GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
Teaching and Examination Scheme for B. Tech. (Mechanical Engineering 4 Year Course)
For students of Session 2011-12 batches

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
Teaching and Examination Scheme for B.Tech. (Mechanical Engineering 4 Year Course)
For students of Session 2011-12 batches

Year: II **Semester: III**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	ME 201	Fundamentals of Thermodynamics	3	3	-	-	3	30	70
2	ME 203	Mechanics of Solid	4	3	1	-	3	30	70
3	ME 205	Material Science	3	3	-	-	3	30	70
4	ME 207	Elements of Machine Design	4	3	1	-	3	30	70
5	ME 209	Object Oriented Programming	3	3	-	-	3	30	70
6	MA 205	Advance Engg. Mathematics-III	4	3	1	-	3	30	70
		B. Practicals / Sessionals							
7	ME 251	Thermal Engg. Lab. – I	2	-	-	2	3	60	40
8	ME 253	Strength of Material Lab.	2	-	-	2	3	60	40
9	ME 255	Material Science Lab.	2	--	-	2	3	60	40
10	ME 257	Machine Drawing Lab	3	-	-	3	3	60	40
11	ME 259	Computer Programming lab	2	-	-	2	3	60	40
		C. Discipline and Extra Curricular Activities							
12	DE 201	Discipline and Extra Curricular Activities – III	2					100	
		Total	**34**	**18**	**2**	**11**			
		Total Teaching Load		**31**					

Year: II **Semester: IV**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	ME 202	Machine Design	3	3	-		3	30	70
2	ME 204	Industrial Engg. – I	3	3	-		3	30	70
3	ME 206	Production Process – I	3	3	-		3	30	70
4	ME 208	Fluid Mechanics	4	3	1		3	30	70
5	ME 210	Internal Combustion Engines	3	3	-		3	30	70
6	ME 212	Instrumentation & Control	4	3	1		3	30	70
		B. Practicals / Sessionals							
7	ME 252	Machine Design Lab.	3	0		3	3	60	40
8	ME 256	Production Process – I Lab	3	0		3	3	60	40
9	ME 258	Fluid Mechanics Lab.	2	0		2	3	60	40
10	ME 260	Internal Combustion Lab	2	0		2	3	60	40
11	ME 262	Instrumentation & Control Lab	2	0		2	3	60	40
		C. Discipline and Extra Curricular Activities							
12	DE 202	Discipline and Extra Curricular Activities – IV	2					100	
		Total	**34**	**18**	**2**	**12**			
		Total Teaching Load		**32**					

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
Teaching and Examination Scheme for B.Tech. (Mechanical Engineering 4 Year Course)
For students of Session 2011-12 batches

Year: III **Semester: V**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	ME 301	Production Process – II	3	3	-		3	30	70
2	ME 303	Fluid Machines	3	3	-		3	30	70
3	ME 305	Dynamics of Machine – I	4	3	1		3	30	70
4	ME 307	Fundamental of Aerodynamics	3	3	-		3	30	70
5	ME 309	Mechanical Vibration & Noise Engg.	4	3	1		3	30	70
6	ME 311	Facility Planning & Material Handling	3	3	-		3	30	70
		B. Practicals / Sessionals							
7	ME 351	Production Process Lab – II	3	0		3	3	60	40
8	ME 353	Fluid Machine Lab	2	0		2	3	60	40
9	ME 355	Dynamics of Machine Lab – I	3	0		3	3	60	40
10	ME 359	Mechanical Vibration Lab	2	0		2	3	60	40
		C. Discipline and Extra Curricular Activities							
11	DE 301	Discipline and Extra Curricular Activities – V	2					100	
		Total	**32**	**18**	**2**	**12**			
		Total Teaching Load		**32**					

Year: III **Semester: VI**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	ME 302	Dynamics of Machine – II	4	3	1		3	30	70
2	ME 304	Heat & Mass Transfer	3	3	0		3	30	70
3	ME 306	Steam Turbine & Steam Power Plant	4	3	1		3	30	70
4	ME 308	Automobile Engg.	3	3	0		3	30	70
5	ME 310	Industrial Engg. – II	3	3	0		3	30	70
6		**Elective I (any one of the following)**	3	3	0		3	30	70
	ME 312	Mechatronics							
	ME 314	Cryogenic Engineering							
	ME 316	Welding Engineering							
		B. Practicals / Sessionals							
7	ME 352	Dynamics of Machine – II Lab	3	0		3	3	60	40
8	ME 354	Heat & Mass Transfer Lab	2	0		2	3	60	40
9	ME 358	Automobile Lab	2	0		2	3	60	40
10	ME 360	Industrial Engg. Lab.	3	0		3	3	60	40
		C. Discipline and Extra Curricular Activities							
11	DE 302	Discipline and Extra Curricular Activities – VI	2					100	
		Total	**34**	**18**	**2**	**12**			
		Total Teaching Load		**32**					

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Teaching and Examination Scheme for B.Tech. (Mechanical Engineering 4 Year Course)
For students of Session 2011-12 batches

