – Hellriegel, Srocum and woodman, Thompson Defineing, 9th Edition, Prentice HallIndia, 2010
2. Organizational Behaviour – VSP Rao and others, Konark Publishers 2002.

Sub Title :	MAINTENANCE & SAFETY ENGINEERING		
Sub Code : IM 663	**No. of Credits:3= 3 : 0 : 0 (L-T-P)**		**No. of lecture hours/week : 3**
Exam Duration : 3 hrs	**CIE +Assignment + SEE = 45 + 5 + 50 =100**		**Total No. of Contact Hours : 39**

Objectives:
1. To explain the basic concepts of maintenance system and maintenance of machinery.
2. To elucidate the economics of Maintenance and importance of computers in Maintenance management.
3. To describe the significance of Industrial Safety, fire prevention, and protection
4. To elaborate the importance of Industrial pollution control and to Define about the types and sources of Industrial pollution

Unit No	Syllabus	No of Hours
1	**INTRODUCTION TO MAINTENANCE SYSTEM:** Definition, Scope, Objective, Importance of maintenance system, Type of maintenance system, Break Down Maintenance system, Preventive Maintenance, Predictive Maintenance, design out Maintenance, corrective Maintenance, Planned Maintenance, total productive Maintenance, conditioning Maintenance.	7
2	**MAINTENANCE OF MACHINERY:** Causes of machine failure, performance evaluation, complete overhauling of lathes, Drilling machines, Drilling machines, Milling machines, shapers and Grinding machines, maintenance planning and scheduling, Repair order control man power equipment, Maintenance job analysis, spare parts control.	10
3	**ECONOMICS IN MAINTENANCE:** repair, replacement, Repair complexity, Finding out most optimal preventive frequency. **COMPUTERS IN MAINTENANCE MANAGEMENT:** File data bank, storage of data such as break downs, spare parts, lubricating point, drawing of machine parts.	6
4	**INDUSTRIAL SAFETY:** Economic importance of accidents, Types of safety organizations, Analysis of accident safety standard for- Mechanical equipment, Electrical equipment and systems, Chemical hazards, Material Handling, exhaust systems, Plant housekeeping, building, Aisles passages, floors, tool cribs, washrooms.	6
5	**FIRE PREVENTION AND PROTECTION:** Condition favouring fire breakdown, preventing of firing methods, fire protection- Classification of fires, fire extinguishing system, fire alarms,fire fighting equipments, mock drills, emergency, response time. **INDUSTRIAL POLUTION CONTROL:** Dust control- Fiber collectors, mechanical dust collectors, wet type collectors, Electro static precipitators, Noise pollution control-Noise measurement and control, Industrial vibration and its control, ILO conventions, Risk assessment.	10

Note 1: **Unit 2 and Unit 5   will have internal choice.**
Note 2: **Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.**
     Assignment - 2 from units 3, 4 and 5.

Outcomes:
1. Able to memorize types of maintenance systems
2. Able to evaluate machine failure and performance of the machines
3. Able to evaluate the economics of maintenance and express the use of computers in maintenance
4. Demonstrate and outline the Industrial safety through proper safety standards to reduce accidents.
5. Demonstrate and outline the Industrial pollution control and fire prevention and protection.

Cos	Mapping with POs
CO1	PO7,PO11,PO12
CO2	PO1,PO2,PO3,PO4,PO11,P12
CO3	PO1,PO2,PO3,PO4,PO11,P12
CO4	PO5,PO6,PO9,PO10,P12
CO5	PO6,PO9,PO10,P12

TEXT BOOKS:
1. Staniar-plant Engineering hand Book, 2nd Edition, McGrawHill
2. Morrow, Lindley.R and Higgins-Maintenance Engineering hand Book, 3rd Edition McGrawHill-2001
REFERENCE BOOKS:
1. Frank Herbaty-Hand book of maintenance management, Crest Publishing house-2004
2. W.Grant Lerson & Eugene L.Grant-Hand book of Industrial Engg & Management, Prentice Hall
3. of India, 2nd Edition-1988
4. Herbert.F.Lund-Industrial Pollution control Hand Book, McGrawHill
5. H.P.Garg-Industrial Maintenance, 3rd Edition-S.Chand publishers

Sub Title : QUALITY ENGINEERING LAB		
Sub Code : IML67	No. of Credits:1 =1 : 0 : 0 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 36

Objectives:
1. To Explain and apply the basic fundamental concepts of Statistics to engineering problems.
2. Application of probability distributions to various manufacturing problems.
3. Application of hypothesis to random experiments of manufacturing processes.
4. To test the statistical parameters by regression and correlation.
5. To construct the Variable and attribute type of control charts.
6. To test the goodness of fit for various quality characteristics using different distribution.

Unit No.	Syllabus Content	No of Hours
1	i).To test the Goodness of fit for the given quality characteristic using Normal distribution ii).To test the Goodness of fit for the given quality characteristic using Poisson distribution iii).,To test the Goodness of fit for the given quality characteristic using Binomial distribution iv).To test the Goodness of fit for the given quality characteristic using Uniform distribution v).Conduction of Repeatability and Reproducibility studies for appraiser and instrument using R&R Software vi).Assessing Process Capability of the given manufacturing process using Normal Probability paper method and process capability indices vii).Assessing Process Capability of the given manufacturing process using Digital Motorized multifunctional Height Gauge and SQC Display unit	18
2	i) Experiments on Application of 7 QC Tools as applied to Manufacturing and Service Operations. ii).Construction of control chart for variable quality characteristic using Digital Motorized Multifunctional Height Gauge iii).Construction of control chart for attribute quality characteristic iv).Construction of control charts using Systat Software v) Attribute sampling Plans – Single, Double and Multiple sampling plans. vi)Experiments on correlation and Simple linear regressions vii).Experiments on multiple linear regressions	18

Outcomes:
1. Able to identify type of probability distribution and solve the various manufacturing problems.
1. Able to test the hypothesis and give inference to random experiments.

2. Can make use or test the statistical parameters by estimation.
3. Able to apply 7 QC tools

Cos	Mapping with POs
CO1	PO1,PO2,PO3,PO4,PO12
CO2	PO1,PO2,PO3,PO4,PO5,PO6,PO7,PO10,PO12
CO3	PO1,PO2,PO3,PO4,PO12
CO4	PO1,PO2,PO3,PO4,PO5,PO12

Scheme of Examination:

ONE question from Unit -1 : 20 marks
ONE question from Unit -2 : 20 marks
                    Viva-Voce: 10 marks.

Reference Books:
1. Introduction to statistical Quality Control D C Montgomery - 3rd Edition, John Wiley and Sons.
2. Quality Planning & Analysis- J M Juran, Frank M Gryna; Tata McGraw Hill, 3rd edn.,
3. Statistical Quality Control - Grant and Leavenworth, McGraw Hill

Sub Title : SIMULATION LAB		
Sub Code : IML68	No. of Credits: =0 : 0 : 1 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 36

Objectives:
1. To Explain and apply the basic fundamental concepts of Statistics to manufacturing operations.
2. Application of probability distributions to various manufacturing problems.
3. Application of random number generations for different experiments of simulation models.
4. To test the input and output analysis using statistical analysis.

Unit No.	Syllabus Content	No of Hours
1	**Introduction to Simulation Package.** Features of Simulation Package and Input Modeling Identifying probability distributions for given data Building simulation models for manufacturing operations (With Common templates) Building simulation models for manufacturing operations (With Basic templates) Building simulation models for manufacturing operations with transport System Building simulation models for manufacturing operations with layout. Simulation of Multi Product Assembly line System.	18
2	**Building simulation models for service operations and analysis of data.** Building simulation Models for Banking service (Bank teller problem) Building simulation Models for Mortgage application problem Building simulation Models for food processing problem Building simulation Models for Post office animation Statistical Analysis of Simulation models (input analysis) Statistical Analysis of Simulation models (output analysis) Modelling a Live Problem	18

Outcomes:
1. Able to identify type of probability distribution and analyze nature of input data
2. Able to apply various simulation models using common and basic process templates
3. Will be able to solve the various manufacturing related problems and analyze output data

Cos	Mapping with POs
CO1	PO2,PO5, PO11
CO2	PO2,PO4,PO5,PO11
CO3	PO2,PO5,PO11

Scheme of Examination:
ONE question from Unit -1: 20 marks ONE question from Unit -2: 20 marks Viva-Voce: 10 marks.
Suggested software: **1. Suggested Software Packages: Arena / Quest / Witness / Extend.** **Note: A minimum of 12 exercises are to be conducted.**

Sub Title : Mini Project		
Sub Code : IMP69	No. of Credits:2 =0 : 0 : 2 (L-T-P)	No. of lecture hours/week :
Exam Duration :	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours :

Objective:
1. To equip students for making a subject presentation based on a thorough research review on any contemporary area of engineering and management fields.
2. Offering the student an opportunity to interact with faculty and peer group and to build the ability to making independent presentation.

Sl. No.	Syllabus	
1	**Procedure:** 1. A list of contemporary topics will be offered by the faculty of the department in the in the interlude period between 7th and 8th Semester. 2. Student can opt for topic of their own choice and indicate their option to the department at the beginning of the 8th semester. This component is also evaluated twice in the semester like Mini Project-CIE-1 and CIE-II. The final, marks shall be submitted to the exam section at the end of the semester.	

VII Semester

Code No.	Course Name	CREDITS				Maximum marks		
		Lecture	Tutorial	Lab	Total	Continuous Internal Evaluation	Semester End evaluation	Total
HS 04	Intellectual Property Rights	2	0	0	2	50	50	100
IM 71	Supply Chain Management	3	0	0	3	50	50	100
IM 72	Operations Management	4	0	0	4	50	50	100
IM 73	Financial Management and Accounting	3	1	0	4	50	50	100
IM 74	Project Management	3	0	0	3	50	50	100
IM 75X	*Elective Group–III(Group–C)	3	0	0	3	50	50	100
IML 76	Enterprise Resource Planning Lab	0	0	1.5	1.5	50	50	100
IML 77	CIM Lab	0	0	1.5	1.5	50	50	100
IML78	Project Phase – I	0	0	0	0	00	00	000
IME01	Inter Departmental Elective – I	4	0	0	4	50	50	100
					26			900

Inter Department Elective -I	
IME 01	Engineering Economy

*Elective –III (Group C)	
IM751	Lean Manufacturing
IM752	Product Design and Manufacturing
IM753	World class management practices
IM754	Design of Experiments
IM755	Enterprise Resource Planning and E- commerce

VIII Semester

Code No.	Course Name	CREDITS				Maximum marks		
		Lecture	Tutorial	Lab	Total	Continuous Internal Evaluation	Semester End evaluation	Total
IME 02	Inter departmental Elective - II	4	0	0	4	50	50	100
IM 81*	*Elective – IV (Group D)	3	0	0	3	50	50	100
IM 82**	**Elective – V (Group E)	3	0	0	3	50	50	100
IM P83	Subject Seminar	0	0	2	2	50	00	50
IMS84	Phase _ II Project Work	0	0	12	12	100	100	100
					24			450

Inter departmental Elective –II	
IME 02	Operations research

** Elective Group – D	
IM 811	Rapid Prototyping
IM 812	Advanced Ergonomics
IM 813	Total Quality Management
IM 814	Human Resource Management
IM 815	Advanced Operations Research

* Elective Group – E	
IM 821	Strategic Management
IM 822	Technology Management
IM 823	Precison Manufacturing
IM 824	Human Factors Engineering
IM 825	Management Information System

Electives and Stream of Specialization from V semester to VIII semester

Stream of Specialization	Electives				
	V SEM	**VI SEM**	**VII SEM**	**VIII SEM**	
	Group A	**Group B**	**Group C**	**Group D**	**Group E**
Manufacturing	Tool Engineering Design	Composite Materials	Lean Manufacturing	Rapid Prototyping	Precison Manufacturing
	Advanced Material Processing	--	Product Design and Manufacturing	Advanced Ergonomics	--
Management	Marketing Management	Organizational Behavior	World class management practices	Total Quality Management	Strategic Management
	Value Engineering	Maintenance & Safety Engineering	Design of Experiments	Human Resource Management	Technology Management
	--	--	--	--	--
	--	--	--	--	Human Factors Engineering
Information System	Data Base Management System	Software Engineering & Management	Enterprise Resource Planning & E-commerce	--	Management Information System
	--	--	--	--	--
Optimization Technique	--	Reliability Engineering	--	Advanced Operations Research	

Sub Title :	SUPPLY CHAIN MANAGEMENT	
Sub Code : IM 71	No. of Credits: 3= 3 : 0 : 0 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 52

Objectives:
1. To describe the basic strategic frame work to analyze supply chain   2. To outline the concept of facility location and network design   3. To define about planning and managing inventories, sourcing, transportation.   4. To explain about the role of Information & Technology in Supply chain

Unit No.	Syllabus Content	No of Hours
1	**BUILDING A STRATEGIC FRAMEWORK TO ANALYSE SUPPLY CHAINS:** Supply chain stages and decision phases process view of a supply chain. Supply chain flows. Examples of supply chains. Competitive and supply chain strategies. Achieving strategic fit. Expanding strategic scope. Drivers of supply chain performance	08
2	**FACILITY LOCATION AND NETWORK DESIGN:** Models for facility location and capacity allocation. Impact of uncertainty on SCN –. Framework for structuring drivers – Inventory, Transportation, Facilities, Information. Obstacles to achieving fit. Case discussions. Distribution Networking – Role, Supply Chain Network (SCN) – Role, Factors, Framework for Design Decisions.	08
3	**PLANNING AND MANAGING INVENTORIES IN A SUPPLY CHAIN:** Review of inventory concepts. Trade promotions, Managing multi-echelon cycle inventory, safety inventory determination. Impact of supply uncertainty aggregation, Optimum level of product availability; importance factors. Managerial levers to improve supply chain profitability.	08
4	**SOURCING, TRANSPORTATION AND PRICING PRODUCTS:** Role of sourcing, supplier – scoring & assessment, selection and contracts. Design collaboration. Role of transportation, Factors affecting transportation decisions. Modes of transportation and their performance characteristics. Tailored transportation, International transportation.	08
5	**COORDINATION AND TECHNOLOGY IN THE SUPPLY CHAIN:** Co-ordination in a supply chain: Bullwhip effect. Obstacles to coordination. Managerial levers to achieve co-ordination, Building strategic partnerships. The role of IT supply Chain,. The role of E-business in a supply chain.	07

Note 1: Unit 1 and Unit 4 will have internal choice.

Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
       Assignment - 2 from units 3, 4 and 5.

Outcomes :
1. Will be able to indicate the utilization of supply chain management systems and resources being effectively used in an organization   2. Will be able to identify capacity allocation facility location models, apply Managerial levers to improve supply chain profitability   3. Will be able to plan and manage inventories to improve supply chain profitability   4. Will be able to identify factors affecting transportation decisions and   design

transportation network to improve supply chain operations
5. Will be able to relate Bullwhip effect, role of information technology in supply Chain, apply concepts of Reverse Logistics and recommend Implementation of Six Sigma in Supply Chains

Cos	Mapping with POs
CO1	PO3,PO5,PO8,PO10
CO2	PO3,PO5,PO,PO11
CO3	PO3,PO5,PO11
CO4	PO3,PO5,PO10,PO11
CO5	PO3,PO5,PO8,PO10,PO11

TEXT BOOK:
1. **Supply Chain Management** – 2001, Strategy, Planning & Operation. Sunil Chopra & Peter Meindl; Pearson Education Asia, ISBN: 81-7808-272-1.
2. **Supply Chain Management** – N Chandrashekaran , Oxford Higher education , 2013

REFERENCE BOOKS:
1. **Supply Chain Redesign** – Transforming Supply Chains into Integrated Value Systems –Robert B Handfield, Ernest L Nichols, Jr., 2002, Pearson Education Inc, ISBN: 81-297-0113-8
2. **Modelling the Supply Chain** –Jeremy F Shapiro, Duxbury;, 2002, Thomson Defineing, ISBN 0-534-37363
3. **Designing & Managing the Supply Chain** –David Simchi Levi, Philip Kaminsky & Edith Simchi Levi;; Mc Graw Hill

Sub Title :	OPERATIONS MANAGEMENT	
Sub Code : IM 72	No. of Credits: 4= 4 : 0 : 0 (L-T-P)	No. of lecture hours/week : 4
Exam Duration : 3 hrs	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 52

Objectives :

1. Introduction of operations management and its importance in production operations and decision making.
2. To study system design and capacity planning activities.
3. To study and apply different scheduling methods to determine the idle times of the machines.
4. Introduction to lean manufacturing and its advantages

Unit No.	Syllabus Content	No of Hours
1	**OPERATIONS MANAGEMENT CONCEPTS**: Introduction, Historical development, The trend: Information and Non-manufacturing systems, Operations management, Factors affecting productivity, International dimensions of productivity, The environment of operations. **SYSTEM DESIGN AND CAPACITY**: Introduction, Manufacturing and service systems, Design and systems capacity, Capacity planning.	08
2	**OPERATIONS DECISION MAKING:** Introduction, Management as a science, Characteristics of decisions, and Framework for decision making, Decision methodology, Decision support systems. **FORECASTING DEMAND:** Forecasting objectives and uses, Forecasting variables, Opinion and Judgmental methods, Time series methods, Exponential smoothing, Regression and correlation methods, Application and control of forecasts.	14
3	**AGGREGATE PLANNING AND MASTER SCHEDULING**: Introduction- planning and scheduling, Objectives of aggregate plan, Aggregate planning methods, Master scheduling objectives, Master scheduling methods. **MATERIAL AND CAPACITY REQUIREMENTS PLANNING:** Overview: MRP and CRP, MRP: Underlying concepts, System parameters, MRP logic, System refinements, Capacity management, CRP activities.	08
4	**SCHEDULING AND CONTROLLING PRODUCTION ACTIVITIES:** Introduction, PAC, Objectives and Data requirements, Scheduling strategy and guide lines, Scheduling methodology, priority control, capacity control. **SINGLE MACHINE SCHEDULING**: Concept, measures of performance, SPT rule, Weighted SPT rule, EDD rule, minimizing the number of tardy jobs. **FLOW -SHOP SCHEDULING**: Introduction, Johnson's rule for V jobs on 2 and 3 machines, CDS heuristic. **JOB-SHOP SHEDULING**: Types of schedules, Heuristic procedure, scheduling 2 jobs on 'm' machines.	14

5	**LEAN SYSTEMS**: Pull method of materials flow, consistently high quality, small lot sizes, Uniform workstation loads, Standardized components and work methods, close supplier Ties, Flexible workforce, Line flows, Automated production, Prevention maintenance, continuous improvement.	**08**

Note 1: Unit 2 and Unit 4 will have internal choice.
Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
Assignment - 2 from units 1, 3 and 5.

Outcomes:
1. Able to memorize history and describe importance of OM to take decision based on different models.
2. Able to calculate forecasted values using different forecasting methods
3. Will be able to operate the production activities on Aggregate planning, MPS and MRP
4. Will be able to operate the production activities based on priorities and capacity.
5. Will be able to select the best course of action for better production quality and quantity based on new methods of production.

Cos	Mapping with POs
CO1	PO2,PO4,PO5,PO6,PO9,PO10,PO12
CO2	PO1,PO2,PO3,PO4,PO5,PO8,PO9,PO12
CO3	PO2,PO3,PO4,PO5,PO7,PO8,PO9,PO11,PO12
CO4	PO1,PO2,PO3,PO4,PO6,PO9,PO10,PO11,PO12
CO5	PO2,PO3,PO4,PO5,PO8,PO9,PO12

TEXT BOOKS:
1. **Operations Management**- Monks, J.G., McGraw-Hill International Editions, 1987.
2. **Production and Operations Management**- Pannerselvam. R, 2nd edition PHI.

REFERENCE BOOKS:
1. **Modern Production/ Operations Management**- Buffa, Wiely Eastern Ltd.,
   4th edition
2. **Production and Operations Management**- Chary, S.N, Tata- McGraw Hill.,
   3rd edition
3. **Operations Management for Competitive Advantage** by Chase and Jacobs

Sub Title :	FINANCIAL ACCOUNTING AND MANAGEMENT	
Sub Code : IM 73	**No. of Credits: 4= 3 : 1 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hrs	**CIE +Assignment + SEE =** **45 + 5 + 50 =100**	**Total No. of Contact Hours : 52**

Objectives:
1. The objective of this course is to familiarize the student with the basic concepts, standards and practices of financial accounting. 2. The course is devoted to the basic financial statements, the analysis and recording of transactions, and the underlying concepts and procedures, 3. To carry out financial statement analysis and studying and preparation of cost sheet and budget.

Unit No.	Syllabus Content	No of Hours
1	**FINANCIAL ACCOUNTING:** Introduction to Book keeping: double-entry system, journal & ledger posting, Trial balance.(Simple problems)	7+ 4(T)
2	**FINANCIAL STATEMENTS & ANALYSIS:** Preparation of Trading, Profit & Loss account, and Balance sheet.	8+4(T)
3	**COSTING:** Objectives of costing, Elements of costing, methods of costing preparation of cost sheet (Job costing) **STANDARD COSTING:** Definition of Standard costing, variance, Classification of variances, Material, labor, overhead cost variance.	12+5(T)
4	**WORKING CAPITAL MANAGEMENT:** Components of Current Assets and Current Liabilities, Concepts of Working Capital, Objective of Working Capital Management, Need for Working Capital, Operating Cycle, Determinants of Working Capital, Approaches for Working Capital Management, Estimation of Working Capital **BUDGETING:** Meaning of a Budget, Budgetary control, Objectives of budgetary control, Types of Budgets, Sales budget, production budget, raw materials purchasing budget, selling and administrative expense budget, cash budget, Flexible Budget.	12+5(T)
5	**Introduction to Financial Management**: Definition of financial management, objectives of financial management, forms of business organization, Raising of finance from primary and secondary market. Valuation of securities, SEBI guide lines on capital issues. Stock markets in India, initial public offering (IPO), Sources of long term financing.	6+2(T)

Note 1: Unit 3 and Unit 4 will have internal choice.
Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
         Assignment - 2 from units 3, 4 and 5.

Outcomes:

Upon completion of the course, you will be able to:
   1. Understand and apply fundamental accounting concepts, principles and conventions and to carry out journal entries and adjustments.
   2. Prepare financial statements in accordance with generally accepted accounting principles.

3. Prepare and analyze a trial balance, cash flow statement, cost sheet variance analysis.
4. To prepare and analyze different types of budget
5. To explain the concepts of financial management, working capital and their applications to industries.

Cos	Mapping with POs
CO1	PO1,PO4,PO5,PO7,PO11
CO2	PO1,PO3,PO5,PO6,PO11
CO3	PO1,PO3,PO11
CO4	PO1,PO3,PO5,PO10,PO11,PO12
CO5	PO3,PO5,PO8,PO11,PO12

TEXT BOOKS:
1. **Cost Accounting** – Khan M Y and Jain P K, Tata McGraw-Hill, 4th Edition.
2. **Financial Management –** Prasanna Chandra;; Tata McGraw-Hill, 4th Edition. 1998.
3. **Management Accounting & Costing –** PRASAD .N.K
4. **Financial Management and Policy –** James. C Vanhorne, Pearson education, 12th edition.

REFERENCE BOOKS:
1. **Elements of Accountancy** – B.S Raman,
2. **Practical Costing** – Ahuja, Pandey, Khanna and Arora, , S. Chand & Co. Ltd 2005
3. **Financial Management & Costing –** KHAN & JAIN, TMH – 20

Sub Title : PROJECT MANAGEMENT		
Sub Code : IM 754	**No. of Credits: 3= 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hrs	**CIE +Assignment + SEE =** **45 + 5 + 50 =100**	**Total No. of Contact Hours : 39**

Objectives:
1. To introduce concepts of project management with a strong emphasis on issues and problems associated with delivering successful projects.   2. To Define and study the project planning and estimating its cost.   3. To determine the elapsed time and idle time through project scheduling   4. To determine the critical path for the projects through project management tools and techniques.

Unit No.	Syllabus Content	No of Hours
1	**CONCEPTS OF PROJECT MANAGEMENT:** Concepts of a Project, Categories of projects, Phases of project life cycle, Roles and responsibility of project leader, tools and techniques for project management.	06
2	**PROJECT PLANNING AND INTEGRATION**: Feasibility report phased planning, Project planning steps, Preparation of cost estimation. **Project Integration Management:** Develop project charter, develop project management plan, direct & manage project work, monitor & control project work, perform integrated change control, close project or phase.	07
3	**ORGANIZING AND STAFFING THE PROJECT TEAM:** Authorities and responsibilities of project manager, Project organization and types of accountability in project execution, controls. Tendering and selection of contractors.	06
4	**PROJECT SCOPE MANAGEMENT**: Project scope management, collect requirements, define scope, create WBS, validate scope, and control scope. **Project Risk Management** : Plan risk management, identify risk, Perform qualitative risk analysis, perform quantitative risk analysis, plan risk resources, control risk	10
5	**PROJECT TIME MANGEMENT**: Plan schedule management, define activities, sequence activities, estimate activity resources, estimate activity durations, develop schedule, control schedule. Exercises on PERT/CPM.Case studies on project management.	10

Note 1: Unit 4 and Unit 5   will have internal choice.
Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
Assignment - 2 from units 3, 4 and 5.

Outcomes :
Upon successful completion of this course, the student will be able to: 1. Apply the concept, tools and techniques for managing large projects.   2. Construct project plans for different types of organizations.   3. Evaluate a project to develop the scope of work, provide accurate cost estimates and to plan the various activities;   4. Will be able to explain on resource and time planning, controls, communication mechanisms,

reviews and other project management tools.
5. Analyze and evaluate risks in large and complex project environments

Cos	Mapping with POs
CO1	PO3,PO4,PO5,PO7,PO8,PO9,PO11
CO2	PO3,PO4,PO5,PO7,PO8,PO9,PO11,PO12
CO3	PO3,PO4,PO5,PO6,PO11
CO4	PO4,PO5,PO11
CO5	PO4,PO10,PO11,PO12

TEXT BOOKS:
1. **Project Management a System approach to Planning Scheduling & Controlling** - Harold Kerzner, CBS Publishers and Distributors. 2016.
2. **Project Execution Plan: Plan for project Execution interaction -** Chaudhry S.2016
3. **Project Management Institute, "A guide to the project management body of knowledge (PMBOK Guide)".**5th edition, 2013, ISBN: 978-1-935589-67-9. 2015

REFERENCES BOOKS:
1. **Project Planning Analysis selection financing Implementation and Review-** Tata Mc Graw Hill Publication, 7th edition 2010, Prasana Chandra.
2. **Project Management** – Beningston Lawrence McGraw Hill 1970.
3. **A Management Guide to PERT and CPM**, WEIST & LeVY Eastern Economy of PH 2002.
4. **PERT & CPM**.-L.S.Srinnath, Affiliated East West Press Pvt. Ltd. 2002.
5. **Project planning analysis selection implementation & review** Prasanna Chandra, ISBNO-07-462049-5   2002.
6. **Performing and Controlling Project,-**Angus, Planning, 3rd End, Person Education, ISBN:812970020.2001
7. **Project planning scheduling & control**, James P.Lawis, Meo Publishing Company 2001.
8. **Project Management -**Bhavesh M.Patel, Vikas Publishing House, ISBN 81-259-0777-7 2002

Sub Title : LEAN MANUFACTURING		
Sub Code : IM 751	No. of Credits: 3= 3 : 0 : 0 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 39

Objectives:
1. To recall the history and the birth of Lean Manufacturing system.
2. To know the tools and techniques of lean manufacturing like stability, standardization etc.
3. To understand the concepts of the two pillarts of TPS ie. JIT and JIDOKA.
4. To appriciate the lean culture.

Unit No.	Syllabus Content	No of Hours
1	ORIGIN OF LEAN PRODUCTION: Craft Production – Mass Production – Ford System – Growing Dysfunction – Origin and History of Lean Production. LEAN PRODUCTION SYSTEM: Necessity of Lean Production – Systems and Systems thinking – Construction of Lean Production: Lean image and Lean Activities – Muda and its types – Mura – Muri.	08
2	STABILITY: Standards in Lean System – Visual Management – 5S – Total Productive Maintenance: Key measures; Six Big Losses; Hidden Losses; Machine Loss Pyramid; Small group activity.	06
3	STANDARDIZED WORK: Comparison of Methods Engineering and Lean thinking – Elements to be managed - Necessity and prerequisites of Standardized work – Elements of Standardized work - Charts: Production capacity chart; Standardized combination table; Standardized work analysis chart – Man power reduction – Comparison of overall efficiency with individual efficiency – Kaizen – Common Layouts	09
4	JUST IN TIME (JIT): Definition - Principles of JIT: Continuous Flow; Pull – JIT system – Kanban – Six Kanban rules - Expanded role of conveyance – Production leveling – Three types of Pull Systems – Value Stream Mapping: Symbols; Current state VSM and Future state VSM. JIDOKA: Development and necessity – Poke Yoke: Common errors – Inspection system and Zone control – Using Poke Yokes – Jidoka implementation.	10
5	LEAN INVOLVEMENT AND CULTURE: Necessity of involvement – Waste of Humanity – Activities supporting involvement – Kaizen Circle Activity – Practical Kaizen Training – Key factors in Practical Kaizen Training – Lean Culture – Standardization – Standards and abnormality control – 'Five Why' analysis.	06

Note 1: SEE Question paper contains total seven Questions, student should answer any one question from Unit I and Unit IV and student shall answer total five question.
Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.

Assignment - 2 from units 3, 4 and 5.

Outcomes:
After completing the course students re able to

1. Appreciate the birth of lean manufacturing and the history before it evolution.
2. Discuss and apply the various tools and techniques of lean manufacturing.
3. Know the concepts of JIT and JIDOKA.
4. Understand the Lean culture and its analysis.

Cos	Mapping with POs
CO1	PO3,PO5,PO8,PO10
CO2	PO3,PO5,PO8,PO10,PO11
CO3	PO3,PO5,PO8,PO10,PO11
CO4	PO10,PO11
CO5	PO5,PO8,PO10,PO11

TEXT BOOKS:
1. Devadasan S R, Mohan Sivakumar V, Murugesh R and Shalij P R, "Lean and Agile Manufacturing: Theoretical, Practical and Research Futurities", Prentice Hall of India Learning Limited, New Delhi, 2012.
2. Dennis P, "Lean Production Simplified: A Plain Language Guide to the World's Most Powerful Production System", Productivity Press, New York, 2007.
REFERENCES:
1. Gopalakrishnan N, "Simplified Lean Manufacture: Elements, Rules, Tools and Implementation", Prentice Hall of India Learning Private Limited, India, 2010.
2. Bill Carreira, "Lean Manufacturing that Works: Powerful Tools for Dramatically Reducing Wastes and Maximizing Profits", Prentice Hall of India Learning Private Limited, India, 2007.
3. Don Tapping, Tom Luyster and Tom Shuker, "Value Stream Management: Eight Steps to Planning, Mapping and Sustaining Lean Improvements", Productivity Press, New York, USA, 2002.

Sub Title : DESIGN OF EXPERIMENTS		
Sub Code : IM 754	**No. of Credits: 3= 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hrs	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours : 39**

Objectives:
1. To describe how to design experiments, carry them out, and analyze the data they yield.
2. To introduce Taguchi methods, and compare and contrast them with more traditional techniques.
3. To examine how a factorial design allows cost reduction, increases efficiency of experimentation
4. Design and conduct orthogonal array experiments for process improvement.

Unit No.	Syllabus Content	No of Hours
1	**Introduction:** Strategy of Experimentation, Design of Experiments: Definition, Objectives, Principles of DOE, Applications, Guidelines. Principles of Quality Engineering- Definition of quality, Taguchi's Quality philosophy, Off-line and on-line quality control, Quality loss function, Quadratic loss function, Noise Factors, P- diagram, Optimization of Product and Process design	**09**
2	**Factorial Experimentation** – Single Factor Experiments, The 2^2 Design, The 2^3 Design, The General 2^k Design, A Single Replicate of the 2^k Design, Problems.	**07**
3	**Blocking and Confounding in the 2^k Design:** Blocking a Replicated 2^k Factorial Design, Confounding in the 2^k factorial design, Confounding the 2^k factorial design in two Blocks and Four Blocks	**06**
4	**Designing of experiments through Orthogonal Arrays:** Counting degrees or freedom, selecting a standard orthogonal array, dummy level technique, and compound factor method. Linear graphs and interaction assignment. Modification of linear graphs, column merging method, branching design. Strategy for constructing an orthogonal array. Comparison with the classical statistical experiment design.	**07**
5	**Steps in Robust Design:** Case study discussion, Noise factors and testing conditions. Quality characteristics and objective functions. Control factors and their levels. Matrix experiment and data analysis plan. Conducting the matrix experiment, Data analysis, Verification experiment and future plan. **Signal-To-Noise Ratio:** Evaluation of sensitivity to noise. S/N ratios for Static problems: Smaller-the-better, Larger-the-better, Nominal-the-best and Asymmetric Cases. Signal-to-noise ratio for dynamic problems: S/N ratios for Continuous-continuous, continuous-digital, digital-continuous, digital-digital cases. Introduction to Response Surface Methodology.	**10**

Note 1: Unit 1 and Unit 5   will have internal choice.
Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
Assignment - 2 from units 3, 4 and 5.

Course Outcomes:
CO1: Determine the importance of statistical design of experiments and benefits in R&D   CO2: Investigate the logic of hypothesis testing, including analysis of variance and the detailed analysis of experimental data.   CO3: Design and conduct orthogonal array experiments for process improvement.   CO4:Choose an appropriate experimental design based on the study objectives   CO5:Interpret the results of the experiment and report the conclusions based on S/N ratio analysis

Cos	Mapping with POs
CO1	PO1,PO3,PO4
CO2	PO2,PO4,PO5
CO3	PO3,PO4
CO4	PO2,PO3
CO5	PO2,PO4

TEXT BOOKS:
1. Quality Engineering Using Robust Design – Madhav S. Phadke, Prentice Hall PTR, Englewood Cliffs, New Jersey 07632.
2. Design and Analysis of Experiments – D.C. Montgomery, John Wiley and Sons, 2002.

REFERENCE BOOKS:
1. Designing for Quality – Robert H. Lochner and Joseph E. Matar, - an Introduction Best of Taghuchi and Western Methods or Statistical Experimental Design", Chapman and Hall Madras, 2nd edition.
2. Taguchi techniques for quality engineering, Phillip J. Ross, McGraw Hill, 1996.

Sub Title : ENTERPRISE RESOURCE PLANNING LAB		
Sub Code : IML 76	No. of Credits: 1= 0 : 0 : 1 (L-T-P)	No. of lecture hours/week : 2
Exam Duration : 3 hrs	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 52

Objective:
1. To provide an Determineing of the managerial issues involved in the design and implementation of Enterprise Resource Planning Systems 2. Knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry; 3. Use of statistical tools for data analysis.

Unit No.	Syllabus Content	No of Hours
1	Creating Item Master for various Engineering Designs Creating Supplier Master for Items Creating customer Master for Items Generating Bill of Materials for Various Engineering Designs Creating Purchase order for Items Creating Work order / job card for Items and Dispatch Instruction for Items	24
2	Optimization problems using OR packages Linear programming Transportation problem Assignment problem PERT/CPM	12

Course Outcomes:
CO1: Develop the skills and knowledge to support the implementation and maintenance of Enterprise Resource Planning (ERP) systems. CO2: Formulate and solve Linear programming problems, transportation and assignment Problems

Cos	Mapping with POs
CO1	PO3,PO5,PO6,PO11
CO2	PO2,PO4,PO5

Scheme of Examination:
ONE question from Unit -1   : 30 marks ONE question from Unit -2   : 10 marks   Viva-Voce: 10 marks.
Suggested Software Packages
1. Statistical Packages : SYSTAT / MINITAB / SPSS and such others 2. ERP Packages : SIXTH SENSE / RAMCO / MAARSMAN / CIMAS / UNISOFT 3. OR Packages : Lindo / Lingo / Storm

Sub Title : CIM Lab		
Sub Code : IML 77	No. of Credits:1= 1 : 0 : 0 (L-T-P)	No. of lecture hours/week : 4
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 52

Objective:
1. Develop an determine of the practical aspects of enabling computer aided technologies used in design and manufacturing.
2. Develop a degree of competency in the development and application of modern CAD/CAM system through hands on experience in the solution of practical problems.
3. Define to Operate and program industrial (manipulator) robots.

Unit No.	Syllabus content	Hrs
Unit – 1	CNC part programming using CAM packages. Writing and execution of manual part program using ISO code for machining of simple parts, turning, taper turning, form turning, and thread cutting. Use radius compensation, canned cycles, macros etc. CNC milling: Writing and execution of part program for contour milling.	18
Unit – 2	Simulation of Turning, Drilling, Milling operations. 3 typical simulations to be carried out using simulation packages like CADEM, or any equivalent software.	15
Unit – 3	**(Only for Demo/Viva voce)** Robot programming: Using Teach Pendent to perform pick and place, stacking of objects in increasing or decreasing size, palletizing operations etc.	03

Outcome:
1. Explain the concepts and modeling and the usage of models in different engineering applications. Explain the benefits of a comprehensive and integrated CAD/CAM system.
2. Create accurate and precise geometry of complex engineering systems and use the geometric models in different engineering applications.
3. Compare the different types of modeling techniques and explain the central role solid models play in the successful completion of CAD/CAM-based product development.
4. Use and assess state-of-the-art CAD/CAM codes efficiently, effectively and intelligently in advanced engineering applications.
5. Use and Operate industrial (manipulator) robots.

Cos	Mapping with POs
CO1	PO2,PO5,PO7,PO12
CO2	PO2,PO5,PO7,PO12
CO3	PO2,PO5,PO7,PO12
CO4	PO2,PO5,PO7,PO12
CO5	PO2,PO5,PO7,PO12

Scheme of Examination:
ONE question from Unit -1:   20 marks ONE question from Unit -2:   20 marks Viva-Voce   : 10 marks
Suggested software: 1. Simulation Packages: Fanuc/ CNC Base (SLM/SLC) 2. Simulation Packages : CADEM, CAPStrun, CAPSmill 3. Robot Simulation Aristosim.

Sub Title : STATISTICS LAB		
Sub Code : IML78	No. of Credits: 1= 0 : 0 : 1 (L-T-P)	No. of lecture hours/week : 4
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 36

Objective:
1. To Determine and apply the basic fundamental concepts of Statistics to engineering problems and the importance of Data summary and Display.
2. Application of probability distributions to various manufacturing problems.
3. Application of hypothesis to random experiments of manufacturing processes.
4. To test the statistical parameters by regression and correlation.
5. To design an engineering problem as random experiment to solve and test for variance.

Unit No.	Syllabus content	Hrs
1	1. Determining basic statistics (Mean, Median, Mode, Standard deviation, Range, Harmonic Mean, Geometric Mean, Variance and Coefficient of variation) for the given quality characteristic and interpreting it. 2. Representing the data in graphical forms: Line diagram, Bar chart, Pie Chart, Stem and leaf plot, Histogram, Pareto Chart. 3. Construction of Scatter diagram for the given variables and interpretation of different forms of scatter diagrams. 4. Conduction of regression analysis for two variables using least squares method and fitting a straight line. 5. Conduction of multiple regression analysis for the given variables. 6. Control charts and Process Capability analysis.	15
2	1. Interval estimation and hypothesis testing on mean of a normal distribution. 2. Interval estimation and hypothesis testing on difference in means of two normal distributions. 3. Hypothesis testing on variance of a normal population. 4. Hypothesis testing on variances of two normal populations. 5. Hypothesis testing on a single population proportion. 6. Fitting an appropriate distribution (normal distribution) for the given variable quality characteristic 7. Conduct One way and two way ANOVA Analysis for the given problem 8. Design of experiments using CATAPULT. 9. Use of Orthogonal Arrays to minimize the number of experiments in 2-level, 3- level and mixed- level factorial experiment. 10. Taguchi predictions, S/N ratios.	21

Outcome:
1. To apply the statistical data in the form of Tabular and Graphical display.
2. Able to identify type of probability and solve the various manufacturing problems.

36

3.	Able to test the hypothesis and give inference to random experiments.
4.	Able to develop and test the statistical parameters by estimation.

Cos	Mapping with POs
CO1	PO1,PO2,PO3,PO6,PO7,PO11,PO12
CO2	PO1,PO2,PO3,PO6,PO7,PO11,PO12
CO3	PO1,PO2,PO3,PO6,PO7,PO11,PO12
CO4	PO1,PO2,PO3,PO6,PO7,PO11,PO12

Scheme of Examination:

ONE question from Unit -1: 15 marks
ONE question from Unit -2: 25 marks
Viva-Voce   : 10 marks

Suggested software:
1. Statistical Packages : SYSTAT / MINITAB / SPSS and such others

Sub Title : TOTAL QUALITY MANAGEMENT		
Sub Code: IM 813	No. of Credits:3 =3 : 0 : 0 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hours	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 39

Course objectives:
1. Develop and determining the necessary information and skills needed to manage, control and improve quality practices in the organization through TQM Philosophy.
2. Apply the improvement methodologies for problem solving in organizations.
3. Demonstrate the importance of TQM tools required for problem solving processes.
4. Demonstrate the quality Management standards for the present industrial scenario.

Unit No.	Syllabus Content	No of Hours
1	**Introdction:** TQM introduction- Historical review- Obstacles- Benefits of TQM, Elements of TQM- Principles of TQM- Concepts of TQM- Fundamental Characteristics of TQM- TQM routine duties and awareness- Quality in Manufacturing and Service Systems.	4
2	**Principles and Philosophies of Total Quality Management -**Gurus of TQM and their Contribution-Deming's Management Philosophy- 14 points for management and PDCA cycle – Juran's Philosophy, Juran-quality trilogy, Imai,s Kaizen and innovation, The Crosby Philosophy- quality treatment and and 14 points. Taguchi Loss Function. Leadership: Definition, characteristics of quality leaders, leadership concept.	8
3	**Quality Evolution,Customer Satisfaction and Employee Involvement** Evolution of Quality Concepts **-**Four Fitness of quality and Weakness**-**Evolution of Quality Methodology- Evolution of Company Integration- Quality of Conformance versus Quality of Design-From Deviations to Weakness to Opportunities- Aware of Four Finesses-Future Finesses- Four Revolutions of Management Thinking and Four Levels of Practice of TQM. A Customer Focus – Fact-Based Management– Continuous Improvement – Teamwork and Participation. Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement,	12
4	**TQM Tools and Techniques** 7 Basic tools of TQM –Nominal Group Technique – Quality Circles – Flow Charts – Pareto Analysis– Poka Yoke (Mistake Proofing), Process, Quality Function Deployment (QFD), House of Quality, QFD Process, Benefits, Total Productive Maintenance (TPM) Concept, Improvement Needs, FMEA, Stages of FMEA, cybernetic Analysis, Six Sigma Concepts and Methodology (Introducion ascpets only)	12
5	**Quality Management Systems (Introductory Aspects Only)** a. The ISO 9001:2000 Quality Management System Standard b. The ISO 14001:2004 Environmental Management System Standard c. ISO 27001:2005 Information Security Management System d. ISO / TS16949:2002 for Automobile Industry	03

	e. CMMI Fundamentals and Concepts and f. Certification process.	

Note 1: SEE Question paper contains total seven Questions, student should answer any one question from Unit I and Unit II and student shall answer total five question.

Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
   Assignment - 2 from units 3, 4 and 5.

Outcomes:
1. Ability to Determine the TQM philosophies in organization and concepts of leadership.
2. To Define and Determine the evolution of quality concepts, methods and customer satisfaction.
3. To gain the knowledge of quality control tools in TQM.
4. To determine the concepts of reliability and quality failure.
5. To Determine the fundamental concepts of quality management systems

Cos	Mapping with POs
CO1	PO6,PO7,PO11
CO2	PO5,PO8,PO10,PO12
CO3	PO4,PO5,PO6,PO7
CO4	PO4,PO5,PO6,PO7
CO5	PO4,PO5,PO6,PO7

TEXT BOOKS:
1. A New American TQM Four Practical Revolutions in Management‖ –Shoji Shiba, Alan Graham and David Walden,– Productivity Press, Portlans (USA) , 1993
2. Management for Total Quality" –N Logothetis- Prentice Hall of India, New Delhi, 1994.
3.Dale H. Besterfield "Total Quality Management ''(3rd Edition) 3rd Edition Prentice Hall Publications

REFERENCE BOOK:
1. The Quality Improvement Hand Book, -Roger C Swanson, Publisher Vanity Books International, New Delhi, 1995.
2. Total Quality Management – Kesavan R – I K International Publishing house Pvt. Ltd, 2008

E BOOKS:
1. http://psbm.org/Ebooks/Total%20Quality.pdf
2. http://www.mescenter.ru/images/abook_file/Total_Quality_Management_and_Six_Sigma.pdf
MOOCs:
3. https://www.mooc-list.com/course/fundamentals-six-sigma-quality-engineering-andmanagement-edx?static=true

Sub Title : HUMAN RESOURCE MANAGEMENT		
Sub Code : IM 814	No. of Credits: 3= 3 : 0 : 0 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 39

Objectives :
1. An ability to evaluate and apply theories of social science disciplines to workplace issues 2. Use of HRM functional capabilities to select, develop, and motivate workers **3.** To develop strong analytical, communication, and decision making skills.

Unit No.	Syllabus Content	No of Hours
1	**INTRODUCTION:** Definition, objectives and Functions. **HUMAN RESOURCE PLANNING**: Uses and benefits, Man Power Inventory, Man Power Forecasting, Methods of Man Power Forecasting, job Description, Job Specification.	**07**
2	**RECRUITMENT:** Sources of Man power, Advertisement, Short Listing of Candidates calling Candidates for selection Process.	**06**
3	**SELECTION:** Selection procedure – Written Test, Group Discussion. Interview – Different methods, advantages and Limitations, Psychological testing – Advantages and limitations, Induction procedure, transfers, promotion exit interview, (Tutorial on written test, Group Discussion, Interviews)	**10**
4	**TRAINING AND DEVELOPMENT:** Identification of Training needs, Training Evaluation, Training Budget, Executive Development – Different Approaches, Non-executive development – Different methods. **PERFORMANCE APPRAISAL:** Components (all round performance appraisal), Methods, Advantages and limitations of different methods, Personal Counselling based on Annual Confidential Reports.	**10**
5	**INDUSTRIAL RELATIONS:** Meaning Characteristics of Industrial Relations, Factors of Industrial, Relations, the Three Actors of Industrial Relations, Importance of Harmonious Industrial Relations, Objectives of Industrial Relations, Functions of Industrial Relations, Code of Industrial Relations, Conditions for Congenial Industrial Relations.	**06**

Note 1: SEE Question paper contains total seven Questions, student should answer any one question from Unit 3 and Unit 4 and student shall answer total five question.
Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
     Assignment - 2 from units 3, 4 and 5.

Outcomes:
1. Apply the knowledge and skills needed to effectively manage human resources
2. Examine current issues, trends, practices, and processes in HRM
3. Compare the common methods for recruiting and selecting human resource
4. Contribute to employee performance management and organizational effectiveness
5. Evaluate employee orientation, training, and development programs.

Cos	Mapping with POs
CO1	PO2,PO8,PO12
CO2	PO3,PO5,PO11
CO3	PO2,PO8,PO12
CO4	PO3,PO5,PO11
CO5	PO2,PO8,PO11,PO12

TEXT BOOKS
6. **Human Resources Management** – Dr. K Ashwathappa, Tata McGraw Hill, Edition 2016
7. **Management of Human Resources** – CB Mamoria – Himalaya Publication House, 2003

REFERENCES BOOKS
1. **Essentials of HRM and industrial relationc** – Subbarao,P , Himalaya publishing house 2016
2. **Personnel / Human resource Management** – Decenoz and robbins PHI, 2002
3. **Industrial Acts** by Jain, 2004
4. **Industrial Relations** – Arun Monappa – TMH, ISBN – 0-07-451710-8

The question paper should contain five questions, i.e., each question from each unit and from UNIT III and UNIT IV can have two questions in each unit but, student should answer any one from Unit III and Unit IV and student shall answer total five question

Elective Group – E

Sub Title : STRATEGIC MANAGEMENT		
Sub Code : IM 821	No. of Credits: 3= 3 : 0 : 0 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 39

Objectives:
1. To provide an integrative framework that will allow students to blend knowledge from other courses into a comprehensive determining of competitive advantage.   2. To provide a basic determining of the nature and dynamics of the strategy formulation and implementation processes.   3. To encourage students to think critically and strategically.

Unit No.	Syllabus Content	No of Hours
1	**STRATEGIC MANAGEMENT INTRODUCTION:** Definition- Levels of strategy- Roles of Strategist- Strategic Management Process benefits and limitations. Mission -Objectives -Social responsibilities.	07
2	**STRATEGY FORMULATION:** Strategic Thinking, SWOT analysis- Techniques for environmental analysis- TOWS matrix, Balanced Score Card, Steps in strategy implementation -formulation of SBU strategy. Leadership implementation, communicating the strategy:- Annual and Functional objectives- Development of policies- Organizational Implementation- Evaluation and control. Reward system.	10
3	**STRATEGY AND STRUCTURE:** Strategy- Structure relationship. Organizational restructuring and Transformation, Principles of Organization. Strategic control- Premise and Implementation control strategic Surveillance special alert control- Operational control - Steps in Operational Control, Types of Operational control.	06
4	**PORTFOLIO STRATEGY:** Business portfolio analysis- BGC matrix, GE multi matrix, an evaluation of Portfolio models - factors influencing portfolio strategy.	06
5	**COMPETITIVE ANALYSIS AND STRATEGIES:** Structural analysis of industries threat of entry rivalry among existing competitors, threat of substitutes; Bargaining power of suppliers; structural analysis and competitive strategy - competitor analysis value chain. **BUSINESS GROWTH:** Reasons, Risks and indicators of Business growth, Growth Strategies -- Intensive , Growth Strategies, Integrative Growth Strategies, Diversification, External Growth Strategies.	10

Note 1: SEE Question paper contains total seven Questions, student should answer any one question from Unit 2 and Unit 5 and student shall answer total five question.

Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
Assignment - 2 from units 3, 4 and 5.

Outcomes:
1. Articulate a vision that gives meaning to all the firm's stakeholders of the firm's objectives
2. Formulate a strategic plan that operationalizes the goals and objectives of the firm
3. Implement a strategic plan that takes into account the functional areas of business
4. Evaluate and revise programs and procedures in order to achieve organizational goals
5. Analyse dynamics in competitive rivalry including competitive action and response, for acting both proactively and defensively.

Cos	Mapping with POs
CO1	PO4,PO7,PO8
CO2	PO6,PO7,PO9
CO3	PO6,PO7,PO9,PO11
CO4	PO7,PO10,PO11
CO5	PO7,PO11,PO12

TEXT BOOKS:
1. **Strategic Management** - Francis Cherunilam, Himalya Publishers,
2. **Business Policy and Strategic Management** - Azhar Kazmi, 2nd Edn, Tata McGraw Hill
3. **Strategic Management**, Michael Porter, Prentice-Hall, 1984

REFERENCE BOOKS:
1. **Business Policy and Strategic Management** -P Subba Rao, Himalya Publishers 1st Edition
2. **Corporate Strategic Management** -R.M.Srivastava, Pragati Prakashan , Meerut 1st Edition
3. **Strategic Management** – Robert A Pitts and David Lei, Vikas Publishing House 1st Edition
4. **Business Environment for Strategic Management** - K.Aswantappa, Himalaya Publishers 1st Edition

Sub Title : MANAGEMENT INFORMATION SYSTEM		
Sub Code : IM 826	**No. of Credits: 3= 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hrs	**CIE +Assignment + SEE =** **45 + 5 + 50 =100**	**Total No. of Contact Hours : 39**

Objectives:
1. Determine the importance of information systems for business and management;
2. Evaluate the role of the major types of information systems in a business environment and their relationship to each other;
3. Assess the impact of the Internet and Internet technology on business-electronic commerce and electronic business;

Unit No.	Syllabus Content	No of Hours
1	**Fundamentals of information system**: fundamental roles of is in business, managerial challenges of it, types of information system, components of an IS, information system resources and activities, competitive strategy concepts, strategy uses of it, competitive advantages.	10
2	**Electronic business system**: introduction, cross-functional enterprise application, enterprise application integration, transactional processing systems, enterprise collaboration systems, enterprise application architecture. **Functional business systems**: introduction, marketing information systems, manufacturing systems, human resource systems, accounting systems, financial management systems.	10
3	**Electronic commerce systems**: introduction, the scope of ecommerce, essential of e-commerce process, electronic payment process. E-commerce applications and issues: ecommerce application trends, business-tocustomer ecommerce, web store requirement, business-to-business e-commerce.	06
4	**Security and ethical challenges**: introduction, ethical responsibility of business professionals, computer crime, privacy issues, other challenges, health issues, societal solutions. Security management of it: introduction, internetworked security defences, other security measures, system control and audits.	06
5	**Enterprise and global management of IT**: managing IT, business/IT planning, managing and IT function. Failures of IT management: global IT management, cultural political and geoeconomic challenges, global business/IT applications.	07

Note 1: Unit 1 and Unit 2 will have internal choice.
Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3, 4 and 5.