Year: IV **Semester: VII**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	ME 401	Computer Aided Design	3	3	0		3	30	70
2	ME 403	Refrigeration and Air-Conditioning	4	3	1		3	30	70
3	ME 405	Operation Research	4	3	1		3	30	70
4	ME 407	Reliability and Maintenance	3	3	0		3	30	70
5	ME 409	Gas Turbine & Jet Propulsion	3	3	0		3	30	70
6		**Elective II (any one of the following)**	3	3	0		3	30	70
	ME 411	Finite Element Analysis							
	ME 413	Computational fluid flow and heat transfer							
	BM 449	Entrepreneurship Development							
		B. Practicals / Sessionals							
7	ME 451	CAD Lab	2	0		2	3	60	40
8	ME 453	RAC Lab	2	0		2	3	60	40
9	PT 401	Training Seminar	3	0			3	60	40
10	PE 401	Major Project (Stage I)	3	0		3	3	60	40
		C. Discipline and Extra Curricular Activities							
11	DE 401	Discipline and Extra Curricular Activities – VII	2					100	
		Total	**32**	**18**	**2**	**7**			
		Total Teaching Load		**27**					

Year: IV **Semester: VIII**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	ME 402	Computer Aided Manufacturing	3	3	0		3	30	70
2	ME 404	Power Plant Engg.	3	3	0		3	30	70
3	ME 406	Production Process – III	3	3	0		3	30	70
4		**Elective III (any one of the following)**	3	3	0		3	30	70
	ME 408	Product Design and Development							
	ME 607	Machine Tool Design							
	ME 412	Operation Management							
		B. Practicals / Sessionals							
5	ME 452	CAM Lab	3	0		3		60	40
6	ME 456	Production Process – III Lab	3	0		3		60	40
7	SM 402	Seminar	3	0		3		60	40
8	PE 402	Major Project	6	0		3		60	40
		C. Discipline and Extra Curricular Activities							
9	DE 402	Discipline and Extra Curricular Activities – VIII	2					100	
		Total	**29**	**12**	**0**	**12**			
		Total Teaching Load		**24**					

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
Teaching and Examination Scheme for B.Tech. (Mechatronics 4 Year Course)
EFFECTIVE FROM ACADEMIC SESSION 2012-13

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
Teaching and Examination Scheme for B.Tech. (Mechatronics 4 Year Course)
EFFECTIVE FROM ACADEMIC SESSION 2012-13

Year: II **Semester: III**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	MA - 201	Integral Transforms & Complex Analysis	4	3	1	0	3	30	70
2	ME – 201	Fundaments of Thermodynamics	4	3	1	0	3	30	70
3	ME – 205	Material Sciences	3	3	0	0	3	30	70
4	ME – 206	Production Process I	3	3	0	0	3	30	70
5	EC – 201	EDC	4	3	1	0	3	30	70
6	ME - 212	Instrumentation and Control	3	3	0	0	3	30	70
		B. Practicals / Sessionals							
7	ME – 256	Production Process I Lab	2	0	0	3	3	60	40
8	ME – 255	Material Science Lab	1	0	0	2	3	60	40
9	ME – 261	Machine Drawing Lab	2	0	0	3	3	60	40
10	EC – 253	EDC Lab	2	0	0	3	3	60	40
		C. Discipline and Extra Curricular Activities							
11	DE-201	Discipline and **Extra Curricular Activities-III**	2					100	
		Total	30	18	3	11			
		Total Teaching Load		32					

Year: II **Semester: IV**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	ME - 203	Mechanics of Solid	4	3	1	0	3	30	70
2	ME- 302	Dynamics of Machine - II	4	3	1	0	3	30	70
3	ME - 405	Operation Research	3	3	0	0	3	30	70
4	EC – 302	Microprocessor	4	3	1	0	3	30	70
5	EC – 204	Digital Hardware Design	4	3	1	0	3	30	70
6		**Elective I**	3	3	0	0	3	30	70
	CP – 216	Object Oriented Programming (core java)	-	-	-	-	-	-	-
	CP – 605	Information Security System	-	-	-	-	-	-	-
	CP – 316	Multimedia	-	-	-	-	-	-	-
		B. Practicals / Sessionals							
7	ME - 253	Strength of Material Lab	2	-	-	3	3	60	40
8	ME-352	Dynamics Of Machine Lab	2	-	-	3	3	60	40
9	ME - 251	Thermal Engg. Lab	1	-	-	2	3	60	40
10	EC – 254	Digital Hardware Design lab	1	-	-	2	3	60	40
		C. Discipline and Extra Curricular Activities							
11	DE-202	Discipline and Extra Curricular Activities-IV	2					100	
		Total	30	18	4	10			
		Total Teaching Load		32					

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
Teaching and Examination Scheme for B.Tech. (Mechatronics 4 Year Course)
EFFECTIVE FROM ACADEMIC SESSION 2013-14