Outcomes:
1. Able to determine and define the basic concepts and technologies used in the field of information systems for business operations.
2. Able to apply and operate E-business
3. Able to operate and extend the use of E-commerce

4. Able to operate and extend the use of EDI
5. Able to summarize, judge the ethical, social, and security issues of information systems.

Cos	Mapping with POs
CO1	PO4,PO5 ,PO11,PO12
CO2	PO11,PO12
CO3	PO3,PO5,PO8,PO10,PO11,PO12
CO4	PO8,PO11,PO12
CO5	PO4,PO5,PO7, PO11,PO12

TEXT BOOKS:
1. **Management Information system**- managing information technology in the internet worked enterprise- James. A O'Brien – Tata McGraw Hill publishing company limited, 2002.
2. **Management Information System** – Laudon & Laudon PHI ISBN 81-203-1282-1.1998.
3. **Kalakota and Whinston**, Frontiers of Electronic Commerce, Pearson education Inc. and Dorling Kindersley Publishing Inc, 7th Edition.
REFERENCE BOOKS:
1. **Management Information system**- S.Sadogopan.PHI 1998Edn. ISBN 81-203-1180-9
2. **Information systems for modern management** – G.R. Murdick PHI, 2nd Edition.
3. Turban E.F, Potter R.E, "Introduction to Information Technology"; Wiley, 2 004.
4. Jeffrey A.Hoffer, Joey F.George, Joseph S. Valachich, "Modern Systems Analysis and Design", Third Edition, Prentice Hall, 2002.

Sub Title : Subject Seminar		
Sub Code : IMS 85	No. of Credits: 2= 2 : 0 : 0 (L-T-P)	No. of lecture hours/week : 4
Exam Duration :	CIE +Assignment + SEE = 45 + 5 + 50 =100	Total No. of Contact Hours : 52

Objective:
1. To equip students for making a subject presentation based on a thorough research review on any contemporary area of engineering and management fields.   2. Offering the student an opportunity to interact with faculty and peer group and to build the ability to making independent presentation.

Sl. No.	Syllabus	
1	**Procedure:** 1. A list of contemporary topics will be offered by the faculty of the department in the in the interlude period between 7th and 8th Semester. 2. Student can opt for topic of their own choice and indicate their option to the department at the beginning of the 8th semester. This component is also evaluated twice in the semester like Mini Project-CIE-1 and CIE-II. The final, marks shall be submitted to the exam section at the end of the semester.	

Cos	Mapping with POs
CO1	PO2,PO8,PO12
CO2	PO3,PO5,PO11
CO3	PO2,PO8,PO12
CO4	PO3,PO5,PO11
CO5	PO2,PO8,PO11,PO12

Sub Title : Phase II Project Work		
Sub Code : IM P84	**No. of Credits: 2= 2 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hrs	**CIE +Assignment + SEE =** **45 + 5 + 50 =100**	**Total No. of Contact Hours : 52**

Sl. No.	Syllabus	
1	Phase I – 02 Credits in VII Semester.	
2	Student shall complete the project work well in time and shall be assessed by the guide and the departmental Project Review Committee for 50 marks (CIE). Later project viva-voce shall be conducted by the exam section and both internal and external examiners for 50 marks do evaluation.	

Dr. Ambedkar Institute of Technology

Department of Industrial Engineering and Management

The Enclosed Document is Verified and Approved.

HOD

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Dept. of Industrial Engineering & Management
Dr. Ambedkar Institute of Technology
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III SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BC	18MA31	Transforms and Boundary Value Problems	Mathematics	2	2	--	03	50	50	100	3
2	PC	18IM31	Mechanical Measurements and Metrology		3	0	--	03	50	50	100	3
3	PC	18IM32	Material Science and Metallurgy		3	0	--	03	50	50	100	3
4	PC	18IM33	Thermal and Fluids Engineering		3	2	--	03	50	50	100	4
5	PC	18IM34	Manufacturing Technology		3	0	--	03	50	50	100	3
6	PC	18IM35	Mechanics of Materials		2	2	--	03	50	50	100	3
7	PC	18IM36	PYTHON Programming		2	0	--	03	50	50	100	2
8	PC	18IML37	PYTHON Programming Laboratory		--	---	2	03	50	50	100	1
9	PC	18IML38	Manufacturing Technology Laboratory		--	---	2	03	50	50	100	1
10	HS	18HS31/32	Constitution of India Professional Ethics and Human Rights/ / Env. Studies	HS/ CV	1	--	--	02	50	50	100	1
11	MC	18HS33	Soft skills (MC)	Humanities	02	-	--	02	50	-	50	0
TOTAL					**21**	**06**	**04**	**31**	**550**	**500**	**1100**	**24**

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs												
12	MC	18MAD31	Basic Engg. Mathematics - I	Mathematics	02	01	--	03	50		50	0
Note: BC: Science Course, PC: Professional Core. HS: Humanities, MC: Mandatory Course.												

IV SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BC	18MA41	Numerical Methods & Applied Statistics	Mathematics	2	2	--	03	50	50	100	3
2	PC	18IM41	Work-study and Ergonomics		4	0	--	03	50	50	100	4
3	PC	18IM42	Theory of Machines		2	2	--	03	50	50	100	3
4	PC	18IM43	Engineering Economy		2	2	--	03	50	50	100	3
5	PC	18IM44	Statistics for Engineers		4	0	--	03	50	50	100	4
6	PC	18IML45	Computer Aided Machine Drawing		2	0	2	03	50	50	100	3
7	PC	18IML46	Work-study and Ergonomics Laboratory		--	--	2	03	50	50	100	1
8	PC	18IML47	Mechanical Measurements and Metrology Laboratory		--	---	2	03	50	50	100	1
9	PC	18IML48	Material Testing Laboratory		--	--	2	03	50	50	100	1
10	HS	18HS41/42	Constitution of India Professional Ethics and Human Rights/ Env. Studies	HS/ CV	1	--	--	02	50	50	100	1
11	MC	18HS43	Employability skills (MC)	Humanities	02	-	--	03	50	–	50	0
			TOTAL		**19**	**06**	**08**	**32**	**550**	**500**	**1050**	**24**
Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs												
12	MC	18MAD41	Basic Engg. Mathematics - II	Mathematics	02	01	--	03	50		50	0

Note: BC: Science Course, PC: Professional Core. HS: Humanities, NCMC: Non-Credit Mandatory Course.
ENV: Environmental Studies, CIP: Constitution of India Professional Ethics and Human Rights

Subject Title	: MECHANICAL MESUREMENTS AND METROLOGY		
Sub Code	**: 18IM31**	**No of Credits : 3**	**No of lecture hours/week : 3**
Exam Duration : 3 Hrs.	**CIE + SEE = 50+ 50 =100**		**Total No. of Contact Hours : 39**

Course Objectives:
1. To understand the Measurement standards and systems.
2. To understand and apply the calibration procedure of different instruments.
3. To classify various types and use of gauges, projectors, comparators and transducers

Unit No	Syllabus	No of Hours
1	**Measurements and measurement systems:** Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, Mechanical Transducers: Spiral springs, Torsion Bars, Diaphragms & Bellows, Electrical Transducer: Resistive Transducer, Electronic Transducer, advantages of each transduce	05
2	**Measurement of force, torque and pressure:** Principle, analytical balance, platform balance, proving ring. Torque measurement, Prony brake, hydraulic dynamometer. Pressure measurements, principle, use of elastic members, , McLeod gauge, **Temperature and strain measurement:** Resistance thermometers, thermocouple, law of thermo couple, materials used for construction, Total radiation pyrometer, Optical Pyrometer, Strain measurement, Mechanical strain gauge, preparation and mounting of strain gauges, gauge factor, Basic Wheatstone resistance bridge and methods of strain measurement (Deflection method and null method).	06
3	**Standards of measurement:** Definition and Objectives of metrology, Standards of length-International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M-81, M-112), Numerical problems on building of slip gauges.	06

4	**System of Limits, Fits, Tolerance and Gauging:** Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS919-1963), geometrical tolerance, positionaltolerances, hole basis system, shaft basis system, classification of gauges, brief concept of design of gauges (Taylor's principles), Types of gaugesplain plug gauge, ring gauge, snap gauge, limit gauge and gauge material, simple problems on limits & fits	11
5	**Comparators and Angular measurement:** Introduction to comparators, characteristics, classification of comparators, mechanical comparatorsJohnson Microkator, dial indicator, optical comparator-principle, Zeiss ultraoptimeter, electric comparator-principles, LVDT,. Angular measurements, bevel protractor, sine principle and use of sine bars, sine centre, use of angle gauges (numerical on building of angles). **Interferometer and screw thread, gear measurement:** Interferometer, interferometry, autocollimator. Optical flats. Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, best size wire.	11

Note 1:
- **SEE question paper shall contain 10 questions having internal choice in each unit. Students shall answer one question from each unit.**

Note 2:
- **Assignments are evaluated for 5 marks. ☐ CIE shall be evaluated for 20 marks**

Course Outcome:
After the completion of the above course students will be able to 1. Define and classify Measurements and measurement systems 2. Distinguish and sketch different measurement of force, torque, pressure and temperature, strain measuring instruments. 3. Define standards of measurement and solve problems on building of slip gauges. 4. Illustrate and define Indian Standards, principles of limits of size and tolerances and solve problems on limits and fits. 5. Classify comparators and determine gear parameters and solve problems on building of angles.

Cos	Mapping with POs
CO1	PO2,PO3,PO5,PO12
CO2	PO1,PO2,PO7,PO12
CO3	PO1,PO2,PO7,PO12
CO4	PO1,PO2,PO7,PO12
CO5	PO1,PO2,PO7,PO12

TEXT BOOKS:
1. **Mechanical Measurements,** Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. **Engineering Metrology,** R.K. Jain, Khanna Publishers, 1994.
3. **Mechanical Measurements,** R.K. Jain

REFERENCE BOOKS:
1. **Engineering Metrology,** I.C. Gupta, Dhanpat Rai Publications, Delhi.
2. **Industrial Instrumentation,** Alsutko, Jerry. D. Faulk, Thompson Asia Pvt. Ltd.2002.
3. **Measurement Systems Applications and Design,** Ernest O. Doblin, McGraw Hill Book Co.

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Subject Title	: MATERIAL SCIENCE AND METALLURGY		
Sub Code	: 18IM32	No of Credits : 3:0:0	No of lecture hours/week : 3
Exam Duration : 3 Hrs.		CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 39

Course Objective :
1. To classify different materials and state their properties 2. To identify the structure of materials and imperfections with different mechanisms 3. To study different types of material testing methods and heat treatment process 4. To understand the characteristics and applications of composite and Nano materials process

Unit No	Syllabus	No of Hours
1	**Introduction to Materials**: Ferrous and Non-Ferrous Materials and Alloys, Metals, Production, General Properties, and Applications. **Crystal Structure:** BCC, FCC and HCP Structures, coordination number and atomic packing factors, crystal imperfections -point line and surface imperfections. (Problems) **Atomic Diffusion:** Phenomenon, Flick's I & II laws of diffusion, and Factors affecting diffusion. (Problems) . **Mechanical Behavior of Materials:** Stress-strain diagram showing ductile and brittle behavior of materials, linear and non-linear elastic behavior and properties. **Mechanical Properties of Materials:** Yield Strength, Offset Yield Strength, Ductility, Malleability, Stiffness, Resilience, Rigidity, Ultimate tensile strength and Toughness.	10
2.	**Testing of Materials-** Tensile and Compression testing, **Impact testing-** Izod and Charpy Impact testing. **Fatigue testing**- Fatigue: Types of fatigue loading with examples, Mechanism of fatigue, fatigue properties, fatigue testing and SN diagram **Torsion Testing:** Types of Torsion failure. **Creep:** Description of the phenomenon with examples. Three stages of creep, creep properties, stress relaxation, other related testing methods. **Hardness Testing:** Brinell hardness, Rockwell hardness and Vickers hardness testing of materials, Micro hardness and Nano indentation. **Fracture of Materials:** Fundamentals of fracture, Brittle, Ductile and shear type of fracture (Type I, Type II and Type III). (Problems)	10
3	**Phase Diagram I:** Solid solutions and its types and intermediate phases - Hume Rothery's rule - solidification of metals and alloys, cooling curves, concepts of phase diagrams. Gibbs Phase rule. Coring and segregation as applied to various binary systems, ternary systems. **Phase Diagram II:** Construction of equilibrium diagrams involving complete and partial solubility, Lever rule. Iron-carbon equilibrium diagram description of phases. (Problems)	07

4	**Heat-treatment of steels:** TTT curves, Continuous Cooling Transformation Curves (CCT) diagrams, bainitic transformation, martensitic transformation. **Annealing and its types.** Normalizing, Hardening, Tempering, Mar tempering, Austempering, Harden ability. **Surface hardening:** Carburizing, Cyaniding, Nitriding, Flame hardening and Induction hardening.	06
5	**Advanced Material Processing Technology:** Introduction to Composite material, FRP composites – Fiber types-, properties, Strength and Elastic Modulus of Reinforced Plastics ,Rule of Mixtures and Problems **Matrices:** Matrices type and properties, lamina, laminate. **Introduction, properties and applications-** Metal matrix composites , Ceramic matrix composites, Nano Material, shape memory alloys, High strength alloys, Super alloys. (Problems).	06

Note 1:
- **SEE question paper shall contain 10 questions having internal choice in each unit. ☐ Students shall answer one question from each unit. Note 2:**
- **Assignments are evaluated for 5 marks. ☐ CIE shall be evaluated for 20 marks**

Outcome:

After the completion of the above course students will be able to
  1. Distinguish between different materials and their properties
  2. Test materials for impact, fatigue, torsion, creep, hardness and fracture
  3. Construct phase diagrams
  4. Explain different types of heat treatment processes
  5. Discuss advanced material processing technology, characterization techniques.

Cos	Mapping with POs
CO1	PO3,PO6,PO8,PO10
CO2	PO3,PO4,PO7,PO10,PO11
CO3	PO3,PO4,PO7,PO10,PO11
CO4	PO6,PO10,PO11
CO5	PO6,PO8,PO10

Text books:
1. Raghavan V., „Physical Metallurgy - Principles and Practice", 2nd Edition, Prentice - Hall of India, 2007.
2. Avner S.H., „Introduction to Physical Metallurgy", 2nd edition, Tata McGraw Hill, 2008
3. Derek Hull, „Introduction to Dislocations", Pergamon, 2nd Edition, 1981

Reference books: 1. Dieter G. E., „Mechanical Metallurgy", 1st Edition, McGraw Hill Co- Koga, 2002

2. Suryanarayana AVK, „Testing of Metallic Materials", 2nd Edition, BS Publications, 2007. 3. Mein Schwartz., "Composite Materials Handbook", McGraw Hill, 1992

4. Autar K.Kaw, "Mechanics of Composite Materials", CRC Press, 2005.

5. "ASM Hand book on Composites", Volume 21, 2001

6. Vanviack L.H, "Physical Ceramics for Engineers", Addison Wesley Publication, 1964.

7. Schwartz. M. M., „Composite Materials", Prentice Hall, 1977

8. Broutman K. J., Krock R.H., „Modern Composite Materials", Addison Wesly Publishing, 1967

9. Billmeyer F., „Textbook of Polymer Science", Wiley Interscience, 1994

10. Manufacturing Engineering and Technology, Serope Kalpakjian & Steven R. Schmid.

Subject Title	: Thermal and Fluids Engineering		
Sub Code	**: 18IM33**	**No of Credits: 3:2:0 (L:T:P)**	**No of lecture hours/week : 5**
Exam Duration : 3 Hrs.		**CIE + SEE = 50 + 50 =100**	**Total No. of Contact Hours :65**

Course Objective :
1. To Understand the nature and role of various thermodynamic properties and heat transfer in Engineering Systems
2. Recognize the different forms of energy and restrictions imposed by the first law of thermodynamics on conversion from one form to another;
3. To study the implications of the second law of thermodynamics and limitations placed by the second law on the performance of thermodynamic systems;
4. To understand the working of Internal combustion engines, their performance analysis, and the importance of air standard cycles.
5. Illustrate the basic concepts of fluid mechanics and determine the velocity and flow rate measurement techniques

Unit No.	Syllabus	No of Hours
1	**Fundamental Concepts and Definitions:** Microscopic and Macroscopic approaches. Engineering thermodynamics; definition, some practical applications of engineering thermodynamic. System (Closed system) and Control Volume (open system); Characteristics of system boundary and control surface, examples. Thermodynamic properties; intensive and extensive properties. Thermodynamic process; Thermodynamic equilibrium; diathermic wall, Zeroth law of thermodynamics, Temperature: concepts, scales, measurement. Related numerical problems **Work and Heat:** Thermodynamic definition of work; examples, sign convention. Displacement work, expressions for displacement work in various processes through p-v diagrams (Excluding other types of work). Heat: definition, units and sign convention, misconceptions about heat. Related numerical problems.	9+5(T)
2	**First Law of Thermodynamics:** Joules experiments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy, two-property rule, Specific heat at constant volume, enthalpy, specific heat at constant pressure. Related numerical problems **Extension of the First law to control volume**: Steady State-Energy equation, important applications.Related numerical problems. (Unsteady processes not included).	8+5(T)
3	**Second Law of Thermodynamics:**Thermal reservoir. Direct heat engine; schematic representation and efficiency. Devices converting work to heat in a theromodynamic cycle; reversed heat engine, schematic representation, coefficients of performace. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics; Equivalence of the two statements; Reversible and irrevesible processes; factors that make a process irreversible, reversible heat engines,	7+5(T)

	Carnot cycle, Corollories of Carnot cycle (only statement), Related numerical problems	
4	**Properties of Fluids:** Introduction, Properties of fluids, viscosity, thermodynamic properties, surface tension, capillarity, Related numerical problems **Fluid Dynamics:** Euler's equation of motion, Bernoulli's equation from first Euler's equation. Fluid Flow Measurements: Venturimeter, orificemeter, pitot-tube. Related numerical problems (No Derivations in Fluid Flow Measurements)	8+5(T)
5	**Gas power cycle:** Air Standard cycles: Carnot, Otto, Diesel, and Dual cycles, P-V and T-S diagrams, description, efficiencies and mean effective pressures (No derivation for MEP), Comparison of Otto and Diesel cycles, Related numerical problems **I.C.Engine**: Testing of two stroke and four stroke SI and CI engines for performance, heat balance, Morse test, Related numerical problems	8+5(T)

Course Outcome (CO):
After the completion of the above course students will be able to

1. Estimate the various fluid properties, thermodynamic properties, work transfer and heat transfer.
2. Analyze the different forms of energy and restrictions imposed by the first law of thermodynamics on conversion from one form to another.
3. Analyze the performance of refrigeration and heat pump systems.
4. Assess the working of internal combustion engines and their performance analysis.
5. Determine the velocity and flow rate measurement techniques for flow through pipes.

Cos	Mapping with POs
CO1	PO1,PO3
CO2	PO1,PO2
CO3	PO3,PO4
CO4	PO2,PO3, PO4
CO5	PO3,PO4,PO6

<u>Text books:</u>

1. **Applications of Thermodynamics,** V. Kadambi, T. R. Seetharam and K. B. Subramanya Kumar, Wiley, 1st Edition, 2019.
2. **Basic and Applied Thermodynamics**, P. K. Nag, Tata McGraw-Hill Education Pvt. Ltd, 2nd Edition, 2010
3. **A Textbook of Fluid Mechanics and Hydraulic Machines**, Dr. R.K Bansal, Lakshmi Publications, 9th Edition, 2010 (Reprint 2015)

<u>Reference books:</u>
1. **Thermodynamics: An Engineering Approach**, Yunus A. Cengel, Michael A. Boles, McGraw Hill Education, 8th Edition, 2015
2. **Fluid Mechanics,** Frank M. White, McGraw Hill Publications (SIE), 7th Edition, 2011.

<u>Note 1:</u> SEE Question paper contains total ten Questions and student should answer any one question from each Unit and answer five full questions.

<u>Note 2:</u> Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.

Assignment - 2 from units 3, 4 and 5.

Sub Title : MANUFACTURING TECHNOLOGY		
Sub Code: 18IM34	**No. of Credits:3 =3 : 0 : 0**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE + SEE = 50+ 50 =100**	**Total No. of Contact Hours : 39**

Course objectives:
  1. Outline the importance of manufacturing processes and their industrial applications
     Understand and apply the concept of metal casting.
  2. Study the principles of welding technology.
  3. Understand the basic concepts of Metal cutting and cutting tool parameters.
  4. Study the importance of conventional and semiautomatic machining processes.

Unit No	Syllabus Content	No of Hours
1	**Introduction:** Concept of Manufacturing process and its importance. Classification of Manufacturing processes. Introduction to Casting process & steps involved. Varieties of components produced by casting process. Advantages Limitations and application of casting process. **Patterns:** Materials and classification of patterns, various pattern allowances and their importance and colour coding of pattern. **Sand Moulding:** Types of base sand, Method used for sand moulding, such as Green sand, dry sand and skin dried moulds. **Binder**: Definition and Types of binder **Additives**: Need, Types of additives used. **Cores:** Definition, Need, Types. Method of making cores, Binders used, core sand moulding. **Concept of Gating & Rising.** Principle and types. **Moulding Machines** and its types	8 Hrs
2	**Welding process:** Definition, Principles, Classification, Application, Advantages & limitations of welding. Arc Welding: Principle, Metal Arc welding (MAW), Flux Shielded Metal Arc Welding (FSMAW), Tungsten Inert Gas Welding (TIG & MIG) Submerged Arc Welding (SAW) and Atomic Hydrogen Welding processes. (AHW) **Principles of soldering & brazing:** Parameters involved & Mechanism. Different Types of Soldering & Brazing Methods.	8 Hrs
3	**Theory of metal cutting:** Single point tool nomenclature, geometry, orthogonal & oblique cutting, mechanism of chip formation, types of chips, Merchants analysis, shear angle relationship. Tool wear & tool failure effects of cutting parameters, Tool life criteria, Taylor's tool life equation, problems on Merchants analysis & tool life evaluation **Cutting tool materials:** Desired properties, types of cutting tool materials- HSS carbides, coated carbides, ceramics. Cutting fluids- properties, types & selection. Machinability, factors affecting machinability.	8 Hrs
4	**Production lathes**: Engine lathe, Capstan & turret lathes-constructional features. **Drilling machines:** Classification, constructional features. Types of drill, drill bit nomenclature, geometry of twist drill. Drilling & related operations. Problems on calculating the machining time.	7 Hrs
5	**Milling machines:** Classification, constructional features. Milling cutters &	8 Hrs

	nomenclatures. **Milling operations** - up milling & down milling concepts. Indexing: Purpose of indexing, indexing methods. Problems on indexing. **Grinding machines:** Types of Abrasives, Bonding process, classification, constructional features of surface, cylindrical & centre less grinding machines & operations.	

Note 1:
- **SEE question paper shall contain 10 questions having internal choice in each unit.** □ **Students shall answer one question from each unit. Note 2:**
- **Assignments are evaluated for 5 marks.** □ **CIE shall be evaluated for 20 marks**

Outcome:
After the completion of the above course students will be able to

1. Describe the primary and secondary manufacturing processes and industrial applications in different sectors.
2. Explain the concepts of sand moulding methods and metal melting process and also testing of casting and to produce defect free products.
3. Classify different metal joining methods through welding technologies.
4. Illustrate the characteristics of cutting tool materials.
5. Learns the principles and concepts of conventional and semiautomatic machines

Cos	Mapping with POs
CO1	PO1,PO2,PO3,PO7,P11
CO2	PO2,PO4,PO6,PO7,PO8,P11
CO3	PO2,PO4,PO6,PO7,PO8,P11
CO4	PO2,PO4,PO6,PO7,PO8,P11
CO5	PO1, PO2, PO2, PO7, PO8, P11.

Text books:
Hajra Choudhury, "Elements of Workshop Technology, Vol. I and II", Media Promotors Pvt Ltd., Mumbai, 2001.

S.Gowri, P.Hariharan, and A.Suresh Babu, "Manufacturing Technology 1&2 ", Pearson Education, 2008. 3. Nadkarni S.V. "Modern Arc Welding Technology", 1st Edition, IBH Publishing, 2005
4. **Workshop Technology,** Hajra Choudhry, Vol-II, Media Promoters & Publishers Pvt. Ltd. 2004
5. **Production Technology,** R.K.Jain, Khanna Publications, 2003.
6. **Production Technology,** HMT, Tata McGraw Hill, 2001.
7. **A text book of Manufacturing Technology**, Rajput R.K, Lakshmi Publications, 20074.

Reference Books:
1. Roy A Lindberg, Process and Materials of Manufacturing, 4th Ed. Pearson Edu. 2006.
2. Serope Kalpakjian, Steuen. R. Sechmid "Manufacturing Technology",Pearson Education Asia, 5th Ed. 2006.
3. P N Rao, Manufacturing Technology – "Foundry, Forming, and Welding", 4th edition, McGraw Hill Education (India) Private Limited, 2013, ISBN-13: 978-1-25-9606257-5 and ISBN-10: 1-25-906257-0
4. Mikell P. Groover, "Fundamentals of modern manufacturing: materials, processes and systems", JOHN WILEY & SONS, INC., 4th Edition, 2010, ISBN: 978-0470-467002 5. G.S Sawhney, "Manufacturing Science – I, Forming, Casting and Welding", 2015, I.K. International Publishing House Pvt. Ltd. ISBN: 978-93-82332-53
6. Amitabha Ghosh and Mallik, Manufacturing Science, affiliated East West Press, 2003.
7. G. Boothroyd, Fundamental Machining and Machine Tools, McGraw Hill, 2000
8. P.N. Rao "Manufacturing Technology", Metal Cutting and Machine Tools, Tata McGraw – Hill, New Delhi, 2003.
9. P.C. Sharma, "A Text Book of Production Engineering", S.Chand and Company Ltd, Fourth Edition, 1993.
10. Milton C.Shaw, "Metal Cutting Principles", Oxford University Press, 2nd Edition, 2005.
11. Philip F.Ostwald and Jairo Munoz, "Manufacturing Processes and systems", John Wiley and Sons, 9th Edition, 2002

Subject Title : MECHANICS OF MATERIALS		
Sub Code : 18IM35	No of Credits : 4	No of lecture hours/week : 4
Exam Duration : 3 Hrs.	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 52

Course Objectives:
1. To apply the fundamentals of strength of materials as related to concepts of stress, strain, bending, torsion, stability, and deflection of deformable bodies to applications concerning bars, shafts, beams, columns, and pressure vessels. 2. To discuss the fundamentals of applying equilibrium, compatibility of deformations, and force-deformation relationships in solving problems. 3. To equip with the proficiency in calculating stresses and strains in bars and beams subjected to axial forces and torsional, bending moments, 4. To analyze external and internal forces and moments; calculating deflections of beams; calculating angles of twist of shafts etc.

Unit No	Syllabus	No of Hours
1	**Simple Stress and Strain:** Introduction, Stress, strain, mechanical properties of materials, Linear elasticity, Hooke's Law and Poisson's ratio, Stress-Strain relation - behavior in tension for Mild steel, cast iron and non ferrous metals. Extension/ Shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular), Elongation due to self weight, Principle of super position. **Stress in Composite Section:** Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses (including compound bars).	8+6(T)
2	**Thick and Thin Cylinder** Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume). Thick cylinders Lame's equation (compound cylinders not included).	4+4(T)
3	**Bending Moment and Shear Force in Beams**: Introduction, Types of beams, loads and reactions, shear forces and bending moments, rate of loading, sign conventions, relationship between shear force and bending moments. Shear force and bending moment diagrams for different beams subjected to concentrated loads, uniformly distributed load, (UDL) uniformly varying load (UVL) and couple for different types of beams.	8+3(T)
4	**Bending and Shear Stresses in Beams**: Introduction, Theory of simple bending, assumptions in simple bending. Bending stress equation, relationship between bending stress, radius of curvature, relationship between bending moment and radius of curvature. Moment carrying capacity of a section. Shearing stresses in beams, shear stress across rectangular, circular, symmetrical I and T sections. (Composite beams not included).	6+6(T)
5	**Torsion of Circular Shafts**: Introduction. Pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts. Power transmitted by solid and hollow circular shafts.	4+4(T)

Outcome:
After the completion of the above course students will be able to 1. Analyze two dimensional basic stress, strain, and effect of temperature on the axially loaded members 2. Interpret the effect of pressure on thin and thick cylinders 3. Evaluate the basic design of mechanical part under shear and bending and torsional load of different cross section of beams and column.

Cos	Mapping with POs
CO1	PO1,PO3,PO4,PO12
CO2	PO1,PO3,PO4,PO12
CO3	PO1,PO3,PO4,PO12

Text books:
1. ."**Strength of Materials",** S.S.Bhavikatti, Vikas publications House -1 Pvt. Ltd., 2nd Ed., 2006 2. **"Strength of Materials",** S.S. Rattan, Tata McGraw Hill, 2009 3. " Strength of Materials", Surya Patnayak Elsevier publication Ist Edition 2003 4. **"Mechanics of materials",** B C Punmiaand & Ashok kumar Jain Laxmi Publication 2001

Reference books:
1. **"Engineering Mechanics of Solids**", Egor.P. Popov, Pearson Edu. India, 2nd, Edison, 1998 2. **"Mechanics of materials",** in S.I. Units, Ferdinand Beer & ussell Johnson, TATA Mc GrawHill- 2003 3. **"Mechanics of Materials",** James M. Gero and Barry J. Goodno Cengage learning 8th edition 2014. 4. **" Mechanics of Materials"** William F R ley and Loven W zachery wiley india publication 2018

Subject Title : PYTHON Programming		
Sub Code : 18IM36	No of Credits: 2 : 0 : 0 (LT-P)	No of lecture hours/week :2
Exam Duration : 3 Hrs.	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 28

Objective:
1. To learn Syntax and Semantics and to create functions in Python.
2. To handle strings and files in Python.
3. To understand Lists, Dictionaries and Regular expressions in Python.
4. To implement Object oriented programming concepts in Python.
5. To implement data structure and to organize the data using Python

Unit No	Syllabus	No of Hours
1	**Introduction to Python:** The basic elements of Python - Data types, variables, expressions, operators, Sequence, control-flow statements, Algorithms, building blocks of algorithms. Functions, Scoping and Abstraction – Functions and scoping, Decomposition and Abstraction, Keyword Arguments, Specifications, Recursion, Modules, Inductive Reasoning, Global Variables, System Functions and Parameters. Programming examples.	8
2	**Tuples and Lists:** Tuples, Lists, List Operations, Mutation, Aliasing, Cloning – Dictionaries: Functions as Objects, Dictionaries. **Debugging:** Programming Challenges, Classes of Tests, Bugs, Debugging and Debugging Examples. Assertions and Exceptions, Assertions, Exceptions, Exception Examples	7
3	**Classes and Inheritance:** Why Object Oriented Programming, Classes & Objects, Classes & Methods, Abstract Data Types and Classes, Encapsulation and Information Hiding, Class Instances, Overloading, Composition, Inheritance, Programming examples.	7
4	**Files and exception:** text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, programming examples.	6
5	**Files and exception**: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, programming examples.	6

Note 1:
▪ **SEE question paper shall contain 10 questions having internal choice in each unit.** ☐ **Students shall answer one question from each unit. Note 2:**
▪ **Assignments are evaluated for 5 marks.**
▪ **CIE shall be evaluated for 20 marks**

Course Outcome:
After learning the course, the student will be able:

1. Develop and execute algorithmic solutions to simple computational problems with python programs.
2. Decompose a Python program into functions.
3. To be able to understand the various data structures available in Python programming language and apply them in solving computational problems.
4. To be able to do testing and debugging of code written in Python.
5. Ability to Text Processing scripts.

Text Books / Reference Books:
1. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version.
2. Python Programming using problem solving Approach by Reema Thareja, Oxford University, Higher Education Oxford University Press; First edition.
3. Fundamentals of Python first Programs by Kenneth A Lambert, Copyrighted material Course Technology Inc. 1st edition.

		Subject Title: PYTHON PROGRAMMING LAB	
Sub Code : 18IML37		No of Credits : 0:0:1	No. of Hrs / Week : 2
Exam Duration : 3 Hrs.		CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 13

Course Objectives:
- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples and dictionaries.
- Read and write data from/to files in Python.

		Programs List	No. of Hours
1	a	Write a program that declares 3 integers, determines and prints the largest and smallest in the group.	
	b	Write a program that accepts 'n' numbers from the user and print their sum.	
2	a	Write a program to find factorial of a given number.	
	b	Write a program to print Fibonacci Series.	
3	a	Write a program to implement linear search and binary search.	
	b	Write a program to • Determine whether the given string is a palindrome or not using slicing and without using slicing • Find the number of Vowels and Consonants in a given string	
4	a	Write a program to find that given number is Armstrong or not.	
	b	Write a program to convert decimal number into binary numbers.	
5	a	Write a program for generation of pyramid. Pyramid 1 Pyramid 2 * 1 * * 1 2 * * * 1 2 3 * * * * 1 2 3 4	
6	a	Write a Python program to get the largest and smallest number from a list.	
	b	Write a function ball collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls are colliding.	

7	a	Write A Program that Reads a Text File and Counts the Number of Times a Certain Letter Appears in the Text File.
	b	Write A Program to Read a Text File and Print all the Numbers Present in the Text File
8	a	Write a Python script to sort (ascending and descending) a dictionary by value
	b	Create a dictionary for words and their meanings. Write functions to add a new entry (word : meaning), search for a particular word and retrieve meaning, given meaning find words with same meaning, remove an entry, display all words sorted alphabetically.
9	a	Write A Program to Find the Area of a Rectangle Using Classes
	b	Write A Program to Create a Class and Compute the Area and the Perimeter of the Circle
10		Write A Program to Append, Delete and Display Elements of a List Using Classes
11		Write a Python program to simulate ATM transactions by including the following operations: a) Check for correctness of the ATM pin. b) Perform Balance, Withdraw and Deposit Operations. The above operations should be menu-driven and display appropriate messages after performing each of these operations.

Subject Title : MANUFACTURING TECHNOLOGY LAB		
Sub Code : 18IML38	**No of Credits : 0: 0:1= 1**	**No. of Hrs / Week : 2**
Exam Duration : 3 Hrs.	**CIE + SEE = 50 + 50 =100**	**Total No. of Contact Hours : 12**

Objective:
1.To demonstrate the importance of sand properties in preparing moulds
2.To give hands on practice in preparing moulds using 2 box, split pattern and cores
3.To give hands on practice in preparing forging models using open – hearth furnace

Machine Shop Practice	
1	Preparation of three models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.
2	Cutting of V Groove/ dovetail / Rectangular groove using a shaper.
3	Cutting of Gear Teeth using Milling Machine.
Testing of Molding sand and Core sand	
Preparation of sand specimens and conduction of the following tests:	
1	Compression, Shear and Tensile tests on Universal Sand Testing Machine.
2	Permeability test
3	Core hardness & Mould hardness tests.
4	Sieve Analysis to find Grain Finest number of Base Sand
5	Clay content determination in Base Sand
Foundry Practice	
1	Use of foundry tools and other equipments.
2	Preparation of moulds using two molding boxes using patterns or without patterns. (Split pattern, Match plate pattern and Core boxes).
3	Preparation of one casting (Aluminum or cast iron-Demonstration only)
Forging Operations	
1	Calculation of length of the raw material requited to do the model.
2	Preparing minimum three forged models involving upsetting, drawing and bending operations.
3	Out of these three models, at least one model is to be prepared by using Power Hammer

Outcome:
After the completion of the above course students will be able to
1. The students will be able to utilize foundry and forging tools for various applications
2. Will be able to develop different foundry & forging models
3. Will be able to determine different properties of sand

COs	Mapping with POs
CO1	PO3,PO5
CO2	PO2,PO9,PO12
CO3	PO2,PO3

Scheme of Examination:

One question is to be set from Testing of Molding sand and Core sand   : 10 marks

One question is to be set from either Foundry or Forging   : 30 marks

                              Viva-Voce   : 10 marks.

                              Total   **: 50 marks.**

Sub Title: WORKSTUDY AND ERGONOMICS		
Sub Code : 18IM41	No of Credits : 4:0:0	No of Lecture hours/week : 04
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 52

Objectives:

1. To understand the definition of productivity and the factors affecting productivity.
2. To apply the concept of work study and its related issues.
3. To study the Method study through various charts.
4. To identify work measurement and Time study techniques for better production.
5. To describe the importance and application of ergonomics, man-machine system.

Unit No.	Syllabus Content	No of Hours
1	**PRODUCTIVITY:** Definition, reasons for low productivity, methods to improve productivity, work-study and productivity **HUMAN FACTOR IN WORK-STUDY**: Relationship of work-study man with management, supervisor & workers, qualities of a work-study man.	07
2	**METHOD-STUDY:** Definition, objectives, step-by-step procedure, questioning techniques, charts and diagrams for recording data. Like outline process charts, flow process charts, multiple activity charts, two handed process chart, string diagram, travel chart, cycle graph, Chrono-cycle graph,	10
3	**MICRO AND MEMO MOTION STUDY:** Charts to record movements at work place – principles of motion economy, Therbligs, and classification of movements, SIMO chart, and micro motion study. Development, definition and installation of the improved method, brief concept about synthetic motion studies	07
4	**INTRODUCTION TO WORK MEASUREMENT:** Definition, objective and benefit of work measurement. **Work measurement techniques:** WORK SAMPLING, need, confidence levels, sample size determinations, random observation, and conducting study with the simple problems. **STOP WATCH TIME STUDY:** Time Study, Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information. Rating & standard Rating, standard performance, scale of rating, factors affecting rate of working, allowances and standard time determination. Predetermined Motion Time Study (PMTS) .Method Time Measurement (MTM)	14
5	**ERGONOMICS:** Introduction, Areas of study under Ergonomics, System approach to Ergonomics model, Man-Machine System. Components of Man-Machine System and Their functions – Work capabilities of Industrial Worker, Study and Development of Stress in Human body and their consequences. Computer based ergonomics. **DESIGN OF MAN-MACHINE SYSTEM:** Fatigue in industrial workers. Quantitative, qualitative representation and alphanumeric displays. Controls and their design criteria, control types, relation between controls and displays, layouts of panels and machines. Design of work places, influence of climate on human efficiency. Influence of noise, vibration and light.	14

Note 1:
- **SEE question paper shall contain 10 questions having internal choice in each unit.**
- **Students shall answer one question from each unit.**

Note 2:
- **Assignments are evaluated for 5 marks.**
- **CIE shall be evaluated for 20 marks**

Outcome:

After the completion of the above course, students will be able to
1. Describe the concept of productivity and the importance of productivity.
2. Analyze the existing methods of working for a particular job and develop an improved method through questioning technique.
3. Construct the various charts use recording techniques for improving productivity.
4. Provide appropriate allowances for the jobs under analysis.
5. Analyze and calculate the level of risk of the job causing stress, fatigue and musculoskeletal disorders among the employees of an organization.

Cos	Mapping with POs
CO1	PO3,PO6,PO8PO10
CO2	PO3,PO4,PO7,PO10,PO11
CO3	PO3,PO4,PO7,PO10,PO11
CO4	PO6,PO10,PO11
CO5	PO6,PO8,PO10

TEXT BOOKS:
1. ILO, Introduction to work study - III Revised Edition, 1981
2. Motion and Time study - Ralph M Barnes; John Wiley, 8th Edition, 1985.
3. Engineered work Measurement - Wledon, ELBS , 1991

REFERENCES BOOKS:
1. Human Factors in Engineering Design - S Sanders and E J McCormick, 6th Edition, Mc Graw Hill
2. Work Study and Ergonomics - S Dalela and Sourabh, – Chand Publishers, 3rd edition.
3. Industrial Engineering Hand book Maynard

Subject Title : THEORY OF MACHINES		
Sub Code : 18IM42	No of Credits: 2:2:0	No of lecture hours/week : 4
Exam Duration : 3 Hrs.	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 52

Objective:
1. To define the layout of linkages in the assembly of a system/machine
2. To identify various principles involved in assessing the displacement, velocity and acceleration at any point in a link of a mechanism
3. To analyze the motion resulting from a specified set of linkages in a mechanism.
4. To illustrate the design and application of gears
5. To evaluate the design and application of cams

Unit No	Syllabus	No of Hours
1	**Introduction:** Definitions Link or element, kinematic pairs, Degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, Structure, Mobility of Mechanism, Inversion, Machine. **Kinematic Chains and Inversions**: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.	8+2(T)
2	**Mechanisms:** Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Straight-line motion mechanisms Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms -Geneva wheel mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph.	8+3(T)
3	**Spur Gears:** Gear terminology, law of gearing, Characteristics of involute action, Path of contact. Arc of contact, Contact ratio of spur, helical, bevel and worm gears, Interference in involute gears. Methods of avoiding interference, Back lash. Comparison of involute and cycloidal teeth.	7+3(T)
4	**Gear Trains:** Simple gear trains, Compound gear trains for large speed reduction, Epicyclical gear trains, Algebraic and tabular methods of finding velocity ratio of epicycle gear trains(Simple Problems with tabular column method only). Tooth load and torque calculations in epicyclic gear trains. **Velocity Analysis by Instantaneous Center Method:** Definition, Kennedy's Theorem, Determination of linear and angular velocity using instantaneous center method	12+5(T)
5	**Klein's Construction**: Analysis of velocity and acceleration of single slider crank mechanism. **Cams:** Types of cams, Types of followers. Displacement, Velocity and, Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-face follower, Disc cam with oscillating roller follower. Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.	12+5(T)

❖ Graphical Solutions may be obtained either on the Graph Sheets or on the Answer Book itself

Note 1:

- SEE question paper shall contain 10 questions having internal choice in each unit.
- Students shall answer one question from each unit.

Note 2:
- **Assignments are evaluated for 5 marks.**
- **CIE shall be evaluated for 20 marks**

Outcome:
After the completion of the above course students will be able to

1. Discuss the common mechanisms used in machines and everyday life.
2. Calculate mobility (number of degrees-of-freedom) and enumerate rigid links and types of joints within mechanisms.
3. Analyze the complete (translational and rotational) mechanism velocity and acceleration graphically.
4. Classify gear mechanism and analyze gear train, and interpret gear standards and specification in design.
5. Explain cam mechanism and cam motion profiles, and calculi the velocity and acceleration of cam.

Cos	Mapping with POs
CO1	PO1,PO2,PO3
CO2	PO1,PO2,PO3
CO3	PO1,PO2,PO3
CO4	PO2,PO3,PO5,PO8,PO9,PO12
CO5	PO2,PO3,PO5,PO8,PO9,PO12

TEXT BOOKS:
1. **"Theory of Machines",** Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 3rd edition -2009.
2. **"Theory of Machines",** Sadhu Singh, Pearson Education (Singapore) Pvt. Ltd, Indian Branch New Delhi, 2nd Edi. 2006
3. **"Theory of mechanisms and machine" Amithaba Gose and Asok kumar malik Third edition, east west press, 2006**

REFERENCE BOOKS:
1. **"Theory of Machines & Mechanisms**", J.J. Uicker, G.R. Pennock, J.E. Shigley. OXFORD 3rd Ed. 2009.
2. **Mechanism and Machine theory**, Ambakar. A G ,PHI learning 2007
3. **Theory of machine,** Joseph Edward Shigley, OXFORD PRESS.

Sub Title : ENGINEERING ECONOMY		
Sub Code : 18IM43	No. of Credits:3 =2 : 2 : 0 (L-T-P)	No. of lecture hours/week : 4
Exam Duration : 3 hr.	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 52

Course Objectives :
1. To Prepare Students to analyze cost or Revenue Data
2. To apply engineering economic decision making to realistic problems.
3. To justify or reject alternatives or Projects on an Economic basis
4. To apply the Replacement analysis as part of maintenance aspects for better decision making
5. To learn estimation and costing of the manufactured products as part of financial aspect for profit maximization or minimization of losses in the business

Unit No.	Syllabus Content	No of Hours
1	**INTRODUCTION:** Engineering Decision- Makers, Engineering and Economics, Problem solving and Decision making, Intuition and Analysis, Tactics and Strategy. Interest and Interest factors: Interest rate, simple interest, Compound interest, Cash- flow diagrams, Exercises and Discussion.	08
2	**PRESENT WORTH COMPARISON:** Conditions for present worth comparisons, Basic Present worth comparisons, Present worth equivalence, Net Present worth, Assets with unequal lives, infinite lives, Future worth comparison, Pay – back comparison, Exercises, Discussions and problems. Equivalent annual worth comparisons: Equivalent Annual Worth Comparison methods, Situations for Equivalent Annual Worth Comparison, Consideration of asset life, Comparison of assets with equal and unequal lives, Use of sinking fund method, Annuity contract for guaranteed income, Exercises, Problems.	14
3	**RATE OF RETURN CALCULATIONS:** Rate of return, Minimum acceptable rate of return, IRR, IRR misconceptions, Cost of capital concepts, replacement models. **Depreciation**: Causes of Depreciation, Basic methods of computing depreciation charges**.** Structural analysis of alternatives: Identifying and Defining alternatives, IRR analysis of mutually exclusive alternatives, Capital Budget view point, Ranking criteria.	14
4	**REPLACEMENT ANALYSIS:** Introduction, reasons for replacement**,** Individual Replacement of machinery or equipment with/without value of money, Group Replacement Policies, Problems. **EFFECTS OF INFLATION:** Causes, consequences and control of inflation. After tax actual cash flow comparisons, Lease/ Buy decisions.	07
5	**ESTIMATING & COSTING:** Components of costs such as Direct Material Cost, Direct Labor Cost, Fixed, Over – Heads, Factory Costs, Administrative – Over Heads, First Cost, Marginal Cost, Selling price, Estimation for simple components. Break-even analysis: Basic Concepts Linear & non-linear break even analysis.	09

Note 1:
- **SEE question paper shall contain 10 questions having internal choice in each unit.**
- **Students shall answer one question from each unit.**

Note 2:
- **Assignments are evaluated for 5 marks.**
- **CIE shall be evaluated for 20 marks**

Outcome:
By the end of the course students will be able to 1. Perform and evaluate present worth, future worth and Annual worth analyses on one of more economic alternatives. 2. Assess the payback period and capitalized Cost on one or more economic alternatives. 3. Carry out and estimate the benefit/cost, life cycle. **4.** Interpret breakeven analyses on one or more economic alternatives

Cos	Mapping with POs
CO1	PO2,PO4,PO5,PO7,PO11
CO2	PO4,PO5,PO6,PO7,PO11,PO12
CO3	PO4,PO6,PO7,PO11,PO12
CO4	PO6,PO7,PO11,PO12

TEXT BOOKS:
1. **Engineering economics** - RIGGS J.L. McGraw Hill, 2015.
2. **Engineering economy** - PAUL DEGARMO, Macmillan Pub, Co. 2006.
3. **Engineering Economy** - Naidu, Babu and Rajendra, New Age International Pvt. Ltd. - 2006
REFERENCE BOOKS:
1. **Financial Management** - I M PANDAY, Vikas Publishing House 2016.
2. **Engineering economy -** THUESENH.G. PHI, 9th edition, 2012
3. **Engineering Economics –** Tara Chand, 9th edition, 2012

Sub Title : STATISTICS FOR ENGINEERS		
Sub Code : 18IM44	No. of Credits:4=4 : 0 : 0 (L-T-P)	No. of lecture hours/week : 4
Exam Duration : 3 hr.	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 52

Course Objectives:
1. Apply the basic fundamental concepts of Statistics to engineering problems and the importance of Data summary and Display.   2. Evaluate the application of discrete probability distribution to various manufacturing problems.   3. Evaluate the application of Continuous probability distribution to various manufacturing problems.   4. Explain the hypothesis to random experiments of manufacturing processes.   5. Test the statistical parameters by regression and correlation. and test for variance

Unit No.	Syllabus Content	No of Hours
1	**THE ROLE OF STATISTICS IN ENGINEERING (DATA SUMMARY AND PRESENTATION):** Statistical Thinking, Collecting data, Statistical Modeling Frame work, measure of central tendency and variance, Importance of Data summary and Display, Tabular and Graphical display	08
2	**DISCRETE RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS:** Discrete Random variables, Probability distributions and Probability mass functions, Cumulative distribution functions, Mean and Variance of a discrete random variable, Discrete uniform distribution, Binominal distribution, Hyper Geometric distribution, Poisson distribution and their Applications.	08+ 02(T)
3	**CONTINUOUS RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS:** Continuous random variables, Probability distributions and probability density functions, cumulative distribution functions, Mean and Variance of a continuous random variable, uniform distribution, Normal distribution, Normal approximation to Binominal and Poisson distribution, Exponential distribution and their Applications.	08+ 02(T)
4	**ESTIMATION THEORY:** Statistical Inference, Random sampling, Properties of Estimators, Sampling distribution, Sampling distribution of mean, variance and proportion. Introduction to confidence intervals. **STATISTICAL INFERENCE FOR A SINGLE SAMPLE AND TWO SAMPLES:** Hypothesis testing, Inference on the mean of a population (variance known and unknown), Inference on the variance of a normal population, Inference on a population proportion. Testing for Goodness of Fit, Inference for a difference in Means, Variances known, Inference for a difference in means of two normal distributions, Variances unknown, Inference on the Variances of two normal populations, Inference on two population proportions.	10+ 02(T)
5	**SIMPLE LINEAR REGRESSIONS AND CORRELATION:** Simple Linear Regression, Properties of Least square Estimators and	10+2(T)

| | Estimation of variances, Common abuses of regression, Prediction of new observations, Assessing the adequacy of regression model, Transformations to a straight line, Introduction to multiple regression (no problems), Correlation.
DESIGN OF EXPERIMENTS: Strategy of experimentation, completely randomized single - factor experiment, Tests on individual treatment means, the random effects model, the randomized complete block design, one way analysis of variance and two way analysis of variance. | |

Note 1:
- **SEE question paper shall contain 10 questions having internal choice in each unit.**
- **Students shall answer one question from each unit.**

Note 2:
- **Assignments are evaluated for 5 marks.**
- **CIE shall be evaluated for 20 marks**

Outcome:

At the end of the course students will be able to
1. Apply the statistical data in the form of Tabular and Graphical display.
2. Identify discrete type of probability and solve the various engineering problems.
3. Solve Continuous type of probability and solve the various engineering problems
4. Estimate the hypothesis and give inference to random experiments.
5. Evaluate the statistical parameters by estimation.

Cos	Mapping with POs
CO1	PO1,PO2,PO12
CO2	PO1,PO2,PO3,PO12
CO3	PO1,PO2,PO3,PO12
CO4	PO1,PO2,PO3,PO4,PO12
CO5	PO1,PO2,PO3,PO5,PO9,PO12

TEXT BOOKS:
1. **Applied statistics and Probability for Engineers** – Douglas C Montgomery, George C Runger, 2nd Edition, John Wiley and Sons, ISBN-0-471-17027-5
2. **Statistics for Management -** Richard I Levin, David S Rubin, 6th Edition, Prentice Hall India, ISBN-81-203-0893-X

REFERENCE BOOKS:
1. **Probability and Statistics in Engineering** - William W Hines, Douglas C Montgomery, 2nd Edn, John Wiley and Sons
2. **Business Statistics for Management and Economics** - Daniel, Terrell, 6th Edn, Houghton Mifflin Company, ISBN-0-395-62835-0
3. **Probability and Statistics** - Walpole & Mayer, MacMillan Publishing Company, 1989.

Subject Title : COMPUTER AIDED MACHINE DRAWING		
Sub Code : 18IML45	No of Credits : 3	No. of Hrs / Week : 4
Exam Duration : 3 Hrs.	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 13

Objective:

1. To visualize an object and convert it into a drawing.
2. To train the students to use commercial solid modeling software package
3. To explain the basic concept and to draw the views of section of solids, orthographic projections and threaded fasteners
4. To gain knowledge of conventional representation of mechanical Components
5. This course will give an insight to design, creation of an assembly and detailed drawing of machine components

Unit No	Syllabus	No of Hours
1	**Introduction:** Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap. **Sections of Solids:** Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on, axis inclinations, spheres and hollow solids). True shape of sections. **Orthographic Views:** Conversion of pictorial views into orthographic projections of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions. Precedence of lines.	8
2	**Geometric Dimensions and Tolerances:** Drafting, tolerance and geometrical symbols used in machine drawing. **Fasteners:** Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) **Riveted Joints:** Single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets).	08
3	Assembly Drawings(Part drawings should be given) 1. Screw jack (Bottle type) 2. Machine vice 3. Plummer block 4. I.C. Engine connecting rod	18

Note 1: SEE Question paper contains total six Questions (two questions from each unit) and student should answer any one question from Unit I and Unit II and III (student shall answer total 3 questions).

Course Outcomes:

After the completion of the above course students will have the

1. Ability to use standard software tools to create part assemblies
2. Ability to create fully constrained solid models that can be quickly modified using standard software tools
3. Ability to identify and explain standard features in solid modeling including protrusion, revolution, cutouts and patterns.
4. Ability to use standard software tools to create engineering drawings to describe the geometries and dimensions of parts
5. Ability to create computer aided drawings by interpreting and applying drafting standards.