Year: III **Semester: V**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	ME -202	Machine Design	4	3	1	0	3	30	70
2	ME-401	Computer Aided Design	3	3	0	0	3	30	70
3	ME- 303	Fluid Machines	4	3	1	0	3	30	70
4	ME - 301	Production Process II	3	3	0	0	3	30	70
5	EE - 205	Electro Mechanical Energy Conversion I	3	3	0	0	3	30	70
6		**Elective**	3	3	0	0	3	30	70
	EC - 311	Signal and Networking	-	-	-	-	-	-	-
	ME - 407	Reliability and Maintenance Engg.	-	-	-	-	-	-	-
	MA – 301	Computer Oriented Mathematical Methods	-	-	-	-	-	-	-
		B. Practicals / Sessionals							
8	ME – 451	CAD Lab	2	0	0	3	3	60	40
9	EC – 354	Microprocessor Lab	2	0	0	3	3	60	40
10	EE - 253	Electro Mechanical Energy Conversion I Lab	2	0	0	3	3	60	40
11	ME – 353	Fluid Machines Lab	2	0	0	3	3	60	40
		C. Discipline and Extra Curricular Activities							
12	DE-301	Discipline and Extra Curricular Activities-V	2					100	
		Total	30	18	2	12			
		Total Teaching Load			32				

Year: III **Semester: VI**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	EC – 305	Linear Integrated Circuit	4	3	1	0	3	30	70
2	EC – 208	Telecommunication Engg.	3	3	0	0	3	30	70
3	ME - 318	Automobile and IC Engine	3	3	0	0	3	30	70
4	EC – 405	Microcontrollers & Embedded System	4	3	1	0	3	30	70
5	EC – 312	Communication System	4	3	1	0	3	30	70
6		**Elective**	3	3	0	0	3	30	70
	CP – 415	Neural Networks	-	-	-	-	-	-	-
	CP – 307	Computer Graphics	-	-	-	-	-	-	-
	EE – 310	Industrial Electronics	-	-	-	-	-	-	-
		B. Practicals / Sessionals							
7	PE 302	Mini project	1	0	0	2	3	60	40
8	ME - 362	Automobile and IC engine	2	0	0	3	3	60	40
9	ME - 458	CAD/CAM Lab	2	0	0	3	3	60	40
10	EC – 453	Microcontroller Lab	2	0	0	3	3	60	40
		C. Discipline and Extra Curricular Activities							
11	DE-302	Discipline and Extra Curricular Activities-VI	2					100	
		Total	30	18	3	11			
		Total Teaching Load			32				

Note:- Industrial training for 30 days after 6th Semester Exams is compulsory.

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
Teaching and Examination Scheme for B.Tech. (Mechatronics 4 Year Course)
EFFECTIVE FROM ACADEMIC SESSION 2014-15

Year: IV **Semester: VII**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	ME – 415	Fundamental Of Robotics	3	3	0	0	3	30	70
2	EC – 406	VLSI Design	4	3	1	0	3	30	70
3	EC – 613	Wireless Sensor Networks	3	3	0	0	3	30	70
4		**Elective I**	3	3	0	0	3	30	70
	ME - 518	Industrial Automation							
	ME - 520	Supply Chain Management							
5		**Elective II**	3	3	0	0	3	30	70
	EC – 601	Embedded System Design							
	EC – 401	Antenna & Wave Propagation							
6	EC – 404	Digital Signal Processing	4	3	1	0	0	30	70
		B. Practicals / Sessionals							
7	EC – 454	Signal Processing Lab	2	0	0	3	3	60	40
8	EC – 353	Electronic Engineering Design Lab	2	0	0	3	3	60	40
9	PE401	B. Tech Project(Stage – 1)	2	0	0	3	3	60	40
10	PT 401	Summer Training Seminar	2	0	0	2	3	60	40
		C. Discipline and Extra Curricular Activities							
11	DE-401	Discipline and Extra Curricular Activities-VII	2					100	
		Total	30	18	2	11			
		Total Teaching Load			31				

Year: IV **Semester: VIII**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	EC – 410	Image Processing & Pattern Recognition	3	3	0	0	3	30	70
2	ME – 408	Product Design & Development	3	3	0	0	3	30	70
3	EE – 402	Electrical Drives	4	3	1	0	3	30	70
4	CP 407	Artificial Intelligence	3	3	0	0	3	30	70
5		**Elective I**	4	3	1	0	3	30	70
	ME – 404	Power Plant Engineering							
	EC – 617	Micro-Electro-Mechanical-Systems (MEMS)	-	-	-	-	-	-	-
6		**Elective II**	3	3	0	0	3	30	70
	CP – 301	Data Base Management System	-	-	-	-	-	-	-
	EC – 403	Wireless Communication							
		B. Practicals / Sessionals							
7	ME – 460	Product Design & Development Lab.	2	0	0	3	3	60	40
8	CP – 260	Advanced Computer Programming Lab	2	0	0	3	3	60	40
9	PE 402	B Tech Project(stage 2)	2	0	0	3	3	60	40
10	SM 402	B. Tech Seminar	1	0	0	2	3	60	40
		C. Discipline and Extra Curricular Activities							
11	DE-302	Discipline and Extra Curricular Activities-VIII	2					100	
		Total	29	18	2	11			
		Total Teaching Load			31				

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
Teaching and Examination Scheme for M. Tech. FULL-TIME (Core) (Energy Engineering)
For students of Session 2011-12 batches

Year I **Semester – I**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory Papers							
1	ME 501	Design of Thermal Systems	3	3	0		3	30	70
2	ME 503	Electrical Power Generation, Transmission and Distribution	3	3	0		3	30	70
3	ME 505	Solar Thermal Engineering	3	3	0		3	30	70
4	ME 507	Alternative Fuels in I.C.Engines	3	3	0		3	30	70
5	ME 509	Finite Element Methods	2	3	0		3	30	70
		Total	**14**	**15**	**0**				
		Total Teaching Load		**15**					