Cos	Mapping with POs
CO1	PO2,PO11
CO2	PO2,PO11
CO3	PO2,PO3,PO11
CO4	PO2,PO3,PO11
CO5	PO2,PO3,PO11

Text books:

1. **'Machine Drawing'**, K.R. Gopala Krishna, Subhash Publication
2. **'Machine Drawing'**, N.D.Bhat & V.M.Panchal

Reference books:

1. **'A Primer on Computer Aided Machine Drawing - 2007'**, Published by VTU, Belgaum.

Suitable Software Used: Solid Edge

Scheme of Examination:

ONE question from Unit 1	10 Marks
ONE question from Unit 2	10 Marks
ONE question from Unit 3	30 Marks
Total	**50 Mark**

Subject Title : WORKSTUDY AND ERGONOMICS LAB		
Sub Code : 18IML46	**No. of Credits:1**	**No. of lecture hours/week : 2**
Exam Duration : 3 hrs	**CIE + SEE = 50 + 50 =100**	**Total No. of Contact Hours : 13**

Objectives:
1. To apply the basic fundamental concepts of Industrial engineering to small industrial experimental problems.   2. To construct various charts using recording techniques.   3. Application and development of different plant layouts.   4. Analysis and practice of performance rating experiments.   5. To test the statistical parameters by regression and correlation.

PART – A (METHOD STUDY)	
1	Recording Techniques**:** Preparing the following charts and diagrams (Minimum 3 Charts) - Outline process chart, Multiple Activity Chart, Flow process chart and Flow diagram, String diagram.
2	Experiments on the Application of principle of motion economy, Two handed process chart.
3	Exercises on conducting method study for assembling simple components and office work.
4	Development of Layout plans using SLP technique.
PART – B (WORK MEASUREMENT)	
1	Rating practice using: walking simulator, pin board assembly, dealing a deck of cards and marble collection activity
2	Determining the standard time for simple operations using stopwatch time study
3	Exercises on estimating standard time using PMTS.
4	Measurement of parameters (heart beat rate, calorie consumption) using walking simulator
5	Measurement of parameters (heart beat rate, calorie consumption, revolutions per minute) using ergometer
6	Effect of Noise, Light, Heat on human efficiency in work environments.

Outcome:

After undergoing the machine shop practice will be able to
     1. Use basic fundamental concepts of Industrial engineering to practical applications.
     2. Construct various charts and diagrams for manufacturing activities to minimize the delays and unnecessary activities.
     3. Draw and develop different plant layouts for feasibility check.
     4. Perform rating experiments for good observation.
     5. Test the statistical parameters by regression and correlation.

Subject Title : **MECHANICAL MESUREMENTS AND METROLOGY LAB**		
Sub Code : 18IML47	**No of Credits : 0:0:1**	**No. of Hrs / Week : 2**
Exam Duration : 3 Hrs.	**CIE + SEE = 50 + 50 =100**	**Total No. of Contact Hours : 12**

Objective:
1. To study the Measurement standards available and to apply.
2. To study and learn the calibration procedure for different instruments.
3. To provide hands on experience and to study the various types of gauges, projectors, comparators and transducers.
4. To know and learn the applications of different measuring instruments used in manufacturing / production industries for inspection and calibration.

MECHANICAL MEASUREMENTS	
1	Calibration of Pressure Gauge
2	Calibration of Thermocouple
3	Calibration of LVDT
4	Calibration of Load cell
5	Determination of modulus of elasticity of a mild steel specimen using strain gauges
METROLOGY	
1	Measurements using Optical profile Projector and Toolmaker Microscope.
2	Measurement of straightness using Autocollimator, measurement of angle using Sine Center / Sine bar / bevel protractor
3	Measurement of cutting tool forces using Lathe tool Dynamometer Drill tool Dynamometer.
4	Measurement of Screw threads Parameters using Two wire or Three-wire method.
5	Measurement of surface roughness using Talysurf. Linear measurements using Mechanical Comparator, Electronic comparator.
6	Measurement of gear tooth profile using gear tooth Vernier /Gear tooth micrometer
7	Calibration of Micrometer using slip gauges
8	Measurement using Optical Flats

Outcome:
After the completion of the above course students will be able to
1. Will be able to demonstrate standard operational procedures of different measuring instruments
2. Able to Calibrate Precision Instruments
3. Able to identify the different operating and instrument errors for calibration
4. Able to plot and interpret the operation characteristic and learning curves and also can give remedies/ suggestions for improvement that can be error free instrument.

Cos	**Mapping with POs**
CO1	PO1, PO3, PO4
CO2	PO1, PO2, PO12
CO3	PO5, PO12
CO4	PO4, PO5, PO12

Scheme of Examination:
ONE question from Mechanical Measurements   20 Marks
ONE question from Metrology   20 Marks
    Viva –Voce   10 Marks
    Total   **50 Marks**

Subject Title : **MATERIAL TESTING LAB**		
Sub Code : 18IML48	**No of Credits : 0:0:1**	**No. of Hrs / Week : 3**
Exam Duration : 3 Hrs.	**CIE + SEE = 50 + 50 =100**	**Total No. of Contact Hours : 13**

Objective

1. To learn and demonstrate the basic principles in the area of strength and mechanics of materials through a series of experiments.
2. To provide hands on experience in measuring loads, deflection and strains.

Expt. No	Description
1	Preparation of specimen for Metallographic examination of different engineering materials. Identification of microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites. **(Only Demonstration)**
2	Heat treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of heat-treated samples. **(Only Demonstration)**
3	To study the wear characteristics of ferrous, non-ferrous and composite materials for different parameters. **(Only Demonstration)**

4	Non-destructive test experiments like, **(Only Demonstration)**
	  (a). Ultrasonic flaw detection
	  (b). Magnetic crack detection
	  (c). Dye penetration testing. To study the defects of Cast and Welded specimens.

5	Tensile, shear and compression tests of metallic and non metallic specimens using Universal Testing Machine
6	Torsion Test
7	Bending Test on metallic and nonmetallic specimens.
8	Izod and Charpy Tests on M.S, C.I Specimen.
9	Brinell, Rockwell and Vickers's Hardness test.

Outcome:

After the completion of the above course students will be able to use
  1. Demonstrate the Nondestructive testing methods
  2. Experiment and compute loads, deflection, strains and hardness and various other parameters using basic material testing equipment's.
  3. Evaluate the strengths of metallic specimens using UTM

Cos	Mapping with POs
CO1	PO3,PO12
CO2	PO1,PO2,PO6,PO12
CO3	PO1,PO2,PO6,PO12

Scheme of Examination:

Two question (one from 1,2,3 and 4 and one from 5 , 6, 7, 8, 9) :   15 +25 Marks

Viva -Voice: :   10 Marks

                                              Total   :   50 Marks

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	HS	18HS51/52	M&E / IPR (title as per BOS decision)	HS	3	-	--	03	50	50	100	3
2	PC	18IM51	Operations Research		3	2	--	03	50	50	100	4
3	PC	18IM52	Computer Integrated Manufacturing		2	2	--	03	50	50	100	3
4	PC	18IM53	Design of Machine Elements		3	2	--	03	50	50	100	4
5	PC	18IM54	Quality Assurance and Reliability		2	2	--	03	50	50	100	3
6	PE	18IM55X	Professional Elective -1		3	--	--	03	50	50	100	3
7	PC	18IM56X	Open Elective- A		3	--	--	03	50	50	100	3
8	PC	18IML57	Quality Engineering Laboratory		--	--	2	03	50	50	100	1
9	PC	18IML58	CIM Laboratory		--	--	2	03	50	50	100	1
			TOTAL		19	8	4	27	450	450	900	25

V SEMESTER

Note: HS: Humanities, PC: Professional Core, MC: Mandatory Course,

Electives

Course code	Professional Electives - 1

18IM551	Advanced Machining Processes
18IM552	Marketing Management
18IM553	Rapid Prototyping
18IM554	Enterprise Resource Planning and e- commerce
18IM555	Data Warehousing And Mining

Course code	Open Elective -A
18IM561	Operations Research

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	HS	18HS61/62	M&E/IPR	HS	3	--	--	03	50	50	100	3
2	PC	18IM61	Materials Management		3	--	--	03	50	50	100	3
3	PC	18IM62	Facilities Planning and Design		2	2	--	04	50	50	100	3
4	PC	18IM63	Lean Manufacturing		2	2	--	04	50	50	100	3
5	PC	18IM64	Simulation Modelling and Analysis		2	2	--	04	50	50	100	3
6	PE	18IM65X	Professional Elective -2		3	--	--	03	50	50	100	3
7	OE	18IM66X	Open Elective -B		3	--	--	03	50	50	100	3
8	PC	18IML67	Simulation Laboratory		--	--	2	03	50	50	100	1
9	MP	18IMP68	Mini-project		--	--	2	03	50	50	100	2
10	INT	18IMI69	Industry Internship	(To be carried out during the intervening vacations of VI and VII semesters)				--	--	--	--	--
			TOTAL		**18**	**06**	**04**	**30**	**450**	**450**	**900**	**24**

Note: PC: Professional core, PE: Professional Elective, OE: Open Elective, MP: Mini-Project, INT: Internship.

Electives	
Course code	Professional Electives - 2
18IM651	**Product Design and Development**
18IM652	**Maintenance and Safety Engineering**
18IM653	**Composite Materials**
18IM654	**Organizational Behavior**
18IM655	**Management Information System**
18IM656	**Advanced Manufacturing Technology**

Course code	Open Elective -**B**
18IM661	**Project Management**

Sub Title : MANAGEMENT & ENTREPRENEURSHIP		
Sub Code : 18HS51/ 52	No. of Credits:3=3: 0: 0 (L-T-P)	No. of lecture hours/week: 3
Exam Duration : 3 hrs	CIE + Assignment + Group Activity + SEE =100 40 + 5 + 5 + 50 = 100	Total No. of Contact Hours : 39

Course Objectives:

1. To impart the knowledge about the Management concepts, evolution and Management functions.
2. To familiarize the student on Entrepreneurship and Entrepreneurial process.
3. To understand the role of SSI in economic development and gain an insight of funding agencies.
4. To have a clear understanding of concept of project, preparation of project & its screening.

Unit No.	Syllabus Content	No of Hours
1	**MANAGEMENT:** Introduction- Meaning, characteristics of management, functions of Management- POSDCORB, Levels and Skills of Management, Roles of Managers Management as science or an art or profession, Development of management thought -**Early management approaches (in brief)**- Psychological, Bureaucratic, Scientific and Administrative theory and Human Relations Movement, **Modern management approaches (in brief)**- Behavioral, Systems, Quantitative, and Contingency approach **FUNCTIONS OF MANAGEMENT- PART I:** **PLANNING:** Types of Plans: Single use & Standing plans, Steps in Planning process. **ORGANIZING:** Types of organization (Line, Staff, Line & Staff, Matrix and Committee form) Departmentation (Functional, Product, Process, Territorial and Customer), MBO and MBE.	08
2	**FUNCTIONS OF MANAGEMENT – PART II** **STAFFING:** Sources of recruitment, Process of selection, **DIRECTING:***Leadership***:** Definition, Leadership styles - Autocratic, Democratic, Charismatic, Laissez faire and Participative, *Motivation:*– Definition, Maslow, Herzberg & McGregor's Theory X & Y. *Communication*– Definition, types, communication process and barriers of communication, *CO-ORDINATION***:** importance, **CONTROLLING:** steps in controlling, **REPORTING**: importance, **BUDGETTING**: importance. *Case study discussion with respect to Indian context*	12

	ENTREPRENEUR: Definition &Meaning, Characteristics, types of entrepreneur, Difference between Entrepreneurs, Intrapreneur & Manager, Stages in Entrepreneurial process, barriers to entrepreneurs, Role of Entrepreneurs in economic development. **Rural entrepreneurs** - Meaning & schemes. **Women entrepreneurs** – Concept, challenges, women entrepreneurship in India, Institutional support & special bank scheme. **Family Business:** Meaning, Roles & responsibility, types of family business, challenges faced by family business, reasons for failure of family business. *Case study discussion with respect to Indian context.* *Activity: Profile of successful entrepreneur.*	**10**
3	**ENTREPRENEUR**: Definition & Meaning, Characteristics, types of entrepreneurs- Imitative, Innovative, Fabian and drone and Others, Intrapreneur- meaning, Difference between Entrepreneurs, Intrapreneur & Manager, Stages in Entrepreneurial process, barriers to entrepreneurs, Role of Entrepreneurs in economic development and Business Pan. **Rural entrepreneurship**– Definition, challenges & opportunities. **Women Entrepreneurs** – Definition, challenges, and Institutional support to Women Entrepreneurs in India. **Family Business:** Meaning and Definition, types of family business and reasons for failure of family business. **Corporate Social Responsibility**- Meaning, definition and benefits. *Case study discussion with respect to Indian context.* *Activity: Profile of successful entrepreneur and Writing Business plan*	**12**
4	**MSME:** Definition of MSME (latest). **SMALL SCALE INDUSTRY**: Meaning, and definition, Characteristics, steps to startSSI, role of SSI in economic development, problems faced by SSI. Introduction to GATT, WTO &LPG, Sources of financing (brief), Forms of ownership - Sole proprietorship, Hindu Undivided Family, Partnership, and Cooperative. **Institutional Support**: *Central level Institutions* – NBMSME, KVIC, NSIC, SIDBI, IIB, EDIand NABARD. S*tate level Institutions*- DIC, KSFC, KIADB,TECSOK. **STARTUP COMPANIES**-Meaning and Challenges. Make in India concept and MUDRA Bank Initiative. *Activity for students: Schemes for startup companies.*	**10**
5	**PREPARATION OF PROJECT:** Project- Meaning, Classification of project, Project identification, Project selection, Project Appraisal, Project implementation. Project Report –Outline, Feasibility Study-Financial, Technical, Marketing, and Social Feasibility Study, PESTLE Analysis for Project and errors in preparation of projectreport. *Activity for students***:** *Preparation of project report*	

Note: Every unit will have an internal choice question for SEE.

Course Outcomes:
CO1: The students will gain domain knowledge on management concepts, evolution, management functions.

CO2: The students will be able to gain domain knowledge on Entrepreneurship, entrepreneurial process

CO3 : The students will get an in depth knowledge of entrepreneurial process & contribute to the betterment of the society.

CO4 : Students will be able to identify business opportunities & design a project report.

RECOMMENDED BOOKS:

1. Entrepreneurship and Management- S Nagendra and V S Manjunath- Pearson Publication 4 /e 2009.
2. Principles of Management – PC Tripathi, and P N Reddy – Tata MacGrawHill.
3. Entrepreneurship Development – Poornima M Charanthimath Pearson Education 2ndEdition.

REFERENCE BOOKS:

1. Dynamics of Entrepreneurial Development and Management-Vasant Desai-Himalaya Publishing House. Latest edition.
1. Entrepreneurship and management - Shashi k Gupta- Kalyani publishers, Latestedition.
2. Financial Management- Shashi k Gupta- Kalyani publishers, Latestedition.

Sub Title: OPERATIONS RESEARCH		
Sub Code: 18IM51	No. of Credits:4=3: 1: 0 (L-T-P)	No. of lecture hours/week: 4
Exam Duration: 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours: 52

Objectives:
1. To Define and formulate the LPP for different product types with constraints.
2. Application of graphical, Simplex and Big M and Duality technique.
3. To Define and discuss the Transportation methods to find optimum cost.
4. To explain and define the concepts of queuing and Game theory.
5. Determine the Critical path and its duration, different types of floats using PERT/CPM.

Unit No.	Syllabus Content	No of Hours
1	**INTRODUCTION:** OR Methodology, Definition of OR, Application of OR to Engineering and Managerial Problems, Features of OR models, Limitation of OR. Models of OR. **LINEAR PROGRAMMING, I:** Definition, Mathematical formulation, Standard form, solution space, Solution – Feasible, basic feasible, Optimal, Infeasible, Multiple, Optimal, Redundancy, Degeneracy, Graphical Method.	08
2	**LINEAR PROGRAMMING II:** Simplex method, variants of simplex algorithm – Artificial (Big-M method) basis techniques, Duality, Economic interpretation of Dual, Solution of LPP using duality concept, Dual simplex method. Application problems	10+(2T)
3	**TRANSPORTATION PROBLEM:** Formulation of transportation model, Basic feasible solution using different methods (North-West corner, Least Cost, Vogel's Approximation Method) Optimality Methods. Unbalanced transportation problem, Degeneracy in transportation problems, Variants in Transportation Problems, Applications of Transportation problems. **ASSIGNMENT PROBLEM:** Formulation of the Assignment problem, unbalanced assignment problem **TRAVELING SALESMAN PROBLEM**	10+(2T)
4	**QUEUING THEORY:** Queuing system and their characteristics, The M/M/I Queuing system, Steady state performance analyzing of M/M/1 queuing model. M/M/K/ Model**.** **GAME THEORY:** Formulations of games, Two persons zero sum game, games with and without saddle point, graphical solutions (2xn, mx2 game), and dominance property. Solution of game through LPP.	8+(2T)
5	**PROJECT MANAGEMENT USING NETWORK ANALYSIS:** Network construction, determination of critical path and duration, CPM Structured approach, Calculations of schedules and floats, PERT-Estimation of project duration and variance.	8+(2T)

Note 1:

    Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.

Note 2:

    Two assignments are evaluated for 5 marks.

Outcomes:
1. Can formulate the LPP using constraints and solve by graphical method.
2. Able to determine the optimum solution using Simplex method.
3. Can find out the optimum transportation and assignment cost.
4. Can identify and apply different queuing model to service and arrival pattern problems and solve the game problems by graphical method and dominance property rule.
5. Able to determine the Critical path and its duration using PERT/CPM.

Cos	Mapping with POs
CO1	PO1, PO2, PO3, PO4, PO5, PO12
CO2	PO1, PO2, PO3, PO4, PO5, PO11, PO12
CO3	PO1, PO2, PO3, PO4, PO5, PO11, PO12
CO4	PO1, PO2, PO3, PO4, PO5, PO7
CO5	PO1, PO2, PO3, PO4, PO5, PO7, PO10, PO11

TEXT BOOKS:
1. **Operation Research and Introduction -**Taha H A, Prentice Hall of India, 6th edition, 1999
2. **Principles of Operations Research -**Philips, Ravindran and Solberg- – Theory and Practice, PHI, 2nd Edition, 2007
3. **Operations Research -**S.D. Sharma – Kedarnath, Ramnath &Co, 1996

REFERENCE BOOKS:
1. **Introduction to Operation Research -**Hiller and Libermann, McGraw Hill 5th edn,
Operations Research Theory and Application -J K Sharma, Pearson Education Pvt Ltd ,4th Edn, 2009 ISBN-0333-92394-4

Sub Title : COMPUTER INTEGRATED MANUFACTURING		
Sub Code: 18IM52	No. of Credits:3 =2 :1: 0 (L-T-P)	No. of lecture hours/week: 3
Exam Duration: 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours: 39

Objectives:
1. To study on automating the system, the use of computers in design and manufacturing.
2. To define basic concepts of geometric modeling techniques, Design and exchange of data.
3. To explain modern concepts of manufacturing using NC, CNC and DNC.
4. To express basic concepts of programming for drilling, milling and turning operations.
5. To outline basic concepts of industrial robotics and its applications to industries.

Unit No.	Syllabus Content	No of Hours
1	**Introduction**: Automation definition, Types, Automation Strategies, organization and information processing in manufacturing. Fundamentals of CAD and CAM, product cycle and CAD/CAM, Design process, Applications of computers in design, creating the manufacturing database, Advantages & Disadvantages of CAD and CAM.	9
2	**Introduction to computer graphics:** Color CRT raster scan monitors, computer input devices, hard copy devices. Software Configuration of a Graphics System, Functions of a Graphics Package, Construction of Geometry, Wire-Frame, Surface and Solid Modeling. Desirable modeling facilities. Geometric 2D and 3D transformations.	9
3	**Numerical control machines:** Introduction- basic components of an NC system-the NC procedure- NC coordinate system, NC motion control system, Applications of NC System, Advantages and limitations of NC Machines. **Computer controls in NC:** Problems with conventional NC, CNC system, Functions and advantages of CNC System. Components of DNC system, Functions and advantages of DNC System. **Computerized Manufacturing Planning System:** Computer Aided Process Planning, retrieval types, Generative type. **Group Technology**: Part families, part classification and coding, cellular manufacturing, Applications of GT.	13
4	**CNC Programming**: Manual part programming, Methods, Preparatory Functions, Miscellaneous Functions, Program Number, Tool Length Compensation, Canned Cycles, Cutter Radius Compensation, Drilling and milling exercises. Turning Center programming: Axes System, General Programming Functions, Motion Commands, Exercises. **CNC Machine Tools:** Overview of CNC machining centers, CNC turning centers Tool presetting, ATC.	14
5	**Introduction to Robotics**: Introduction, Robot configuration, Robot	7

	motions, End effectors, Robot Sensors, Robot applications. Programming the robots, Robot-Programming Languages.	

Note 1: **Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit. Note 2: Two assignments are evaluated for 5 marks.**

Outcomes:
1. Summarize the role of CAD/CAM in modern design and manufacturing
2. Create and analyze the capabilities of Computer Aided Designing Systems for designing mechanical parts and elements in 2D and 3D dimensions.
3. Compare and distinguish between the modern concepts of manufacturing using NC, CNC and DNC.
4. Compile and illustrate manual part program to carryout drilling, milling, and turning operations on CNC machine tools.
5. To demonstrate the concepts of industrial robotics and its applications to industries

TEXT BOOKS:
1. Mikel P. Groover and Emory W. Zimmers - **CAD/CAM**, Jr Pearson Education Inc, 2017.
2. P.N. Rao **– CAD/CAM Principles and Applications**, TMH, New Delhi - 2017.
REFERENCE BOOKS:
1. Newman and Sproull – **Principles of Interactive Computer Graphics**, Tata McGraw Hill, 1995.
2. Ibrahim Zeid –**CAD/CAM**, Tata McGraw Hill, 2016.
3. P. N. Rao, N. K. Tewari and T. K. Kundra – **Computer Aided Manufacturing**, Tata McGraw Hill, 2016.

Cos	**Mapping with POs**
CO1	PO5, PO6, PO7
CO2	PO3, PO4, PO5
CO3	PO3, PO5
CO4	PO3, PO5, PO6, PO7
CO5	PO3, PO5, PO6, PO7

Sub Title: DESIGN OF MACHINE ELEMENTS		
Sub Code: 18IM53	**No. of Credits:4=3: 1: 0 (L-T-P)**	**No. of lecture hours/week: 4**
Exam Duration: 3 hrs	**CIE + SEE = 50 + 50 =100**	**Total No. of Contact Hours: 52**

Objective:
1. Explain the basic components of machinery.
2. Select and size the components and achieve design goals in the construction of mechanical systems
3. Choose the design parameters from Data Hand book to solve the design issues.
4. Define the design issues in various engineering components.
5. Determine the stress developed due to various types of loads.

Unit No.	Syllabus Content	No of Hours
1	**Design for Static Strength**: static loads, static strength and factor of safety. Theories of failure: Maximum Normal Stress Theory, Maximum Shear Stress Theory, Distortion energy theory. Failure of Brittle & Ductile materials. Stress concentration. Determination of stress concentration factor.	9+7(T)
2	**Design for Fatigue Strength**: Fatigue strength, S-N Diagram, low cycle and high cycle fatigue. Endurance limit. Modifying factors: Load, Size and Surface finish effects. Fatigue stress concentration factor. Combined study and Fluctuating stresses. Goodman and Soderberg Relationship. Stresses due to combined loading.	7+4(T)
3	**Design of Springs:** Types of springs, stresses in coiled springs of circular and non-circular cross sections, tension and compression springs, stresses in leaf springs.	7+4(T)
4	**Design of Mechanical joints:** Types of riveted joints, rivet materials, failures of riveted joints (Problems on longitudinal joint only). Types of welded joints, Strength of butt and fillet welds, Eccentrically loaded welds, Design of cotter and knuckle joints.	9+6(T)
5	**Design of Gears:** Design of spur gear, Lewis equation, form factor, stresses in gear tooth, dynamic and wear load.	7+5(T)

Note 1:
   Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2:
   Two assignments are evaluated for 5 marks.

Outcome:
By the end of the course students will be able to
1. Illustrate how the static and dynamic strength parameters affect the material and to know the concepts of factor of safety.

2.	Conduct a failure analysis for the design of mechanical components subjected to cyclic load
3.	Calculate the stress distribution for axial, shear forces and bending moments and torques in spring and joints using the "strength of materials" approach.
4.	Explain the gear type and design the spur gear

Cos	Mapping with POs
CO1	PO1, PO3, PO4, PO9
CO2	PO1, PO3, PO4, PO9
CO3	PO1, PO3, PO4, PO9
CO4	PO1, PO3, PO9

TEXT BOOKS:
1. Joseph Edward Shigley – **Mechanical Engineering Design**, Tata McGraw Hill, New Delhi, 1986.
2. VL. Maleev and Hartman **– Machine Design**, CBS Publishers and Distributors, Delhi, 1983.
3. V. B. Bahandari **– Design of Machine Elements**, Tata McGraw Hill, New Delhi, 2000.
4. C.S Sharma and Kamlesh purohit- Design of machine Elements, PHI learning Eastern economy edition.2009

REFERENCE BOOKS:
1. Robert. L. Norton – Machine Design, Pearson Education Asia, New Delhi, 2001.
2. Hall, Holowinko, Laughlin – Theory and Problems of Machine Design, Schaums Outline Series, 2002.
3. N. C. Pandey and C. S. Shah – Elements of Machine Design, 2002 – Chorotar Publishing house.

Sub Title: QUALITY ASSURANCE AND RELIABILITY		
Sub Code: 18IM54	**No. of Credits:3=2 :1: 0 (L-T-P)**	**No. of lecture hours/week: 4**
Exam Duration: 3 hrs	**CIE + SEE = 50 + 50 =100**	**Total No. of Contact Hours: 52**

Objectives:
1. To explain and define the basic concepts of Quality, Quality Assurance and discuss the ISO series.
2. To introduce the Statistical process control and process capability.
3. Application of control charts for variables and attributes.
4. To determine the customer's and producer's risk using sampling distribution.
5. To explain and define the concepts of failure models and reliability of the system.