Year I **Semester – II**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory Papers							
1	ME 502	Design of Combustion System	3	3	0		3	30	70
2	ME 504	Wind Energy Utilization	3	3	0		3	30	70
3	ME 506	Pollution Control Technologies	3	3	0		3	30	70
4	ME 508	Energy Conservation (Electrical)	2	3	0		3	30	70
5	ME 510	Energy Management	3	3	0		3	30	70
		Total	**14**	**15**	**0**	**0**			
		Total Teaching Load		**15**					

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
Teaching and Examination Scheme for M. Tech. FULL-TIME (Core) (Energy Engineering)
For students of Session 2011-12 batches

Year II **Semester – III**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory Papers							
1	ME 601	Energy Conservation Technologies	3	3	0		3	30	70
2	ME 603	Direct Energy Conversion	3	3	0		3	30	70
3	ME 605	Modeling & Planning of Energy System	3	3	0		3	30	70
		B. Practical & Sessional:							
4	ME 651	Industrial Visit	2	0		0		60	40
5	ME 653	Seminar	5	0		3		60	40
		Total	**16**	**9**	**0**	**3**			
		Total Teaching Load		**12**					

Year II **Semester – IV**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Practical & Sessional:							
1	DI 602	M. Tech. Dissertation / Thesis	16	0	0	0		60	40
		Total	**16**	**0**	**0**	**0**			
		Total Teaching Load		**0**					

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
Teaching and Examination Scheme for M. Tech. FULL-TIME (Core) (Manufacturing and Industrial Engineering)
For students of Session 2011-12 batches

Year I **Semester – I**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory Papers							
1	ME 509	Finite Element Methods	2	3	0		3	30	70
2	ME 511	Advanced Manufacturing Process	3	3	0		3	30	70
3	ME 513	Metal Forming Analysis & Technology	3	3	0		3	30	70
4	ME 515	Quality Engineering And Management	3	3	0		3	30	70
5	ME 519	CAD/CAM/CIM	3	3	0		3	30	70
		Total	**14**	**15**	**0**		**15**		
		Total Teaching Load		**14**					

Year I **Semester – II**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory Papers							
1	ME 512	Engineering Economics & Accounting	3	3	0		3	30	70
2	ME 514	Research Methodologies	3	3	0		3	30	70
3	ME 516	Manufacturing Management	2	3	0		3	30	70
4	ME 518	Industrial Automation	3	3	0		3	30	70
5	ME 520	Supply Chain Management	3	3	0		3	30	70
		Total	**14**	**15**	**0**				
		Total Teaching Load		**15**					

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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
Teaching and Examination Scheme for M. Tech. FULL-TIME (Core) (Manufacturing and Industrial Engineering)
For students of Session 2011-12 batches

Year II **Semester – III**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory Papers							
1	ME 607	Machine Tool Design	3	3	0		3	30	70
2	ME 609	Reliability & Failure Analysis	3	3	0		3	30	70
3	ME 611	Tool And Cutter Design	3	3	0		3	30	70
		B. Practical & Sessional:							
4	ME 651	Industrial Visit	3	0		0		60	40
5	ME 653	Seminar	5	0		3		60	40
		Total	**17**	**9**	**0**	**3**			
		Total Teaching Load		**12**					

Year II **Semester – IV**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Practical & Sessional:							
1	DI 602	M. Tech. Dissertation / Thesis	16	0	0	0		60	40
		Total	**16**	**0**	**0**	**0**			
		Total Teaching Load		**0**					

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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
Teaching and Examination Scheme for M. Tech. FULL-TIME (Core) (Automotive Engg. & e-Manufacturing)
For students of Session 2011-12 batches

I YEAR								**I Sem**	
S. No.	**Course Code**	**Course Name**	**Credit**	**Contact Hrs/Wk.**			**Exam Hrs.**	**Weightage (in %)**	
				L	**T/S**	**P**		**CE**	**ESE**
1	ME 521	Automotive chassis	3	3	0		3	30	70
2	ME 523	Engine Modeling & Simulation	3	3	0		3	30	70
3	ME 525	Mechanical System Design	3	3	0		3	30	70
4	ME 527	Control System Engg.	3	3	0		3	30	70
5	ME 551	Thermal Engg. Lab.	2			2	3	60	40
		TOTAL	**14**	**12**	**0**	**2**	**15**		
I YEAR								**II Sem.**	
S. No.	**Course Code**	**Course Name**	**Credit**	**Contact Hrs/Wk.**			**Exam Hrs.**	**Weightage (in%)**	
				L	**T/S**	**P**		**CE**	**ESE**
1	ME 522	Advance Engine Design	3	3	0		3	30	70
2	ME 524	Embedded automotive systems	3	3	0		3	30	70
3	ME 526	Computer aided vehicle design	3	3	0		3	30	70
4	ME 528	Emerging Automotive technologies	3	3	0		3	30	70
5	ME 552	Automobile design and cam lab	2	0	0	2	3	60	40
		TOTAL	**14**	**12**	**0**	**2**	**15**		

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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
Teaching and Examination Scheme for M. Tech. FULL-TIME (Core) (Automotive Engg. & e-Manufacturing)
For students of Session 2011-12 batches

II YEAR **III Sem.**

S. No.	Course Code	Course Name	Credit	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
1	ME 609	Vehicle Dynamics	3	3	0		3	30	70
2	ME 611	Design of combustion system	3	3	0	0	3	30	70
3	ME 613	Pollution control techniques	3	0	0	0	3	30	70
4	ME 651	Industrial visit	2	0	0	0	0	60	40
5	ME 653	Seminar	5	0	0	3	3	60	40
		TOTAL	**16**	**6**	**0**	**3**	**12**		

II YEAR **IV Sem.**

S. No.	Course Code	Course Name	Credit	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
1	DI 602	Dissertation	16	0	0	0	3	60	40
		TOTAL	**16**	**0**	**0**	**0**			

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
Teaching and Examination Scheme for Full-Time Dual Degree (B. Tech Mechanical Engineering + M. Tech. Energy Engineering)
(5 Year Course) For students of Session 2011-12 batches

Year: IV **Semester: VII**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	ME 401	Computer Aided Design	3	3	0		3	30	70
2	ME 403	Refrigeration and Air-Conditioning	4	3	1		3	30	70
3	ME 405	Operation Research	4	3	1		3	30	70
4	ME 407	Reliability and Maintenance	3	3	0		3	30	70
5	ME 409	Gas Turbine & Jet Propulsion	3	3	0		3	30	70
6		**Elective II (any one of the following)**	3	3	0		3	30	70
	ME 411	Finite Element Analysis							
	ME 413	Computational fluid dynamics and Heat Transfer							
	BM 449	Entrepreneurship Development							
7.	ME 501	Design of Thermal System	3	3	0		3	30	70
		B. Practicals / Sessionals							
8	ME 451	CAD Lab	2	0		2	3	60	40
9	ME 453	RAC Lab	2	0		2	3	60	40
10	PT 401	Training Seminar	3	0		-	3	60	40
11	PE 401	Major Project (Stage I)	3	0		3	3	60	40
		C. Discipline and Extra Curricular Activities							
12	DE 401	Discipline and Extra Curricular Activities – VII	2					100	
		Total	**35**	**21**	**2**	**7**			
		Total Teaching Load		**30**					

Year: IV **Semester: VIII A**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	ME 402	Computer Aided Manufacturing	3	3	0		3	30	70
2	ME 404	Power Plant Engg.	3	3	0		3	30	70
3	ME 406	Production Process-III	3	3	0		3	30	70
4		**Elective III (any one of the following)**	3	3	0			30	70
	ME 408	Product Design and Development							
	ME 607	Machine Tool Design							
	ME 412	Operation Management							
5	ME 502	Design of Combustion System	3	3	0		3	30	70
		B. Practicals / Sessionals							
7	ME 452	CAM Lab	3	0		3		60	40
8	ME 456	Production Process-III Lab	3	0		3		60	40
10	SM 402	B. Tech Seminar	3	0		-		60	40
11	PE 402	Major Project	6	0		3		60	40
		C. Discipline and Extra Curricular Activities							
12	DE 402	Discipline and Extra Curricular Activities - VIII	2					100	
		Total	**32**	**15**	**0**	**9**			
		Total Teaching Load		**27**					

Year: IV **Summer Semester: VIII B**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	ME 508	Energy Conservation (Electrical)	3	3	0		3	30	70
2	ME 510	Energy Management	3	3	0		3	30	70
		Total	**6**	**6**	**0**	**0**			
		Total Teaching Load		**6**					

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DEPARTMENT OF MECHANICAL ENGINEERING
Teaching and Examination Scheme for Full-Time Dual Degree (B. Tech Mechanical Engineering + M. Tech. Energy Engineering)
(5 Year Course)
For students of Session 2011-12 batches

Year: V **Semester: IX**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory Papers							
1	ME 503	Electrical Power Generation, Transmission and Distribution	3	3	0		3	30	70
2	ME 505	Solar Thermal Engineering	3	3	0		3	30	70
3	ME 507	Alternative Fuels in I.C.Engines	3	3	0		3	30	70
4	ME 509	Finite Element Methods	2	3	0		3	30	70
5	ME 601	Energy Conservation Technologies	3	3	0		3	30	70
6	ME 603	Direct Energy Conversion	3	3	0		3	30	70
7	ME 605	Modeling & Planning of Energy System	3	3	0		3	30	70
		B. Practical & Sessional:							
8	ME 651	Industrial Visit	3	0		0		60	40
9	ME 653	Seminar	5	0		3		60	40
		Total	**28**	**21**	**0**	**3**			
		Total Teaching Load		**24**					

Year: V **Semester: X**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory Papers							
1	ME 504	Wind Energy Utilization	3	3	0		3	30	70
2	ME 506	Pollution Control Technologies	3	3	0		3	30	70
		B. Practical & Sessional:							
3	DI 602	M. Tech. Dissertation / Thesis	16	0	0	0		60	40
		Total	**22**	**6**	**0**	**0**			
		Total Teaching Load		**6**					