Unit No.	Syllabus Content	No of Hours
1	**INTRODUCTION:** Definition of Quality, Quality function, Dimensions of Quality, Quality Engineering terminology, Brief history of quality methodology, Statistical methods for quality improvement, Quality costs – four categories costs and hidden costs. Brief discussion on sporadic and chronic quality problems. Introduction to Seven QC tools. **QUALITY ASSURANCE**: Definition and concept of quality assurance, departmental assurance activities. Quality audit concept, audit approach etc. structuring the audit program, planning and performing audit activities,audit reporting, ingredients of a quality program. ISO Series.(BIS standards/ISO 9000 series standards)	**08**
2	**STATISTICAL PROCESS CONTROL:** Introduction to statistical process control – chance and assignable causes variation. Basic principles of control charts, choice of control limits, sample size and sampling frequency, rational subgroups. Analysis of patterns of control charts. Case Studies on application of SPC. Process capability – Basic definition, standardized formula, relation to product tolerance and six sigma concept of process capability. **CONTROL CHARTS FOR VARIABLES:** Control charts for X bar and Range, Statistical basis of the charts, Development and use of X bar R charts, Interpretation of charts for X bar and Standard Deviation (S), Development and use of X bar S control charts with Variable sample size, Control charts for individual measurements, cumulative-sum chart, moving-range charts.	**12+(3T)**

3	**CONTROL CHARTS FOR ATTRIBUTES:** Controls chart for fraction non- conforming (defectives) development and operation of control chart, brief discussion on variable sample size. Control chart for non-conformities (defects) – development and operation of control chart for constant sample size and variable sample size. Choice between variables and attributes control charts. Guidelines for implementing control charts.	**08**
4	**SAMPLING INSPECTION:** Concept of accepting sampling, economics of inspection, Acceptance plans – single, double and multiple sampling. Operating characteristic curves – construction and use. Determinations of average outgoing quality, average outgoing quality level, average total inspection, producer risk and consumer risk. **USE OF PUBLISHED SAMPLING PLANS:** Gauge Repeatability & Reproducibility & Measurement system analysis.	**12+(3T)**
5	**RELIABILITY AND LIFE TESTING:** Failure models of components, definition of reliability, MTTF, MTBF, MTTR, Failure rate, common failure rate curve, types of failure, reliability evaluation in simple cases of exponential failures in series, paralleled and series-parallel device configurations, Redundancy and improvement factors evaluations.	**06**

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit. Note 2: Two assignments are evaluated for 5 marks.

Outcomes:
1. Able to identify the Quality products using dimensions of quality and be Aware of Quality Assurance and relate the ISO series
2. Can determine six sigma and process capability and construct control charts for variables.
3. Can determine control limits and construct control charts for attributes.
4. Can evaluate the acceptance criteria using sampling distribution.
5. Can Explain and evaluate the failure models and reliability of the system.

Cos	Mapping with POs
CO1	PO3, PO5, PO6, PO7, PO8, PO9, PO12
CO2	PO1, PO2, PO3, PO5, PO8, PO9, PO12
CO3	PO1, PO2, PO3, PO5, PO8, PO9, PO12
CO4	PO1, PO2, PO3, PO5, PO8, PO9, PO12
CO5	PO1, PO2, PO3, PO5, PO8, PO9, PO12

TEXT BOOKS

Introduction to statistical Quality Control - D C Montgomery 3rd Edition, John Wiley and Sons.

Statistical Quality Control - Grant and Leavenworth, McGraw Hill, 6th Edition

REFERENCE BOOKS

1. **The QS9000 Documentation Toolkit** -Janet L Novak and Kathleen C Bosheers," Prenctice Hall PTR, 2nd Edition
2. **ISO 9000 a Manual for Total Quality Management** - Suresh Dalela and Saurabh, S Chand and Co. 1st Edition
3. **Total Quality Management** – NVR Naidu, KM Babu and G. Rajendra – New Age International Pvt. Ltd – 2006
4. **Quality Planning & Analysis** - J M Juran, Frank M Gryna; Tata McGraw Hill, 3rd edition

Sub Title: ADVANCED MACHINING PROCESSES		
Sub Code: 18IM551	**No. of Credits:3 =3: 0: 0 (L-T-P)**	**No. of lecture hours/week: 3**
Exam Duration: 3 hours	**CIE + SEE = 50 + 50 =100**	**Total No. of Contact Hours: 39**

Course objectives:
1. Explain the basic concepts of Advanced Machining Process.
2. Determine the factors influencing process parameters and their performance and applications.

Unit No.	Syllabus Content	No of Hours
1.	**INTRODUCTION TO ADVANCED MACHINING PROCESS**- Introduction to advanced machining, need for advanced machining process, Comparison between traditional and non-traditional machining, general classification of advanced machining processes, classification based on nature of energy employed in machining, selection of advanced machining processes, Specific advantages, limitations and applications of non-traditional machining processes.	04
2	**ULTRASONIC MACHINIG PROCESS, ABRASIVE JET MACHINING PROCESS AND WATER JET MACHINING (WJM):** **Ultrasonic Machining Process:** Working Principles – equipment used and operations of Ultrasonic Machining, -USM Process Parameters-Amplitude and frequency and vibration, Effect of grain diameter, Effect of applied static load, Effect of slurry and tool and work material Applications, Advantages and Limitations of USM **Abrasive Jet Machining Process:** AJM Variables and accuracy- carrier Gas Type of abrasive, Size of abrasive grain, velocity of the abrasive jet, Mean No. abrasive particles per unit volume of the carrier gas, Work material, standoff distance (SOD), shape of cut & surface finish, Nozzle wear, accuracy & surface finish. Applications, advantages & Limitations of AJM. **Water Jet Machining (WJM):** Equipment & process, Operation, applications, advantages and limitations of WJM	12
3	**ELECTRIC DISCHARGE MACHINING PROCESS (EDM)-** Introduction, mechanism of metal removal, EDM equipment, dielectric medium- its functions & desirable Properties, electrode feed control system. Flushing types; pressure flushing, suction flushing, side flushing, pulsed flushing. EDM process parameters: Spark frequency, current & spark gap, surface finish, Heat Affected Zone. Advantages, limitations & applications of EDM.	06
4	**ELCETRO CHEMICAL AND CHEMICAL MACHINING PROCESS:** Introduction, Principle of electro chemical machining: ECM equipment, elements of ECM operation, Chemistry of ECM. Electrolytes functions and properties – MRR, accuracy, surface finish and Process Parameters.	12

	Electrochemical grinding and electrochemical honing process. Advantages, disadvantages and application of ECG, ECH. **CHEMICAL MACHINING (CHM)** Elements of the process: Resists (maskants), Etchants. Types of chemical machining process-chemical blanking process, chemical milling process. Process characteristics of CHM: material removal rate, accuracy, surface finish, advantages, limitations and applications of chemical machining process.	
5	**LASER BEAM MACHINING (LBM), ELECTRON BEAM MACHINING (EBM) AND PLASMA ARC MACHINING (PAM)** Introduction, Principle, equipment and mechanism of metal removal, applications, advantages and limitations. **Hybrid Manufacturing Process** and **Additive Manufacturing Process** (Introduction aspects only)	**05**

Outcome:
1. Explain the modern manufacturing process and define the concepts of non-conventional machining process.
2. Describe the working principle, process parameters and variables in mechanical energy-based machining process.
3. Define the concepts of electrical energy-based metal removal process.
4. Illustrate the process of chemical and electro chemical machining.
5. Explain the machining process of thermal energy-based machine tools.

Note 1:
    Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2:
    Two assignments are evaluated for 5 marks.

Cos	Mapping with POs
CO1	PO1, P03, PO8, P10, P11.
CO2	PO1, P03, PO5, PO8, P10, P11.
CO3	PO2, PO5, PO10, P11.
CO4	PO1, P03, PO8, P10, P11.
CO5	PO1, P03, PO5, PO8, P10, P11.

TEXT BOOKS:
1. Modern machining process - PANDEY AND SHAH, TATA Mc Graw Hill 2000.
2. New technology - BHATTACHARAYA 2000
REFERENCE BOOKS:
1. **Production Technology**, by HMT TATA McGraw Hill 2001.
2. **Modern Machining Process** - ADITYAN 2002.
3. **Thermal Metal cutting processes** - B G Ranganath - I K International Publishing house Pvt. Ltd,
4. **Fundamentals of Machining and Machine Tools** - R.K.Singal - I K International Publishing house Pvt Ltd,
5. **Wohlers Report 2001-**Terry Wohlers, Wohlers Associates, 2008.

Sub Title: MARKETING MANAGEMENT		
Sub Code: 18IM552	No. of Credits:3=3: 0: 0 (L-T-P)	No. of lecture hours/week: 3
Exam Duration: 3 hrs.	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours: 39

Objectives:
1. To understand the concepts of marketing management.
2. To comprehend marketing decisions, based upon the combination of product, price, promotion, and distribution elements.
3. Identify the roles of advertising, sales promotion, public relations, personal selling
4. To understand fundamental premise underlying advertising and sales promotion

Unit No.	Syllabus Content	No of Hours
1	**INTRODUCTION TO MARKETING** Introduction, Definitions of market and marketing, Selling Vs marketing, The Exchange Process, Elements of Marketing Concept, Functions of Marketing, Old Concept or Product oriented Concept, New or Modern or Customer- oriented Concept, Marketing Myopia, Marketing Environment analysis, (Micro and Macro), Marketing in the 21st century opportunities, challenges & Ethics. **BUYER BEHAVIOUR ANALYSIS** Meaning and Characteristics, Importance, Factors Influencing Consumer Behaviour, Consumer Purchase Decision Process, Buying Roles, Buying Motives. The black box model of consumer behaviour. B2B marketing Vs Consumer Marketing	**08**
2	**MARKET SEGMENTATION, TARGETING & POSITIONING (STP):** Concept of Market Segmentation, Benefits, Requisites of Effective Segmentation, Bases for Segmenting Consumer Markets, Market Segmentation Strategies. Targeting - Bases for identifying target Customer target Marketing strategies, Positioning - Meaning, Product Differentiation Strategies, Tasks involved in Positioning. Branding - Concept of Branding, Types, Brand Equity, Branding strategies. **Managing the Product:** Pricing decisions, Marketing Channels, Promotion Strategy, Sales Promotion: Marketing Planning, Case Study on "Facebook", Marketing Management Concept, product hierarchy, product line, product mix, product mix strategies,	**08**
3	**PRODUCT PLANNING AND DEVELOPMENT:** Product life cycle and its strategies, New Product Development, packing as a marketing tool, Role of labeling in packing. Services Marketing & its Characteristics **INTRODUCTION TO E-MARKETING:** Landscape – Past – Today – Future – Internet Marketing Paradigm, Internet Infrastructure Stack Business Models & Strategies: Strategic Planning , Strategy to Electronic Planning, Strategic Drivers of the Internet Economy, Business Models to E-Business Models.	**07**

4	**BRANDING :** Branding, Reasons for branding, functions of branding, features and types of brands, kinds of brand name. **LABELLING:** Types, functions, advantages and disadvantages **PACKAGING:** Meaning, growth of packaging, function of packaging, kinds of packaging.	**10**
	PRICING: Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for price determination, kinds of pricing, pricing strategies and decisions. **DISTRIBUTION:** Marketing channels – functions, types of channels of distribution, number of channel levels. Physical distribution – importance, total systems concept, strategy, use of physical distribution.	
5	**ADVERTISING AND SALES PROMOTION:** Objectives of advertisement function of advertising, classification of advertisement copy, advertisement media – kinds of media, advantages of advertising. Objectives of sales promotion, advantages sales promotion. **PERSONAL SELLING:** Objectives of personal selling, establishing the Sales force objectives, sales – force strategy, sales force structure and size, salesmanship, qualities of good salesman, types of salesman, major steps in effective selling.	**06**

Note 1:
Each unit has internal choice. Total of 10 questions i.e. 2 full questions from each unit.

Note 2:
- Assignments are evaluated for 5 marks comprising of the following:
- Analyze Product Life Cycle of few Products like-Electronic goods, Computers etc
- Study Packaging strategies used by FMCG companies
- Understand Marketing strategies, plans used by automobile, cosmetic, FMCG companies
- Marketing Games and quiz for Students

.**Outcomes:**
1. Develop an ability to assess the impact of the environment on marketing function.
2. To use the STP model in marketing to analyze the product, its price.
3. Identify and analyze the strategic elements of product development processes
4. Understand the role of packaging, labeling, pricing and distribution in the brand-building process
5. Understand the effectiveness of advertising and sales promotion.

Cos	Mapping with POs
CO1	PO1,PO5
CO2	PO1,PO2, PO5,PO6, PO7,PO9, PO10,PO12
CO3	PO3,PO5, PO6, PO7, PO8, PO9, PO10,PO11, PO12.
CO4	PO3, PO5, PO6, PO7, PO8, PO9, PO10,PO11, PO12.

TEXT BOOKS:

1. Principles of Marketing - Philip Kotler , Prentice – Hall. 11th Edn.
2. Marketing Management - Philip Kotler , Prentice – Hall. 12th Edn.
3. Marketing Management: A South Asian Perspective–Kotler, Keller, Koshy & Jha, 14/e, Pearson Education, 2012.
4. Marketing- Lamb, Hair, Mc Danniel, 7/e, Cengage Learning 2012.
5. Marketing Management, Tapan Panda, 2/e, Excel Publication
6. Marketing Management – An Indian perspective – Prof. Vijay Prakash Anand

REFERENCE BOOKS:

1. **Fundamentals of Marketing -** Wiliam J Stanton, McGraw Hill, 1994
2. **Marketing Management** - S.A Sherlaker", 1999.
3. **Rajagopal, Marketing Management Text& Cases** - Vikas Publishing House, ISBN 81-2590773-4

Sub Title: RAPID PROTOTYPING		
Sub Code: 18IM553	No. of Credits:3=3: 0: 0 (L-T-P)	No. of lecture hours/week: 3
Exam Duration: 3 hours	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours: 39

Course objectives:
1. To understand the concept of Rapid Prototyping and its applications.
2. To comprehend various RP machining techniques and its applications.
3. To understand the different Rapid tooling.
4. To learn more about RP software and RP process optimization.

UNIT No	Syllabus Content	No of Hours
1	Introduction: Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems. Stereo Lithography Systems: Principle, Process parameter, Process details, Data preparation, data files and machine details, Application.	08
2	Selective Laser Sintering: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications. Fusion Deposition Modelling: Principle, Process parameter, Path generation, Applications	08
3	Solid Ground Curing: Principle of operation, Machine details, Applications. Laminated Object Manufacturing: Principle of operation, LOM materials. Process details, applications. Concepts Modelers: Principle, Thermal jet printer, Sander's model market, 3-D printer. Genisys Xs printer HP system 5.	08
4	Rapid Tooling: Indirect Rapid tooling, Silicon rubber tooling, Aluminium filled epoxy tooling, Spray metal tooling, Cast kirksite, 3Q keltool, etc. Rapid Tooling: Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling	10
5	Software For RP: STL files, Overview of Solid view, magics, Gimmicks, magic communicator, etc. Internet based software, Collaboration tools. Rapid Manufacturing Process Optimization: factors influencing accuracy. Data preparation errors, Part building errors, Error in finishing, influence of build orientation	05

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit. Note 2: Two assignments are evaluated for 5 marks.

Course Outcomes: By the end of the course students will be able to

	1. Understand the Rapid Prototyping system, its applications and growth.
2.	Analyse the Selective Laser Sintering and Fusion Deposition modelling technique and applications.
3.	Learn the concepts of Solid Ground Curing, Laminated Object Manufacturing and the Concepts Modelers.
4.	Explain the different Rapid tooling types.
5.	Appreciate the rapid prototyping software and Rapid Manufacturing Process Optimization.

Cos	Mapping with POs
CO1	PO2, PO3, PO5, PO6, PO7, PO9, PO12
CO2	PO1, PO2, PO3, PO6, PO7, PO9, PO12
CO3	PO1, PO2, PO3, PO6, PO7, PO9, PO12
CO4	PO4, PO5, PO7, PO8, PO9, PO10, PO12
CO5	PO4, PO5, PO7, PO8, PO9, PO10, PO12

TEXT BOOK:
1. Stereo Lithography and other RP & M Technologies, Paul F. Jacobs: SME, NY 1996.
2. Rapid Manufacturing, Flham D.T & Dinjoy S.S Verlog London 2001.

REFERENCE BOOKS / WEBLINKS:
1. Rapid Prototyping, Terry Wohlers Wohler's Report 2000" Wohler's Association 2000.
2. Rapid Prototyping Materials, Gurumurthi, IISc Bangalore.
3. Rapid Automated, Lament wood. Indus press New York

Sub Title : QUALITY ENGINEERING LAB		
Sub Code : 18IML57	No. of Credits:1 =1 : 0 : 0 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 12

Objectives:

1. To Explain and apply the basic fundamental concepts of Statistics to engineering problems.
2. Application of probability distributions to various manufacturing problems.
3. Application of hypothesis to random experiments of manufacturing processes.
4. To test the statistical parameters by regression and correlation.
5. To construct the Variable and attribute type of control charts.
6. To test the goodness of fit for various quality characteristics using different distribution.

Unit No.	Syllabus Content	No of Hours
1	i).To test the Goodness of fit for the given quality characteristic using Normal distribution ii).To test the Goodness of fit for the given quality characteristic using Poisson distribution iii).,To test the Goodness of fit for the given quality characteristic using Binomial distribution iv).To test the Goodness of fit for the given quality characteristic using Uniform distribution v).Conduction of Repeatability and Reproducibility studies for appraiser and instrument using R&R Software vi).Assessing Process Capability of the given manufacturing process using Normal Probability paper method and process capability indices vii).Assessing Process Capability of the given manufacturing process using Digital Motorized multifunctional Height Gauge and SQC Display unit	18
2	i) Experiments on Application of 7 QC Tools as applied to Manufacturing and Service Operations. ii).Construction of control chart for variable quality characteristic using Digital Motorized Multifunctional Height Gauge iii).Construction of control chart for attribute quality characteristic iv).Construction of control charts using Systat Software v) Attribute sampling Plans – Single, Double and Multiple sampling plans. vi)Experiments on correlation and Simple linear regressions vii).Experiments on multiple linear regressions	18

Outcomes:

1. Able to identify type of probability distribution and solve the various manufacturing problems.
2. Able to test the hypothesis and give inference to random experiments.
3. Can make use or test the statistical parameters by estimation.
4. Able to apply 7 QC tools

Cos	Mapping with POs
CO1	PO1,PO2,PO3,PO4,PO12
CO2	PO1,PO2,PO3,PO4,PO5,PO6,PO7,PO10,PO12
CO3	PO1,PO2,PO3,PO4,PO12
CO4	PO1,PO2,PO3,PO4,PO5,PO12

Scheme of Examination:
ONE question from Unit -1 : 20 marks ONE question from Unit -2 : 20 marks   Viva-Voce: 10 marks.
Reference Books: 1. Introduction to statistical Quality Control D C Montgomery - 3rd Edition, John Wiley and Sons. 2. Quality Planning & Analysis- J M Juran, Frank M Gryna; Tata McGraw Hill, 3rd edn., 3. Statistical Quality Control - Grant and Leavenworth, McGraw Hill

Sub Title : Computer Integrated Manufacturing Lab		
Sub Code : 18IML58	**No. of Credits:1= 1 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 2**
Exam Duration : 3 hrs	**CIE + SEE = 50 + 50 =100**	**Total No. of Contact Hours : 13**

Objective:
Develop and determine of the practical aspects of enabling computer aided technologies used in design and manufacturing.
Develop a degree of competency in the development and application of modern CAD/CAM system through hands on experience in the solution of practical problems.
Define to Operate and program industrial (manipulator) robots.

Unit No.	Syllabus content	Hrs
1	CNC part programming using CAM packages. Writing and execution of manual part program using ISO code for machining of simple parts, turning, taper turning, form turning, and thread cutting. Use radius compensation, canned cycles, macros etc. CNC milling: Writing and execution of part program for contour milling.	18
2	Simulation of Turning, Drilling, Milling operations. 3 typical simulations to be carried out using simulation packages like CADEM, or any equivalent software.	15
3	**(Only for Demo/Viva voce)** Robot programming: Using Teach Pendent to perform pick and place, stacking of objects in increasing or decreasing size, palletizing operations etc.	03

Outcome:
1. Explain the concepts and modeling and the usage of models in different engineering applications.
2. Explain the benefits of a comprehensive and integrated CAD/CAM system.
3. Create accurate and precise geometry of complex engineering systems and use the geometric models in different engineering applications.
4. Compare the different types of modeling techniques and explain the central role solid models play in the successful completion of CAD/CAM-based product development.
5. Use and assess state-of-the-art CAD/CAM codes efficiently, effectively and intelligently in advanced engineering applications.Use and Operate industrial (manipulator) robots.

Cos	Mapping with POs
CO1	PO2,PO5,PO7,PO12
CO2	PO2,PO5,PO7,PO12
CO3	PO2,PO5,PO7,PO12
CO4	PO2,PO5,PO7,PO12
CO5	PO2,PO5,PO7,PO12

Scheme of Examination:
ONE question from Unit -1: 20 marks ONE question from Unit -2: 20 marks Viva-Voce   : 10 marks
Suggested software: 1. Simulation Packages: Fanuc/ CNC Base (SLM/SLC) 2. Simulation Packages : CADEM, CAPStrun, CAPSmill 3. Robot Simulation Aristosim.

Sub Title : MATERIALS MANAGEMENT		
Sub Code : 18IM61	No. of Credits:3=3 : 0 : 0 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 39

Objective:
1. Define the concepts of modern materials management and aims to increase profitability.
2. Explain the purchasing principles and relationships with vendors.
3. Define the Application of different systems of codification and analysis of stores management and selective control techniques.
4. Determine basic concepts of Inventory management and their applications to industry.
5. Develop inventory models for different manufacturing situations along with price breaks.

Unit No.	Syllabus Content	No of Hours
1	**Introduction:** Importance of Materials Management – Definition, scope, organization for Materials Management, Objectives of materials management, an overview of system concepts, Benefits of an integrated system approach. **Materials Planning:** Making the materials plan work, the materials cycle and flow control system, Materials budget.	07
2	**Purchasing:** Purchasing Principles, Procedures and Practices, Fundamental Objectives of Purchasing, Scope, Preparation of forms and records for purchasing, Methods of Purchasing, reciprocity, Cost-Plus Contracts, Hedging, Sources of Supply and Supplier Selection, Legal Aspects of Purchasing, Law of Agency, Law of Contract, Vendor-Vendee Relations, Vendor Development, Vendor Rating.	10
3	**Stores Management and Operation:** Storage System, Stores Location and Layout, Development of Storing, Centralization and Decentralization of Stores. The Systems classification and Codification of Materials, ABC, FSND, VED analysis. Case studies on ABC Analysis	07
4	**Inventory Management: :** Definition of inventory, Need of inventory and its management, functions of inventory management, types of inventories, inventory control, cost elements, Economic Order Quantity, Max - Min system. Inventories and demand uncertainty.	05
5	**Deterministic Inventory models**: Dynamic inventory models, Instantaneous and finite rate of replenishment with and without shortage. Models with Price breaks & quantity discounts, (Numerical Exercises on EOQ) Determining safety stock. Q-system & P-system.	10

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2: Two assignments are evaluated for 5 marks.

Outcome:
1. Explain the concepts and Importance of Integrated Materials Management
2. Elaborate about the concepts of purchasing, types, objectives, procedure including vendor rating.

3. Design and layout for a stores, do codification, use selective control techniques to stock the items in stores.
4. Explain the basic concepts on inventory, inventory costs, EOQ.
5. Use the inventory models in practical applications.

Cos	Mapping with POs
CO1	PO3,PO9,PO10
CO2	PO4,PO8,PO9,PO12
CO3	PO3,PO4,PO9
CO4	PO2,PO3,PO4
CO5	PO2,PO3,PO4,PO9,PO11

TEXT BOOK:
1. Materials Management, P. Gopalakrishnan, PHI Pvt. Ltd, New Delhi, 2002
2. Materials Management, A.K. Datta., PHI Pvt. Ltd, New Delhi, 2001.
3. Operations Research, Kanti Swaroop, S Chand & Co. 2003

REFERENCE BOOK:
1. Handbook of Materials Management, P. Gopalakrishnan, PHI Pvt. Ltd, New Delhi, 2002.
2. Operations Research, Taha, McMillan, 4th edtion.
3. Gupta and hira, problems on operations reasearch

Sub Title :	FACILITIES PLANNING AND DESIGN	
Sub Code : 18IM62	**No. of Credits: 3= 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hrs	**CIE + SEE = 50 + 50 =100**	**Total No. of Contact Hours : 39**

Objectives:
1. Explain the concepts of plant layout, layout planning and designing efficient facilities
2. Solve location and layout problems by considering the entire manufacturing and/or service systems within their supply chains.
3. Assess the role of facilities planning in reducing costs and increasing productivity and service level through selection of better material handling.
4. Elaborate on the concepts of computer-aided layout designs better facility design.

Unit No.	Syllabus Content	No of Hours
1	**PLANT LOCATION:** Factors influencing plant location, Theories of plant location and location economics. Location models: Selection of site by Break even analysis, Factor Rating method, Centre of gravity method (problems) **Plant layout**-Objectives of plant layout, Principles of plant layout, types of plant layout, and their merits and demerits **PLANT DESIGN:** Layout procedures: Immer, Nadler, Muther, Apple and Reed's approaches, systematic layout planning.	10
2	**MATERIAL HANDLING:** Objectives and principles of Material handling, Unit load concept, Material handling equipments, Selection of material handling equipments, Production line balancing.	06
3	**COMPUTERIZED LAYOUT PLANNING:** CRAFT, COFAD, PLANET, CORELAP, ALDEP	05
4	**SPACE DETERMINATION AND AREA ALLOCATION:** Factors for consideration in space planning, receiving, storage, production, shipping, tool room and tool crib, other auxiliary service actions, Establishing total space requirement, area allocation factors to be considered, expansion, flexibility, aisles column, area allocation procedure, the plot plan. **CONSTRUCTION OF THE LAYOUT:** Methods of constructing the layout, evaluation of layout, efficiency indices.	10
5	**QUANTITATIVE APPROACHES TO FACILITIES PLANNING:** Deterministic models single and multi-facility location models, Location allocation problems – quadratic assignment problem, Warehouse layout models, Evaluation, selection and implementation of facilities plan.	08

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2: Two assignments are evaluated for 5 marks.

Outcomes:
By the end of the course students will be able to
1. Solve facility location problems and prepare a facilities layout for the efficient flow of materials through a facility
2. Analyze material handling systems through different material handling equipment and material handling principles used in the warehousing, manufacturing
3. Plan the layout and evaluate facilities related problems using different layout planning algorithms
4. Identify activity, relationships and space requirements for various departments
5. Evaluate and select facilities plan

Cos	Mapping with POs
CO1	PO3,PO4
CO2	PO3,PO6
CO3	PO5,PO6
CO4	PO4,PO7
CO5	PO3,PO4,PO7

TEXT BOOKS:
1. Plant Layout and Material handling - James M Apple, 2nd Edition, John, Wiely and Sons
2. Facility layout and Location- Francies R L and White J A, Mc- Graw Hill 2nd edition

REFERENCE BOOKS:
1. Practical layout- Muther Richard, Mc- Graw Hill-1955.
2. Facilities Design, Sunderesh Heragu, PWS Publishing Company, ISBN-0-534-95183.
3. Plant Layout Design - James M Moore, Mc Millon Co.1962 LCCCN61- 5204.