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DEPARTMENT OF MECHANICAL ENGINEERING
Teaching and Examination Scheme for Full-Time Dual Degree (B. Tech Mechanical Engineering + M. Tech. Manufacturing and Industrial Engineering) (5 Year Course) 2014-15 EFFECTIVE FOR STUDENTS OF BATCH 2011-12

Year: IV **Semester: VII**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	ME 401	CAD	3	3	0		3	30	70
2	ME 403	Refrigeration and Air-Conditioning	4	3	0		3	30	70
3	ME 405	Operation Research	4	3	0		3	30	70
4	ME 407	Reliability and Maintenance	3	3	0		3	30	70
5	ME 409	Gas turbine & Jet Propulsion	3	3	0		3	30	70
6		**Elective II (any one of the following)**	3	3	0		3	30	70
	ME 411	Finite Element Analysis							
	ME 413	Computational Fluid Flow and Heat Transfer							
	BM 449	Entrepreneurship Development							
7	ME 511	Advanced Manufacturing Process	3	3	0		3	30	70
		B. Practicals / Sessionals							
8	ME 451	CAD Lab	2	0		3	3	60	40
9	ME 453	RAC Lab	2	0		3	3	60	40
10	PT 401	Training Seminar	3	0		-	3	60	40
11	PE 401	Major Project (Stage I)	3	0		3	3	60	40
		C. Discipline and Extra Curricular Activities							
12	DE 401	Discipline and Extra Curricular Activities - VII	2					100	
		Total	**35**	**21**	**0**	**9**			
		Total Teaching Load		**30**					

Year: IV **Semester: VIII A**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	ME 402	Computer Aided Manufacturing	3	3	0		3	30	70
2	ME 404	Power Plant Engg.	3	3	0		3	30	70
3	ME 406	Production Process-III	3	3	0		3	30	70
4		**Elective III (any one of the following)**	3	3	0			30	70
	ME 408	Product Design and Development							
	ME 414	Operation Management							
5	ME 512	Engineering Economics & Accounting	3	3	0		3	30	70
		B. Practicals / Sessionals							
6	ME 452	CAM Lab	3	0		3		60	40
7	ME 454	Production Process-III Lab	3	0		3		60	40
8	SM 402	B. Tech Seminar	3	0		3		60	40
9	PM 402	Major Project	6	0		3		60	40
		C. Discipline and Extra Curricular Activities							
10	DE 402	Discipline and Extra Curricular Activities - VIII	2					100	
		Total	**32**	**15**	**0**	**12**			
		Total Teaching Load		**27**					

Year: IV **Summer Semester: VIII B**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	ME 518	Industrial Automation	3	3	0		3	30	70
2	ME 520	Supply Chain Management	3	3	0		3	30	70
		Total	**6**	**6**	**0**	**0**	**6**		
		Total Teaching Load		**6**					

NOTE

- Since Summer Semester VIII B is of shorter duration each summer course shall be double the teaching hours/week i.e. the above courses shall be of 6 hours/week

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
Teaching and Examination Scheme for Full-Time Dual Degree (B. Tech Mechanical Engineering + M. Tech. Manufacturing and Industrial Engineering) (5 Year Course) 2015-16 EFFECTIVE FOR STUDENTS OF BATCH 2011-12

Year: V **Semester: IX**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory Papers							
1	ME 509	Finite Element Methods	2	3	0		3	30	70
2	ME 513	Metal Forming Analysis & Technology	3	3	0		3	30	70
3	ME 514	Research Methodologies	3	3	0		3	30	70
4	ME 515	Quality Engineering And Management	3	3	0		3	30	70
5	ME 519	CAD/CAM/CIM	3	3	0		3	30	70
6	ME 607	Machine Tool Design	3	3	0		3	30	70
7	ME 609	Reliability And Failure Analysis	3	3	0		3	30	70
		B. Practical & Sessional:							
8	ME 651	Industrial Visit	3	0		0		60	40
9	ME 653	Seminar	5	0		3		60	40
		Total	**28**	**21**	**0**	**3**			
		Total Teaching Load		**24**					

Year: V **Semester: X**

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weight age (in%)	
				L	T/S	P		CE	ESE
		A. Theory Papers							
1	ME 516	Manufacturing Management	3	3	0		3	30	70
2	ME 611	Tool And Cutter Design	3	3	0		3	30	70
		B. Practical & Sessional:							
3	DI 602	M. Tech. Dissertation / Thesis	16	0	0	0		60	40
		Total	**22**	**6**	**0**	**0**	**6**		
		Total Teaching Load		**6**					

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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
LIST OF COURSES OFFERED

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
1	ME 201	Fundamentals of Thermodynamics	3	3	-	-	3	30	70
2	ME 202	Machine Design	3	3	-		3	30	70
3	ME 203	Mechanics of Solid	4	3	1	-	3	30	70
4	ME 204	Industrial Engg. – I	3	3	-		3	30	70
5	ME 205	Material Science	3	3	-	-	3	30	70
6	ME 206	Production Process – I	3	3	-		3	30	70
7	ME 207	Elements of Machine Design	4	3	1	-	3	30	70
8	ME 208	Fluid Mechanics	4	3	1		3	30	70
9	ME 209	Object Oriented Programming	3	3	-	-	3	30	70
10	ME 210	Internal Combustion Engines	3	3	-		3	30	70
11	ME 212	Instrumentation & Control	3	3	-		3	30	70
12	ME 251	Thermal Engg. Lab. – I	2	-	-	2	3	60	40
13	ME 252	Machine Design Lab.	2	0		2	3	60	40
14	ME 253	Strength of Material Lab.	2	-	-	2	3	60	40
15	ME 255	Material Science Lab.	2	--	-	2	3	60	40
16	ME 256	Production Process – I Lab	2	0		3	3	60	40
17	ME 258	Fluid Mechanics Lab.	2	0		2	3	60	40
18	ME 259	Computer Programming lab	2	-	-	2	3	60	40
19	ME 260	Internal Combustion Lab	2	0		2	3	60	40
20	ME 261	Machine Drawing Lab	3	-	-	3	3	60	40
21	ME 262	Instrumentation & Control Lab	2	-	-	2	3	60	40
22	ME 301	Production Process – II	3	3	-		3	30	70
23	ME 302	Dynamics of Machine – II	4	3	1		3	30	70
24	ME 303	Fluid Machines	4	3	1		3	30	70
25	ME 304	Heat & Mass Transfer	3	3	-		3	30	70
26	ME 305	Dynamics of Machine – I	4	3	1		3	30	70
27	ME 306	Steam Turbine and Steam Power plant	4	3	1		3	30	70
28	ME 307	Fundamental of Aerodynamics	3	3	-		3	30	70
29	ME 308	Automobile Engg.	3	3	-		3	30	70
30	ME 309	Mechanical Vibration & Noise Engg.	4	3	1		3	30	70
31	ME 310	Industrial Engg. – II	3	3	-		3	30	70
32	ME 311	Facility Planning & Material Handling	3	3	-		3	30	70
33	ME 312	Mechatronics	3	3	-		3	30	70
34	ME 314	Cryogenic Engineering	3	3	-		3	30	70
35	ME 316	Welding Engineering	3	3	-		3	30	70
36	ME 318	Automobile and IC Engine	3	3	0	0	3	30	70
37	ME 351	Production Process Lab – II	3	0		3	3	60	40
38	ME 352	Dynamics of Machine – II Lab	2	0		2	3	60	40

39	ME 353	Fluid Machine Lab	2	0		2	3	60	40
40	ME 354	Heat & Mass Transfer Lab	2	0		2	3	60	40
41	ME 355	Dynamics of Machine Lab – I	3	0		3	3	60	40
42	ME 358	Automobile Lab	2	0		2	3	60	40
43	ME 359	Mechanical Vibration Lab	2	0		2	3	60	40
44	ME 360	Industrial Engg. Lab.	3	0		3	3	60	40
45	ME 362	Automobile and IC engine	2	0	0	3	3	60	40
46	ME 401	Computer Aided Design	3	3	0		3	30	70
47	ME 402	Computer Aided Manufacturing	3	3	0		3	30	70
48	ME 403	Refrigeration and Air-Conditioning	3	3	0		3	30	70
49	ME 404	Power Plant Engg.	3	3	0		3	30	70
50	ME 405	Operation Research	4	3	0		3	30	70
51	ME 406	Production Process – III	3	3	0		3	30	70
52	ME 407	Reliability and Maintenance	3	3	0		3	30	70
53	ME 408	Product Design and Development	3	3	0		3	30	70
54	ME 409	Gas Turbine & Jet Propulsion	3	3	0		3	30	70
55	ME 411	Finite Element Analysis	3	3	0		3	30	70
56	ME 412	Operation Management	3	3	0		3	30	70
57	ME 413	Computational fluid flow and heat transfer	3	3	0		3	30	70
58	ME 415	Fundamental Of Robotics	3	3	0	0	3	30	70
59	ME 451	CAD Lab	2	0		3		60	40
60	ME 452	CAM Lab	2	0		3		60	40
61	ME 453	RAC Lab	2	0		3		60	40
62	ME 456	Production Process – III Lab	2	0		3		60	40
63	ME - 458	CAD/CAM Lab	2	0	0	3	3	60	40
64	ME – 460	Product Design & Development Lab.	2	0	0	3	3	60	40
65	ME 501	Design of Thermal Systems	3	3	0		3	30	70
66	ME 502	Design of Combustion System	3	3	0		3	30	70
67	ME 503	Electrical Power Generation, Transmission and Distribution	3	3	0		3	30	70
68	ME 504	Wind Energy Utilization	3	3	0		3	30	70
69	ME 505	Solar Thermal Engineering	3	3	0		3	30	70
70	ME 506	Pollution Control Technologies	3	3	0		3	30	70
71	ME 507	Alternative Fuels in I.C.Engines	3	3	0		3	30	70
72	ME 508	Energy Conservation (Electrical)	2	3	0		3	30	70
73	ME 509	Finite Element Methods	2	3	0		3	30	70
74	ME 510	Energy Management	3	3	0		3	30	70
75	ME 511	Advanced Manufacturing Process	3	3	0		3	30	70
76	ME 512	Engineering Economics & Accounting	3	3	0		3	30	70
77	ME 513	Metal Forming Analysis & Technology	3	3	0		3	30	70
78	ME 514	Research Methodologies	3	3	0		3	30	70
79	ME 515	Quality Engineering And Management	3	3	0		3	30	70
80	ME 516	Manufacturing Management	2	3	0		3	30	70
81	ME 518	Industrial Automation	3	3	0		3	30	70
82	ME 519	CAD/CAM/CIM	3	3	0		3	30	70
83	ME 520	Supply Chain Management	3	3	0		3	30	70
84	ME 521	Automotive chassis	3	3	0		3	30	70
85	ME 522	Advance Engine Design	3	3	0		3	30	70