Sub Title : LEAN MANUFACTURING		
Sub Code : 18IM63	No. of Credits: 3= 3 : 0 : 0 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 39

Objectives:
1. To recall the history and the birth of Lean Manufacturing system.
2. To know the tools and techniques of lean manufacturing like stability, standardization etc.
3. To understand the concepts of the two pillars of TPS i.e. JIT and JIDOKA.
4. To appreciate the lean culture.

Unit No.	Syllabus Content	No of Hours
1	ORIGIN OF LEAN PRODUCTION: Craft Production – Mass Production – Ford System – Growing Dysfunction – Origin and History of Lean Production. LEAN PRODUCTION SYSTEM: Necessity of Lean Production – Systems and Systems thinking – Construction of Lean Production: Lean image and Lean Activities – Muda and its types – Mura – Muri.	08
2	STABILITY: Standards in Lean System – Visual Management – 5S – Total Productive Maintenance: Key measures; Six Big Losses; Hidden Losses; Machine Loss Pyramid; Small group activity.	06
3	STANDARDIZED WORK: Comparison of Methods Engineering and Lean thinking – Elements to be managed - Necessity and prerequisites of Standardized work – Elements of Standardized work - Charts: Production capacity chart; Standardized combination table; Standardized work analysis chart – Man power reduction – Comparison of overall efficiency with individual efficiency – Kaizen – Common Layouts	09
4	JUST IN TIME (JIT): Definition - Principles of JIT: Continuous Flow; Pull – JIT system – Kanban – Six Kanban rules - Expanded role of conveyance – Production leveling – Three types of Pull Systems – Value Stream Mapping: Symbols; Current state VSM and Future state VSM. JIDOKA: Development and necessity – Poke Yoke: Common errors – Inspection system and Zone control – Using Poke Yokes – Jidoka implementation.	10
5	LEAN INVOLVEMENT AND CULTURE: Necessity of involvement – Waste of Humanity – Activities supporting involvement – Kaizen Circle Activity – Practical Kaizen Training – Key factors in Practical Kaizen Training – Lean Culture – Standardization – Standards and abnormality control – 'Five Why' analysis.	06

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2: Two assignments are evaluated for 5 marks.

Outcomes:
After completing the course students re able to
1. Appreciate the birth of lean manufacturing and the history before it evolution.
2. Discuss and apply the various tools and techniques of lean manufacturing.
3. Know the concepts of JIT and JIDOKA.
4. Understand the Lean culture and its analysis.

Cos	Mapping with POs

CO1	PO3,PO5,PO8,PO10
CO2	PO3,PO5,PO8,PO10,PO11
CO3	PO3,PO5,PO8,PO10,PO11
CO4	PO10,PO11
CO5	PO5,PO8,PO10,PO11

TEXT BOOKS:
1. Devadasan S R, Mohan Sivakumar V, Murugesh R and Shalij P R, "Lean and Agile Manufacturing: Theoretical, Practical and Research Futurities", Prentice Hall of India Learning Limited, New Delhi, 2012.
2. Dennis P, "Lean Production Simplified: A Plain Language Guide to the World's Most Powerful Production System", Productivity Press, New York, 2007.
REFERENCES:
1. Gopalakrishnan N, "Simplified Lean Manufacture: Elements, Rules, Tools and Implementation", Prentice Hall of India Learning Private Limited, India, 2010.
2. Bill Carreira, "Lean Manufacturing that Works: Powerful Tools for Dramatically Reducing Wastes and Maximizing Profits", Prentice Hall of India Learning Private Limited, India, 2007.
3. Don Tapping, Tom Luyster and Tom Shuker, "Value Stream Management: Eight Steps to Planning, Mapping and Sustaining Lean Improvements", Productivity Press, New York, USA, 2002.

Sub Title : SIMULATION MODELLING AND ANALYSIS		
Sub Code : 18IM64	**No. of Credits: 2 : 1 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hrs	**CIE + SEE = 50 + 50 =100**	**Total No. of Contact Hours : 52**

Objectives:
1. Demonstrate the major capabilities and commonly encountered limitations of discrete-event simulation for modeling systems that industrial engineers commonly encounter.
2. Be able to build and run simple discrete-event simulation models in practical situations
3. Illustrate the main assumptions underlying these models; and Explain what can happen when these assumptions do not hold.
4. Be able to communicate the results of the modeling process to management and other non-specialist users of engineering analysis.

Unit No.	Syllabus Content	No of Hours
1	**Introduction To Simulation:** Simulation, advantages & disadvantages, Areas of application, System environment, Components of a system, Model of a system, Types of models, Monte carlo simulation and Steps in a simulation study.	6+2T
2	**Simulation Examples:** Simulation of Queuing systems, Simulation of Inventory Systems. **General Principles:** Concepts in discrete - events simulation, event scheduling / Time advance algorithm	8 + 4T
3	**Random Numbers:** Properties, Generations methods, Tests for Random number- Frequency test, Runs test, Auto correlation test, Gap test, Poker test	6 + 4T
4	**Introduction To Probability Distributions:** Weibull and triangular distribution and their applications. **Random Variate Generation:** Inverse Transform Technique- Exponential, Uniform, Weibull, Triangular distributions, Direct transformation for Normal and log normal Distributions, convolution methods- Erlang distribution, Acceptance – Rejection Techniques – Poisson Distribution, Gamma Distribution.	6 + 4T
5	**Analysis Of Simulation Data:** Input Modeling: Data collection, Identification and distribution with data, parameter estimation, Goodness of fit tests, Selection of input models without data. Verification and Validation of Model – Model Building, Verification, Calibration and Validation of Models **Output Analysis:** Stochastic Nature of output data, Measures of Performance and their estimation.	8 + 4T

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2: Two assignments are evaluated for 5 marks.

Outcomes:

After completion of the course the student will be able to
   1. Illustrate basic concepts in modeling and simulation (M&S).
   2. Classify various simulation models and give practical examples for each category.
   3. Construct a model for a given set of data and motivate its validity.
   4. Generate and test random number variates and apply them to develop simulation models.
   5. Fit statistical distributions to input data, obtain parameter estimation and goodness of fit.

Cos	Mapping with POs
CO1	PO1,PO2
CO2	PO2,PO3,PO4
CO3	PO4,PO6
CO4	PO4,PO5,PO6
CO5	PO1,PO2,PO4

TEXT BOOKS:
1.Discrete Event system Simulation – Jerry Banks, John S Carson, II, Berry L Nelson, David M Nicol, III Edition, Pearson Education, Asia, ISBN - 81- 7808 – 505 - 4. **2.Systems Simulation with Digital Computer** – Narsingh Deo; PHI Publication (EEE), ISBN – 0-87692-028-8 **3.Simulation Modelling & Analysis** – Averill M Law, W David Kelton; McGraw Hill International Editions – Industrial Engineering series, ISBN – 0-07-100803-9.

Sub Title : COMPOSITE MATERIALS		
Sub Code : 18IM653	**No. of Credits:3= 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hrs	**CIE + SEE = 50 + 50 =100**	**Total No. of Contact Hours : 39**

Objectives:
1. To introduce composite materials and its different types.
2. To explain the advanced methods of the manufacturing of composite material and different fabrication techniques.

Unit No	Syllabus	No of Hours
1	**Introduction To Composite Materials:** Definition-Classification and characteristics of composite materials- fibrous composites, laminated composites and particulate composites	**06**
2	**FIBER REINFORCED PLASTIC PROCESSING:** **Primary and secondary manufacturing of composites** – Layup and curing, fabricating process-open and closed mould process-hand layup techniques-structural laminate bag molding, Autoclave Molding filament Winding, Pultrusion, Compression Molding, RTM, RIM, SRIM, machining, drilling and routing.	**08**
3	**FIBER REINFORCED PLASTIC PROCESSING:** Production procedures for bag molding- filament winding, pultrusion, pulforming, thermo-forming, injection, injection molding, liquid injection molding, blow molding.	**06**
4	**FABRICATION OF COMPOSITES:** Cutting, machining, drilling, mechanical fasteners and adhesive bonding, joining, computer aided design and manufacturing, tooling, fabrication equipment.	**08**
5	**METAL MATRIX COMPOSITES (MMC'S):** Reinforcement materials, types, characteristics, and selection base metals selection-Need for production MMC's and its application. **CERAMIC MATRIX COMPOSITES** – Manufacturing routes and application	**09**

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2: Two assignments are evaluated for 5 marks.

Outcome:
1. Students are able to explain the different concepts of manufacturing of fiber reinforced composites.
2. Laminate design for different combinations of plies with different orientations of the fiber.
3. To Explain the machining of composite materials
4. To Explain the Manufacturing routes and application of Metal matrix and Ceramic matrix composites

Cos	Mapping with POs
CO1	PO3,PO8,PO10
CO2	PO3,PO8,PO10
CO3	PO3
CO4	PO3,PO8,PO10

TEXT BOOKS:

1. .Mein Schwartz., "Composite Materials Handbook", McGraw Hill, 1992

2. Autar K.Kaw, "Mechanics of Composite Materials", CRC Press, 2005.

3. Gibson, R.F., "Principles of Composite Material Mechanics", McGraw-Hill, 1994, 2nd
Edition - CRC press in progress.

4. Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw-
Hill, 1998.

REFERENCE **BOOK:**

1. "ASM Hand book on Composites", Volume 21, 2001

2. Vanviack L.H, "Physical Ceramics for Engineers", Addison Wesley Publication, 1964.

3. Issac M. Daniel and OriIshai, "Engineering Mechanics of Composite Materials", Oxford
University Press, 2006, First Indian Edition, 2007.

4. Mallick, P.K., Fiber,"Reinforced Composites: Materials, Manufacturing and Design",
Maneel Dekker Inc, 1993.

5. Halpin, J.C., "Primer on Composite Materials, Analysis", Techomic Publishing Co., 1984.

6. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites",
John Wiley and Sons, New York, 1990.

7. Mallick, P.K. and Newman, S., "Composite Materials Technology: Processes and
Properties", Hansen Publisher, Munish, 1990.

Sub Title : ORGANIZATIONAL BEHAVIOUR		
Sub Code : 18IM654	**No. of Credits:3 =3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hrs	**CIE + SEE = 50 + 50 =100**	**Total No. of Contact Hours : 39**

Objectives:
1. To introduce the scope and importance of Organization behavior.
2. To Explain and study the different behaviors in organizations.
3. To develop motivation and leadership power.
4. To introduce the dynamics of Organization behavior.

Unit No.	Syllabus Content	No of Hours
1	**Introduction:** Organizational Behaviour: Introduction, definition, historical development, fundamental principles of OB, contributing disciplines, challenges and opportunities. **Management**: Introduction, Definition of management, Nature, Purpose and Functions, Levels and types of managers, managerial roles, skills for managers, evolution of management thought, Fayol's fourteen principles of management, Recent trends in management.	6
2	**INDIVIDUAL BEHAVIOUR:** Personality-types, factors influencing personality, theories, Defining, types of Definers, the Defining process, Defining theories, Organizational Behaviour modification, Misbehavior, types, Management Intervention, Emotions, Emotional labour, Emotional Intelligence, Theories. Attitudes, Characteristics, Components, Formation, Measurement, Values. Perception, Importance, Factors influencing perception, Interpersonal perception, Impression Management, Motivation- Importance Types, Effects on work Behaviour.	10
3	**GROUP BEHAVIOUR:** Organization structure, formation, groups in organization, influence, group dynamics, emergence of informal leader and working norms, group decision making techniques, team building, interpersonal relations, communication, control.	10
4	**MOTIVATION:** Maslow's hierarchy of needs, Douglas Mc Gregor Theory X &Theory Y, Chris Argyris pattern A & pattern B, Motivation Hygiene theory, Motivation and Satisfaction. **LEADERSHIP AND POWER:** Meaning, importance, leadership style, theories, leaders Vs managers, sources of power, power centers, power and politics.	6
5	**DYNAMICS OF ORGANIZATIONAL BEHAVIOUR:** Organizational culture and climate, factors affecting organizational climate-importance, job satisfaction, determinants, measurements, influence on behavior. organizational change, importance, stability Vs change, proactive vs reaction change, the change process, resistance to change, managing change, stress work, stressors, prevention and management of stress, balancing work and life. Organizational development, characteristics, objectives, organizational effectiveness.	7

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2: Two assignments are evaluated for 5 marks.

Cos	Mapping with POs
CO1	PO5,PO6,PO12
CO2	PO5,PO6,PO7.PO8,PO10,PO12
CO3	PO6,PO7,PO8,PO9,PO10,PO12
CO4	P05,PO6,PO7,PO8,PO9,PO10,PO12
CO5	PO3,PO5,PO6,PO7,PO8,PO9,PO12

TEXT BOOKS:
1. Organizational Behaviour, Stephen P Robbins, 15thEdn, 2015 Pearson Education Publications, ISBN–81–7808–561-5
2. Management of Organizational Behavious, Paul Henry and Kenneth H. Blanchard, Prentice Hall of India, 1996.
3. Organizational Behaviour – Fred Luthans, 9thEdn, McGraw Hill International Edition, ISBN–0–07– 20412–1
REFERENCE BOOKS:
1. Organization Behavior – Hellriegel, Srocum and woodman, Thompson Defineing, 9th Edition, Prentice HallIndia, 2010
2. Organizational Behavior – VSP Rao and others, Konark Publishers 2002.

Sub Title : SIMULATION LAB		
Sub Code : 18IML67	No. of Credits: =0 : 0 : 1 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 36

Objectives:
1. To Explain and apply the basic fundamental concepts of Statistics to manufacturing operations.
2. Application of probability distributions to various manufacturing problems.
3. Application of random number generations for different experiments of simulation models.
4. To test the input and output analysis using statistical analysis.

Unit No.	Syllabus Content	No of Hours
1	**Introduction to Simulation Package.** Features of Simulation Package and Input Modeling Identifying probability distributions for given data Building simulation models for manufacturing operations (With Common templates) Building simulation models for manufacturing operations (With Basic templates) Building simulation models for manufacturing operations with transport System Building simulation models for manufacturing operations with layout. Simulation of Multi Product Assembly line System.	18
2	**Building simulation models for service operations and analysis of data.** Building simulation Models for Banking service (Bank teller problem) Building simulation Models for Mortgage application problem Building simulation Models for food processing problem Building simulation Models for Post office animation Statistical Analysis of Simulation models (input analysis) Statistical Analysis of Simulation models (output analysis) Modelling a Live Problem	18

Outcomes:
1. Able to identify type of probability distribution and analyze nature of input data
2. Able to apply various simulation models using common and basic process templates
3. Will be able to solve the various manufacturing related problems and analyze output data

Cos	Mapping with POs
CO1	PO2,PO5, PO11
CO2	PO2,PO4,PO5,PO11
CO3	PO2,PO5,PO11

Scheme of Examination:		
ONE question from Unit -1: 20 marks ONE question from Unit -2: 20 marks Viva-Voce: 10 marks.		
Suggested software: **1. Suggested Software Packages: Arena / Quest / Witness / Extend.** **Note: A minimum of 12 exercises are to be conducted.**		

Sub Title : Mini Project		
Sub Code : 18IMP68	No. of Credits:2 =0 : 0 : 2 (L-T-P)	No. of lecture hours/week :
Exam Duration :	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours :

Objective:
1. To equip students for making a subject presentation based on a thorough research review on any contemporary area of engineering and management fields.
2. Offering the student an opportunity to interact with faculty and peer group and to build the ability to making independent presentation.

Sl. No.	Syllabus	
1	**Procedure:** 1. A list of contemporary topics will be offered by the faculty of the department in the in the interlude period between 7th and 8th Semester. 2. Student can opt for topic of their own choice and indicate their option to the department at the beginning of the 8th semester. This component is also evaluated twice in the semester like Mini Project-CIE-1 and CIE-II. The final, marks shall be submitted to the exam section at the end of the semester.	

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	MC	18HS71/ 72	CMEP / OSHA	IM/ CV	2	--	--	03	50	50	100	2
2	PC	18IM71	Operations Management		2	2	--	03	50	50	100	4
3	PE	18IM72	Supply Chain Management		2	2	--	03	50	50	100	4
4	PE	18IM73 X	Professional Elective -3		3	--	--	03	50	50	100	3
5	PE	18IM74 X	Professional Elective -4		3	--	--	03	50	50	100	3
6	OE	18IM75 X	Open Elective - C		3	--	--	03	50	50	100	3
7	PC	18IML76	Statistics Laboratory		--	--	2	03	50	50	100	1
8	PC	18IML77	ERP & OR Laboratory		--	--	2	03	50	50	100	1
9	Project	18IMP78	Project Work Phase - 1		--	--	2	03	50	50	100	2
10	INT		Internship	(If not completed after VI semester examinations, it has to be carried out during the intervening vacations of VII and VIII semesters)				--	--	--	--	--
			TOTAL		15	4	6	27	450	450	900	23

VII SEMESTER

Note: PC: Professional Core, PE: Professional Elective, OE: Open Elective, INT: Internship, MC: Mandatory Course

Internship: All the students admitted to III year of BE have to undergo mandatory internship of 4 weeks during the vacations of VI and VII semesters and /or VII and VIII semesters. A SEE examination will be conducted during VIII semester and prescribed credits shall be added to VIII semester. Internship is considered as a head of passing and is considered for the award of degree. Those, who do not take-up/complete the internship will be declared as failed and have to complete during subsequent SEE examination after satisfy the internship requirements.

Electives			
Course code	Professional Electives - 3	Course code	Professional Electives - 4
18IM731	Project Management	18IM741	Design of Experiments
18IM732	Nanotechnology	18IM742	Strategic Management
18IM733	Human Resource Management	18IM743	Product Design and Manufacturing
18IM734	Database Management System	18IM744	Total Quality Management
18IM735	Technology Management	18IM745	Industrial Relations and Labour Welfare
CMEP: Cost Management of Engineering Projects, OSHA: Occupational Safety and Health Administration			

Course code	Open Elective -C
18IM751	Human Resource Management

VIII SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	MC	18HS81/82	CMEP / OSHA	IM/CV	2	--	--	03	50	50	100	2
2	Project	18IMP82	Project Work Phase - 2		--	--	2	03	50	50	100	10
3	Seminar	18IMS83	Technical Seminar		--	--	2	03	50	50	100	1
4	INT	18IMI84	Internship	(Completed during the intervening vacations of VI and VII semesters and /or VII and VIII semesters.)				03	50	50	100	2
				TOTAL	2	--	4	12	350	350	700	15

Note: PC: Professional Core, PE: Professional Elective, OE: Open Elective, INT: Internship, MC: Mandatory Course

Internship: Those, who have not pursued /completed the internship, will be declared as failed and have to complete during subsequent SEE examination after they satisfy the internship requirements.

CMEP: Cost Management of Engineering Projects OSHA: Occupational Safety and Health Administration

VII SEMESTER

Sub Title : COST MANAGEMENT OF ENGINEEREINGT PROJECTS		
Sub Code : 18HS71	**No. of Credits: 2**	**No. of lecture hours/week : 2**
Exam Duration : 2 hrs	**CIE + SEE = 50 + 50 =100**	**Total No. of Contact Hours : 26**

Objectives:
1. The objective of this course is to familiarize the student with the basic concepts, standards and practices of financial accounting.
2. The course is devoted to the basic financial statements, the analysis and recording of transactions, and the underlying concepts and procedures,
3. To carry out financial statement analysis and studying and preparation of cost sheet and budget.

Unit No.	Syllabus Content	No of Hours
1	**COST CONCEPTS:** Cost- meaning, Cost v/s Expense, meaning of loss, classification of cost, cost driver & cost unit. Overheads- Meaning and Classification of Overheads.	05
2	**COMPONENTS OF COSTING:** objectives of costing, elements of Costing. Preparation of Cost Sheet, Job Costing-Batch Costing, Process Costing and Activity Based Costing(Simple Problems on Activity Based Costing)	05
3	**INTRODUCTION TO ECONOMICS**: Meaning, Scope, Engineering Decision Makers, Nature and Significance of Economies, Laws of Demand - Concepts, Exceptions. Elasticity of Demand, Demand Forecasting - meaning, methods. Law of Supply - Concepts, Exception. Law of Diminishing Marginal Utility. .	05
4	**INDIAN AND GLOBAL BUSINESS ECONOMICS / MACRO ECONOMICS:** National Income Concept, Per Capita Income (PCI), Gross Domestic Product (GDP) – Concept, Components. Business Cycles – Meaning, Phases. Inflation-Types, Causes and Measurements-Consumer Price Index (CPI) and Whole Sale Price Index (WSI). SWOT Analysis of Indian Economy.	05
5	**FINANCIAL PLANNING:** Income Statement and Balance Sheet (Proforma), Indian Financial System Components. Capital Budgetiing – Phases, Techniques- Pay Back Period (PBP), Net present Value (NPV), Internal Rate of Returns (IRR). Projecting the Cash Flows – Components.	06

Outcomes:

Upon completion of the course, you will be able to:

1. Understand and apply fundamental accounting concepts, principles and conventions and to carry out journal entries and adjustments.
2. Prepare financial statements in accordance with generally accepted accounting principles.
3. Prepare and analyze a trial balance, cash flow statement, cost sheet variance analysis.
4. To prepare and analyze different types of budget
5. To explain the concepts of financial management, working capital and their applications to industries.

Mapping with POs:

Cos	Mapping with POs
CO1	PO1, PO4, PO5, PO7, PO8, PO11, PO12
CO2	PO1, PO3, PO5, PO6, PO11, PO12
CO3	PO1,PO3, PO5, PO11, PO12
CO4	PO1,PO3,PO5,PO10,PO11,PO12
CO5	PO3,PO5,PO8,PO11,PO12

TEXT BOOKS:

1 Cost Accouting- Principles and Practices, S P Jain K L Narang, Kalyani Publishers.
2 Enineering Economy, Riggs J.L., 5th Edition, Tata McGraw Hill, ISBN 0-07-058670-5.
3. Financial Management-Theory and practices, Shashi.K.Gupta, R K Sharma, Kalyani Publishers, ISBN 13, 978 9327235975.

REFERENCE BOOKS:

1 Cost Accounting, Khan M Y, 2nd Edition, 2000, Tata McGraw Hill, ISBN 007042248.
2 Engineering Economics, R.Paneerselvam, Eastern Economy Edition 2001, PHI, ISBN-81-203-1743-2Khan & Jain.
3. Financial Management, Khan & Jain, McGrawHill, India.

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2: Two assignments are evaluated for 5 marks.

Scheme of semester End Examination (SEE):

Units	Unit-1				Unit-2				Unit-3				
Qno.	1.a	1.b	O	2.a	3.a	3.b	O	4.a	5.a	5.b	O	6.a	6.b
Marks	05	05	R	10	05	05	R	10	05	05	R	05	05

Units	Unit-4					Unit- 5				
Qno.	7.a	7.b	O	8.a	8.b	9.a	9.b	O	10.a	10.b
Marks	05	05	R	05	05	05	05	R	05	05

Sub Title :	OPERATIONS MANAGEMENT	
Sub Code : 18IM71	No. of Credits: 4= 3: 2 : 0 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 39

Course Objectives :

1. Introduction of operations management and its importance in production operations and decision making.
2. To apply the knowledge of forecasting of production demand.
3. To study and apply the knowledge of Aggregate planning, MPS and MRP
4. To study and apply different scheduling methods to determine the idle times of the machines.

Unit No.	Syllabus Content	No of Hours
1	**OPERATIONS MANAGEMENT CONCEPTS**: Introduction, Historical development, The trend: Information and Non-manufacturing systems, Operations management, Factors affecting productivity, International dimensions of productivity, The environment of operations. Manufacturing and service systems. **OPERATIONS DECISION MAKING:** Introduction, Management as a science, Characteristics of decisions, and Framework for decision making, Decision methodology.	07
2	**FORECASTING DEMAND:** Forecasting objectives and uses, Forecasting variables, Opinion and Judgmental methods, Time series methods, Exponential smoothing, Regression and correlation methods, Application and control of forecasts.	07
3	**AGGREGATE PLANNING:** Introduction- planning and scheduling, Objectives of aggregate plan, Aggregate planning methods. **MASTER PRODUCTION SCHEDULING**: Master scheduling objectives, Master scheduling methods. Developing a master production schedule, Reconciling the MPS with sales operation. **RESOURCE PLANNING FOR SERVICE PROVIDERS**: Dependent demand for srvices, Bill of resources. Case study-ERP implementation by SAP	08
4	**MATERIAL AND CAPACITY REQUIREMENTS PLANNING:** Overview: MRP and CRP, MRP: Underlying concepts, System parameters, MRP logic, System refinements, Capacity management, CRP activities.	08
5	**SCHEDULING AND CONTROLLING PRODUCTION ACTIVITIES:** Introduction, PAC, Objectives and Data requirements, Scheduling strategy and guide lines, Scheduling methodology, priority control, capacity control. **SINGLE MACHINE SCHEDULING**: Concept, measures of performance, SPT rule, Weighted SPT rule, EDD rule, minimizing the number of tardy jobs. **FLOW -SHOP SCHEDULING**: Introduction, Johnson's rule for V jobs on 2 and 3 machines, CDS heuristic. **JOB-SHOP SHEDULING**: Types of schedules, Heuristic procedure, scheduling 2 jobs on 'm' machines.	09

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2: Two assignments are evaluated for 5 marks.

Course Outcomes:
1. Able to memorize history and describe importance of OM to take decision based on different models.
2. Able to calculate forecasted values using different forecasting methods
3. Will be able to operate the production activities on Aggregate planning, MPS and MRP
4. Will be able to operate the production activities based on priorities and capacity.
5. Will be able to select the best course of action for better production quality and quantity based on new methods of production.

Cos	Mapping with POs
CO1	PO2,PO4,PO5,PO6,PO9,PO10,PO12
CO2	PO1,PO2,PO3,PO4,PO5,PO8,PO9,PO12
CO3	PO2,PO3,PO4,PO5,PO7,PO8,PO9,PO11,PO12
CO4	PO1,PO2,PO3,PO4,PO6,PO9,PO10,PO11,PO12
CO5	PO2,PO3,PO4,PO5,PO8,PO9,PO12

TEXT BOOKS:
1. Operations Management- Monks, J.G., McGraw Hill; Second edition (8 January 2020)
2. Production and Operations Management- Pannerselvam. R, Prentice Hall India Learning Private Limited; 3rd edition (1 January 2012).
3. Production and Operations Management- Chary S.N, McGraw-Hill; Sixth edition (10 April 2019)

REFERENCE BOOKS:
4. Modern Production/ Operations Management- John Wiley & Sons Inc; 7th edition (1 January 1983)
5. Operations Management for Competitive Advantage by Chase and Jacobs, McGraw-Hill Education; 11th edition (16 May 2005)
6. B. Mahadevan   Operations Management: Theory and Practice, Pearson (1 January 2018)

Sub Title :	SUPPLY CHAIN MANAGEMENT	
Sub Code : 18IM72	No. of Credits: 4= 3 : 2 : 0 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 39

Objectives:

1. To describe the basic strategic frame work to analyze supply chain
2. To outline the concept of facility location and network design
3. To define about planning and managing inventories, sourcing, transportation.
4. To explain about the role of Information & Technology in Supply chain

Unit No.	Syllabus Content	No of Hours
1	**BUILDING A STRATEGIC FRAMEWORK TO ANALYSE SUPPLY CHAINS:** Supply chain stages and decision phases process view of a supply chain. Supply chain flows. Examples of supply chains. Competitive and supply chain strategies. Achieving strategic fit. Expanding strategic scope. Drivers of supply chain performance	08
2	**FACILITY LOCATION AND NETWORK DESIGN:** Models for facility location and capacity allocation. Impact of uncertainty on SCN –. Framework for structuring drivers – Inventory, Transportation, Facilities, Information. Obstacles to achieving fit. Case discussions. Distribution Networking – Role, Supply Chain Network (SCN) – Role, Factors, Framework for Design Decisions.	08
3	**PLANNING AND MANAGING INVENTORIES IN A SUPPLY CHAIN:** Review of inventory concepts. Trade promotions, Managing multi-echelon cycle inventory, safety inventory determination. Impact of supply uncertainty aggregation, Optimum level of product availability; importance factors. Managerial levers to improve supply chain profitability.	08
4	**SOURCING, TRANSPORTATION AND PRICING PRODUCTS:** Role of sourcing, supplier – scoring & assessment, selection and contracts. Design collaboration. Role of transportation, Factors affecting transportation decisions. Modes of transportation and their performance characteristics. Tailored transportation, International transportation.	08
5	**COORDINATION AND TECHNOLOGY IN THE SUPPLY CHAIN:** Co-ordination in a supply chain: Bullwhip effect. Obstacles to coordination. Managerial levers to achieve co-ordination, Building strategic partnerships. The role of IT supply Chain, The role of E-business in a supply chain.	07

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2: Two assignments are evaluated for 5 marks.

Outcomes :

1. Will be able to indicate the utilization of supply chain management systems and resources being effectively used in an organization
2. Will be able to identify capacity allocation facility location models, apply Managerial levers to improve supply chain profitability
3. Will be able to plan and manage inventories to improve supply chain profitability
4. Will be able to identify factors affecting transportation decisions and design transportation network to improve supply chain operations
5. Will be able to relate Bullwhip effect, role of information technology in supply Chain,

apply concepts of Reverse Logistics and recommend Implementation of Six Sigma in Supply Chains

Cos	Mapping with POs
CO1	PO3,PO5,PO8,PO10
CO2	PO3,PO5,PO,PO11
CO3	PO3,PO5,PO11
CO4	PO3,PO5,PO10,PO11
CO5	PO3,PO5,PO8,PO10,PO11

TEXT BOOK:
1. **Supply Chain Management** – 2001, Strategy, Planning & Operation. Sunil Chopra & Peter Meindl; Pearson Education Asia, ISBN: 81-7808-272-1.
2. **Supply Chain Management** – N Chandrashekaran , Oxford Higher education , 2013
3. **Supply Chain Engineering: Models and Applications,** A. Ravi Ravindran, Donald Warsing Jr., CRC Press; First edition (1 January 2019)

REFERENCE BOOKS:
1. **Supply Chain Redesign** – Transforming Supply Chains into Integrated Value Systems –Robert B Handfield, Ernest L Nichols, Jr., 2002, Pearson Education Inc, ISBN: 81-297-0113-8
2. **Modelling the Supply Chain** –Jeremy F Shapiro, Duxbury;, 2002, Thomson Defineing, ISBN 0-534-37363
3. **Designing & Managing the Supply Chain** –David Simchi Levi, Philip Kaminsky & Edith Simchi Levi;; Mc Graw Hill

Sub Title : PROJECT MANAGEMENT		
Sub Code : 18IM731	No. of Credits: 3= 3 : 0 : 0 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 39

Objectives:
1. To introduce concepts of project management with a strong emphasis on issues and problems associated with delivering successful projects.   2. To Define and study the project planning and estimating its cost.   3. To determine the elapsed time and idle time through project scheduling   4. To determine the critical path for the projects through project management tools and techniques.

Unit No.	Syllabus Content	No of Hours
1	**CONCEPTS OF PROJECT MANAGEMENT:** Concepts of a Project, Categories of projects, Phases of project life cycle, Roles and responsibility of project leader, tools and techniques for project management.	06
2	**PROJECT PLANNING AND INTEGRATION**: Feasibility report phased planning, Project planning steps, Preparation of cost estimation. **Project Integration Management:** Develop project charter, develop project management plan, direct & manage project work, monitor & control project work, perform integrated change control, close project or phase.	07
3	**ORGANIZING AND STAFFING THE PROJECT TEAM:** Authorities and responsibilities of project manager, Project organization and types of accountability in project execution, controls. Tendering and selection of contractors.	06
4	**PROJECT SCOPE MANAGEMENT**: Project scope management, collect requirements, define scope, create WBS, validate scope, and control scope. **Project Risk Management** : Plan risk management, identify risk, Perform qualitative risk analysis, perform quantitative risk analysis, plan risk resources, control risk	10
5	**PROJECT TIME MANGEMENT**: Plan schedule management, define activities, sequence activities, estimate activity resources, estimate activity durations, develop schedule, control schedule. Exercises on PERT/CPM. Case studies on project management.	10

Outcomes :

Upon successful completion of this course, the student will be able to:
1. Apply the concept, tools and techniques for managing large projects.
2. Construct project plans for different types of organizations.
3. Evaluate a project to develop the scope of work, provide accurate cost estimates and to plan the various activities;
4. Will be able to explain on resource and time planning, controls, communication mechanisms, reviews and other project management tools.
5. Analyze and evaluate risks in large and complex project environments

Cos	Mapping with POs
CO1	PO3,PO4,PO5,PO7,PO8,PO9,PO11
CO2	PO3,PO4,PO5,PO7,PO8,PO9,PO11,PO12
CO3	PO3,PO4,PO5,PO6,PO11
CO4	PO4,PO5,PO11
CO5	PO4,PO10,PO11,PO12

TEXT BOOKS:
1. **Project Management a System approach to Planning Scheduling & Controlling** - Harold Kerzner, CBS Publishers and Distributors. 2016.
2. **Project Execution Plan: Plan for project Execution interaction** - Chaudhry S.2016
3. **Project Management Institute, "A guide to the project management body of knowledge (PMBOK Guide)".**5th edition, 2013, ISBN: 978-1-935589-67-9. 2015

REFERENCES BOOKS:
1. **Project Planning Analysis selection financing Implementation and Review-** Tata Mc Graw Hill Publication, 7th edition 2010, Prasana Chandra.
2. **Project Management** – Beningston Lawrence McGraw Hill 1970.
3. **A Management Guide to PERT and CPM**, WEIST & LeVY Eastern Economy of PH 2002.
4. **PERT & CPM**.-L.S.Srinnath, Affiliated East West Press Pvt. Ltd. 2002.
5. **Project planning analysis selection implementation & review** Prasanna Chandra, ISBNO-07-462049-5   2002.
6. **Performing and Controlling Project,-**Angus, Planning, 3rd End, Person Education, ISBN:812970020.2001
7. **Project planning scheduling & control**, James P.Lawis, Meo Publishing Company 2001.
8. **Project Management -**Bhavesh M.Patel, Vikas Publishing House, ISBN 81-259-0777-7 2002

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2: Two assignments are evaluated for 5 marks.

Sub Title : HUMAN RESOURCE MANAGEMENT		
Sub Code : 18IM733	**No. of Credits: 3= 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hrs	**CIE + SEE = 50 + 50 =100**	**Total No. of Contact Hours : 39**

Objectives :
1. An ability to evaluate and apply theories of social science disciplines to workplace issues
2. Use of HRM functional capabilities to select, develop, and motivate workers
3. To develop strong analytical, communication, and decision making skills.

Unit No.	Syllabus Content	No of Hours
1	**INTRODUCTION:** Introduction, meaning, nature, scope of HRM. Importance and Evolution of the concept of HRM. Major functions of HRM, Principles of HRM, Organization of Personnel department, Role of HR Manager. **JOB ANALYSIS:** Meaning, process of job analysis, methods of collecting job analysis data, Job Description and Specification, Role Analysis	**08**
2	**HUMAN RESOURCE PLANNING**: Uses and benefits, Man Power Inventory, Man Power Forecasting, Methods of Man Power Forecasting.. **RECRUITMENT:** Sources of Man power, Advertisement, Short Listing of Candidates calling Candidates for selection Process.	**08**
3	**SELECTION:** Selection procedure – Written Test, Group Discussion. Interview – Different methods, advantages and Limitations, Psychological testing – Advantages and limitations, Induction procedure, transfers, promotion exit interview, (Tutorial on written test, Group Discussion, Interviews)	**08**
4	**TRAINING AND DEVELOPMENT:** Identification of Training needs, Training Evaluation, Training Budget, Executive Development – Different Approaches, Non-executive development – Different methods. **PERFORMANCE APPRAISAL:** Components (all round performance appraisal), Methods, Advantages and limitations of different methods, Personal Counselling based on Annual Confidential Reports.	**08**
5	**INDUSTRIAL RELATIONS:** Meaning Characteristics of Industrial Relations, Factors of Industrial, Relations, the Three Actors of Industrial Relations, Importance of Harmonious Industrial Relations, Objectives of Industrial Relations, Functions of Industrial Relations, Code of Industrial Relations, Conditions for Congenial Industrial Relations.	**07**

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2: Two assignments are evaluated for 5 marks.

Outcomes:
1. Apply the knowledge and skills needed to effectively manage human resources
2. Examine current issues, trends, practices, and processes in HRM
3. Compare the common methods for recruiting and selecting human resource

4. Contribute to employee performance management and organizational effectiveness
5. Evaluate employee orientation, training, and development programs.

Cos	Mapping with POs
CO1	PO2,PO8,PO12
CO2	PO3,PO5,PO11
CO3	PO2,PO8,PO12
CO4	PO3,PO5,PO11
CO5	PO2,PO8,PO11,PO12

TEXT BOOKS
1. **Human Resources Management** – Dr. K Ashwathappa, Tata McGraw Hill, Edition 2016
2. **Essentials of HRM and industrial relations** – Subbarao,P , Himalaya publishing house 2016

REFERENCES BOOKS

1 **Management of Human Resources** – CB Mamoria – Himalaya   Publication House, 2003

2 **Personnel / Human resource Management** – Decenoz and robbins PHI, 2002
3 **Industrial Acts** by Jain, 2004
4 **Industrial Relations** – Arun Monappa – TMH, ISBN – 0-07-451710-8

Sub Title : STRATEGIC MANAGEMENT		
Sub Code : 18IM742	No. of Credits: 3= 3 : 0 : 0 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 39

Objectives:
1. To provide an integrative framework that will allow students to blend knowledge from other courses into a comprehensive determining of competitive advantage.
2. To provide a basic determining of the nature and dynamics of the strategy formulation and implementation processes.
3. To encourage students to think critically and strategically.

Unit No.	Syllabus Content	No of Hours
1	**STRATEGIC MANAGEMENT INTRODUCTION:** Definition- Levels of strategy- Roles of Strategist- Strategic Management Process benefits and limitations. Mission -Objectives -Social responsibilities.	**07**
2	**STRATEGY FORMULATION:** Strategic Thinking, SWOT analysis- Techniques for environmental analysis- TOWS matrix, Balanced Score Card, Steps in strategy implementation -formulation of SBU strategy. Leadership implementation, communicating the strategy:- Annual and Functional objectives- Development of policies- Organizational Implementation- Evaluation and control. Reward system.	**10**
3	**STRATEGY AND STRUCTURE:** Strategy- Structure relationship. Organizational restructuring and Transformation, Principles of Organization. Strategic control- Premise and Implementation control strategic Surveillance special alert control- Operational control - Steps in Operational Control, Types of Operational control.	**06**
4	**PORTFOLIO STRATEGY:** Business portfolio analysis- BCG matrix, GE multi matrix, an evaluation of Portfolio models - factors influencing portfolio strategy.	**06**
5	**COMPETITIVE ANALYSIS AND STRATEGIES:** Structural analysis of industries threat of entry rivalry among existing competitors, threat of substitutes; Bargaining power of suppliers; structural analysis and competitive strategy - competitor analysis value chain. **BUSINESS GROWTH:** Reasons, Risks and indicators of Business growth, Growth Strategies- Intensive, Growth Strategies, Integrative Growth Strategies, Diversification, External Growth Strategies.	**10**

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2: Two assignments are evaluated for 5 marks.

Outcomes:
1. Articulate a vision that gives meaning to all the firm's stakeholders of the firm's objectives
2. Formulate a strategic plan that operationalizes the goals and objectives of the firm
3. Implement a strategic plan that takes into account the functional areas of business

4. Evaluate and revise programs and procedures in order to achieve organizational goals
5. Analyse dynamics in competitive rivalry including competitive action and response, for acting both proactively and defensively.

Cos	Mapping with POs
CO1	PO4,PO7,PO8
CO2	PO6,PO7,PO9
CO3	PO6,PO7,PO9,PO11
CO4	PO7,PO10,PO11
CO5	PO7,PO11,PO12

TEXT BOOKS:
1. **Strategic Management** - Francis Cherunilam, Himalya Publishers, 4th Edition, 2016
2. **Strategic Management**, Azhar Kazmi, Adela Kazmi, McGraw Hill, Fifth Edition, 2020

REFERENCE BOOKS:
1. **Business Policy and Strategic Management** -P Subba Rao, Himalya Publishers 1st Edition, 2011
2. **The Competitive Strategy: Techniques for Analyzing Industries and Competitors,** Michael Porter, Simon & Schuster, 2004
3. **Strategic Management** – Robert A Pitts and David Lei, South Western Publishing, 4th Edition, 2006

Sub Title : TOTAL QUALITY MANAGEMENT		
Sub Code: 18IM744	No. of Credits:3 =3 : 0 : 0 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hours	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 39

Course objectives:
1. Develop and determining the necessary information and skills needed to manage, control and improve quality practices in the organization through TQM Philosophy.
2. Apply the improvement methodologies for problem solving in organizations.
3. Demonstrate the importance of TQM tools required for problem solving processes.
4. Demonstrate the quality Management standards for the present industrial scenario.

Unit No.	Syllabus Content	No of Hours
1	**Introdction:** TQM introduction- Historical review- Obstacles- Benefits of TQM, Elements of TQM- Principles of TQM- Concepts of TQM- Fundamental Characteristics of TQM- TQM routine duties and awareness- Quality in Manufacturing and Service Systems.	6
2	**Principles and Philosophies of Total Quality Management -**Gurus of TQM and their Contribution-Deming's Management Philosophy- 14 points for management and PDCA cycle – Juran's Philosophy, Juran-quality trilogy, Imai,s Kaizen and innovation, The Crosby Philosophy- quality treatment and and 14 points. Taguchi Loss Function. Leadership: Definition, characteristics of quality leaders, leadership concept.	8
3	**Quality Evolution,Customer Satisfaction and Employee Involvement** Evolution of Quality Concepts **-**Four Fitness of quality and Weakness**-**Evolution of Quality Methodology- Evolution of Company Integration- Quality of Conformance versus Quality of Design-From Deviations to Weakness to Opportunities- Aware of Four Finesses-Future Finesses- Four Revolutions of Management Thinking and Four Levels of Practice of TQM. A Customer Focus – Fact-Based Management– Continuous Improvement – Teamwork and Participation. Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement,	10
4	**TQM Tools and Techniques** 7 Basic tools of TQM –Nominal Group Technique – Quality Circles – Flow Charts – Pareto Analysis– Poka Yoke (Mistake Proofing), Process, Quality Function Deployment (QFD), House of Quality, QFD Process, Benefits, Total Productive Maintenance (TPM) Concept, Improvement Needs, FMEA, Stages of FMEA, cybernetic Analysis, Six Sigma Concepts and Methodology (Introducion ascpets only)	10
5	**Quality Management Systems (Introductory Aspects Only**) a. The ISO 9001:2000 Quality Management System Standard b. The ISO 14001:2004 Environmental Management System Standard c. ISO 27001:2005 Information Security Management System d. ISO / TS16949:2002 for Automobile Industry e. CMMI Fundamentals and Concepts and f. Certification process.	05

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2: Two assignments are evaluated for 5 marks.

Outcomes:
1. Ability to Determine the TQM philosophies in organization and concepts of leadership.
2. To Define and Determine the evolution of quality concepts, methods and customer satisfaction.
3. To gain the knowledge of quality control tools in TQM.
4. To determine the concepts of reliability and quality failure.
5. To Determine the fundamental concepts of quality management systems

Cos	Mapping with POs
CO1	PO6,PO7,PO11
CO2	PO5,PO8,PO10,PO12
CO3	PO4,PO5,PO6,PO7
CO4	PO4,PO5,PO6,PO7
CO5	PO4,PO5,PO6,PO7

TEXT BOOKS:
1. A New American TQM Four Practical Revolutions in Management‖ –Shoji Shiba, Alan Graham and David Walden,– Productivity Press, Portlans (USA) , 1993
2. Management for Total Quality" –N Logothetis- Prentice Hall of India, New Delhi, 1994.
3.Dale H. Besterfield "Total Quality Management ''(3rd Edition) 3rd Edition Prentice Hall Publications

REFERENCE BOOK:
 1. The Quality Improvement Hand Book, -Roger C Swanson, Publisher Vanity Books International, New Delhi, 1995.
2. Total Quality Management – Kesavan R – I K International Publishing house Pvt. Ltd, 2008

E BOOKS:
1. http://psbm.org/Ebooks/Total%20Quality.pdf
2. http://www.mescenter.ru/images/abook_file/Total_Quality_Management_and_Six_Sigma.pdf
MOOCs:
3. https://www.mooc-list.com/course/fundamentals-six-sigma-quality-engineering-andmanagement-edx?static=true

Sub Title : STATISTICS LAB		
Sub Code : 18IML76	No. of Credits: 1= 0 : 0 : 1 (L-T-P)	No. of lecture hours/week : 3
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 36

Objective:
1. Explain and apply the basic fundamental concepts of Statistics to engineering problems and the importance of Data summary and Display.
2. Application of probability distributions to various manufacturing problems.
3. Application of hypothesis to random experiments of manufacturing processes.
4. Test the statistical parameters by regression and correlation.
5. Design an engineering problem as random experiment to solve and test for variance.

Unit No.	Syllabus content	Hrs
1	1. Determining basic statistics (Mean, Median, Mode, and Standard deviation, Range, Harmonic Mean, Geometric Mean, Variance and Coefficient of variation) for the given quality characteristic and interpreting it. 2. Representing the data in graphical forms: Line graph, Bar graph, Pie Chart, Stem and leaf plot, Histogram, Pareto Chart. 3. Construction of Scatter diagram for the given variables and interpretation of different forms of scatter diagrams. 4. Conduction of regression analysis for two variables using least squares method and fitting a straight line. 5. Conduction of multiple regression analysis for the given variables.	15
2	1. Interval estimation and hypothesis testing on mean of a normal distribution. 2. Interval estimation and hypothesis testing on difference in means of two normal distributions. 3. Hypothesis testing on variance of a normal population. 4. Hypothesis testing on variances of two normal populations. 5. Hypothesis testing on a single population proportion. 6. Fitting an appropriate distribution (normal distribution) for the given variable quality characteristic 7.Conduct One way and two way ANOVA Analysis for the given problem 8.Design of experiments using CATAPULT	21

Outcome:
By the end of the course students will be able to
1. Apply the statistical data in the form of Tabular and Graphical display.
2. Identify discrete type of probability and solve the various engineering problems.
3. Solve Continuous type of probability and solve the various engineering problems
4. Estimate the hypothesis and give inference to random experiments.
5. Evaluate the statistical parameters by estimation.

Cos	Mapping with POs
CO1	PO1,PO2,PO3,PO6,PO7,PO11,PO12
CO2	PO1,PO2,PO3,PO6,PO7,PO11,PO12
CO3	PO1,PO2,PO3,PO6,PO7,PO11,PO12
CO4	PO1,PO2,PO3,PO6,PO7,PO11,PO12

Scheme of Examination:
ONE question from Unit -1: 15 marks
ONE question from Unit -1: 25 marks
Viva-Voce   : 10 marks

Suggested software:
1. Statistical Packages : SYSTAT / MINITAB / SPSS/ R- studio and such others

Sub Title : ENTERPRISE RESOURCE PLANNING and OR LAB		
Sub Code : 18IML77	No. of Credits: 1= 0 : 0 : 1 (L-T-P)	No. of lecture hours/week : 2
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 13

Objective:
1. To provide an determining of the managerial issues involved in the design and implementation of Enterprise Resource Planning Systems 2. Knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry; 3. Use of statistical tools for data analysis.

Unit No.	Syllabus Content	No of Hours
1	Creating Item Master for various Engineering Designs Creating Supplier Master for Items Creating customer Master for Items Generating Bill of Materials for Various Engineering Designs Creating Purchase order for Items Creating Work order / job card for Items and Dispatch Instruction for Items	24
2	Optimization problems using OR packages Linear programming Transportation problem Assignment problem PERT/CPM	12

Course Outcomes:
CO1: Develop the skills and knowledge to support the implementation and maintenance of Enterprise Resource Planning (ERP) systems. CO2: Formulate and solve Linear programming problems, transportation and assignment Problems

Cos	Mapping with POs
CO1	PO3,PO5,PO6,PO11
CO2	PO2,PO4,PO5

Scheme of Examination:
ONE question from Unit -1   : 30 marks ONE question from Unit -2   : 10 marks   Viva-Voce: 10 marks.
Suggested Software Packages
1. Statistical Packages : SYSTAT / MINITAB / SPSS and such others 2. ERP Packages : SIXTH SENSE / RAMCO / MAARSMAN / CIMAS / UNISOFT 3. OR Packages : Lindo / Lingo / Storm

Sub Title : Project Work Phase II		
Sub Code : 18IMP82	No. of Credits: 10= 0: 0: 2 (L-T-P)	No. of lecture hours/week : 2
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 32

Sl. No.	Syllabus
1	Phase– 02: 10 Credits in VII Semester.
2	Student shall complete the project work well in time and shall be assessed by the guide and the departmental Project Review Committee for 50 marks (CIE). Later project viva-voce shall be conducted by the exam section and both internal and external examiners for 50 marks do evaluation.

Sub Title : Technical Seminar		
Sub Code : 18IMS83	**No. of Credits: 2= 0 : 0 : 2(L-T-P)**	**No. of lecture hours/week : 2**
Exam Duration: 3 hr.	**CIE + SEE = 50 + 50 =100**	**Total No. of Contact Hours : 32**

Objective:
1. To equip students for making a subject presentation based on a thorough research review on any contemporary area of engineering and management fields.   2. Offering the student an opportunity to interact with faculty and peer group and to build the ability to making independent presentation.

Sl. No.	Syllabus
1	**Procedure:** 1. A list of contemporary topics will be offered by the faculty of the department in the interlude period between 7th and 8th Semester. 2. Students can opt for topic of their own choice and indicate their option to the department at the beginning of the 8th semester. This component is also evaluated twice in the semester. The final marks shall be submitted to the exam section at the end of the semester.

Cos	Mapping with POs
CO1	PO2,PO8,PO12
CO2	PO3,PO5,PO11
CO3	PO2,PO8,PO12
CO4	PO3,PO5,PO11
CO5	PO2,PO8,PO11,PO12

Sub Title : Internship		
Sub Code : 18IMI84	No. of Credits: 2= 0 : 0 : 2(L-T-P)	No. of lecture hours/week : 2
Exam Duration: 3 hr.	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 32

Sl. No.	Syllabus
1	**Internship:** All the students admitted to III year of BE shall undergo mandatory internship program for a duration for 4 weeks either during the vacation period of IV& V semester or during VI and VII. A SEE examination will be conducted during VIII semester and prescribed credits shall be added to VIII semester. Students who do not take-up/complete the internship will be declared as failed and have to complete during subsequent SEE examination after satisfying the internship requirements.

Sub Title : Project Work Phase II		
Sub Code : 18IMP82	No. of Credits: 10= 0: 0: 2 (L-T-P)	No. of lecture hours/week : 2
Exam Duration : 3 hrs	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 32

Sl. No.	Syllabus
1	Phase– 02: 10 Credits in VII Semester.
2	Student shall complete the project work well in time and shall be assessed by the guide and the departmental Project Review Committee for 50 marks (CIE). Later project viva-voce shall be conducted by the exam section and both internal and external examiners for 50 marks do evaluation.

Sub Title : Technical Seminar		
Sub Code : 18IMS83	No. of Credits: 2= 0 : 0 : 2(L-T-P)	No. of lecture hours/week : 2
Exam Duration: 3 hr.	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 32

Objective:
3. To equip students for making a subject presentation based on a thorough research review on any contemporary area of engineering and management fields.
4. Offering the student an opportunity to interact with faculty and peer group and to build the ability to making independent presentation.

Sl. No.	Syllabus
1	**Procedure:** 3. A list of contemporary topics will be offered by the faculty of the department in the interlude period between 7th and 8th Semester. 4. Students can opt for topic of their own choice and indicate their option to the department at the beginning of the 8th semester. This component is also evaluated twice in the semester. The final marks shall be submitted to the exam section at the end of the semester.

Cos	Mapping with POs
CO1	PO2,PO8,PO12
CO2	PO3,PO5,PO11
CO3	PO2,PO8,PO12
CO4	PO3,PO5,PO11
CO5	PO2,PO8,PO11,PO12

Sub Title : Internship		
Sub Code : 18IMI84	No. of Credits: 2= 0 : 0 : 2(L-T-P)	No. of lecture hours/week : 2
Exam Duration: 3 hr.	CIE + SEE = 50 + 50 =100	Total No. of Contact Hours : 32

Sl. No.	Syllabus
1	**Internship:** All the students admitted to III year of BE shall undergo mandatory internship program for a duration for 4 weeks either during the vacation period of IV& V semester or during VI and VII. A SEE examination will be conducted during VIII semester and prescribed credits shall be added to VIII semester. Students who do not take-up/complete the internship will be declared as failed and have to complete during subsequent SEE examination after satisfying the internship requirements.