86	ME 523	Engine Modeling & Simulation	3	3	0		3	30	70
87	ME 524	Embedded automotive systems	3	3	0		3	30	70
88	ME 525	Mechanical System Design	3	3	0		3	30	70
89	ME 526	Computer aided vehicle design	3	3	0		3	30	70
90	ME 527	Control System Engg.	3	3	0		3	30	70
91	ME 528	Emerging Automotive technologies	3	3	0		3	30	70
92	ME 551	Thermal Engg. Lab.	2			2	3	60	40
93	ME 552	Automobile design and cam lab	2	0	0	2	3	60	40
94	ME 601	Energy Conservation Technologies	3	3	0		3	30	70
95	ME 603	Direct Energy Conversion	3	3	0		3	30	70
96	ME 605	Modeling & Planning of Energy System	3	3	0		3	30	70
97	ME 607	Machine Tool Design	3	3	0		3	30	70
98	ME 609	Reliability & Failure Analysis	3	3	0		3	30	70
99	ME 611	Tool And Cutter Design	3	3	0		3	30	70
100	ME 613	Pollution control techniques	3	0	0	0	3	30	70
101	ME 615	Vehicle Dynamics	3	3	0		3	30	70
102	ME 617	Design of combustion system	3	3	0	0	3	30	70
103	ME 651	Industrial Visit	2	0		0		60	40
104	ME 653	Seminar	5	0		3		60	40
105	EC – 201	EDC	4	3	1	0	3	30	70
106	EC – 204	Digital Hardware Design	4	3	1	0	3	30	70
107	EC – 208	Telecommunication Engg.	3	3	0	0	3	30	70
108	EC – 253	EDC Lab	2	0	0	3	3	60	40
109	EC – 254	Digital Hardware Design lab	1	-	-	2	3	60	40
110	EC – 302	Microprocessor	4	3	1	0	3	30	70
111	EC – 305	Linear Integrated Circuit	4	3	1	0	3	30	70
112	EC - 311	Signal and Networking	-	-	-	-	-	-	-
113	EC – 312	Communication System	4	3	1	0	3	30	70
114	EC – 353	Electronic Engineering Design Lab	2	0	0	3	3	60	40
115	EC – 354	Microprocessor Lab	2	0	0	3	3	60	40
116	EC – 401	Antenna & Wave Propagation							
117	EC – 403	Wireless Communication							
118	EC – 404	Digital Signal Processing	4	3	1	0	0	30	70
119	EC – 405	Microcontrollers & Embedded System	4	3	1	0	3	30	70
120	EC – 406	VLSI Design	4	3	1	0	3	30	70
121	EC – 410	Image Processing & Pattern Recognition	3	3	0	0	3	30	70
122	EC – 453	Microcontroller Lab	2	0	0	3	3	60	40
123	EC – 454	Signal Processing Lab	2	0	0	3	3	60	40
124	EC – 601	Embedded System Design							
125	EC – 613	Wireless Sensor Networks	3	3	0	0	3	30	70
126	EC – 617	Micro-Electro-Mechanical-Systems (MEMS)	-	-	-	-	-	-	-
127	EE - 205	Electro Mechanical Energy Conversion I	3	3	0	0	3	30	70
128	EE - 253	Electro Mechanical Energy Conversion I Lab	2	0	0	3	3	60	40
129	EE – 310	Industrial Electronics	-	-	-	-	-	-	-
130	EE – 402	Electrical Drives	4	3	1	0	3	30	70
131	CP – 216	Object Oriented Programming (core java)	-	-	-	-	-	-	-
132	CP – 260	Advanced Computer Programming Lab	2	0	0	3	3	60	40
133	CP – 301	Data Base Management System	-	-	-	-	-	-	-

134	CP – 307	Computer Graphics	-	-	-	-	-	-	-
135	CP – 316	Multimedia	-	-	-	-	-	-	-
136	CP - 407	Artificial Intelligence	3	3	0	0	3	30	70
137	CP – 415	Neural Networks	-	-	-	-	-	-	-
138	CP – 605	Information Security System	-	-	-	-	-	-	-
139	MA - 201	Integral Transforms & Complex Analysis	4	3	1	0	3	30	70
140	MA 205	Advance Engg. Mathematics-III	4	3	1	-	3	30	70
141	MA – 301	Computer Oriented Mathematical Methods	-	-	-	-	-	-	-
142	BM 449	Entrepreneurship Development	3	3	0		3	30	70
143	PE 302	Mini project	1	0	0	2	3	60	40
144	PE 401	Major Project (Stage I)	3	0		3		60	40
145	PE 402	Major Project	8	0		3		60	40
146	PE 402	B Tech Project(stage 2)	2	0	0	3	3	60	40
147	PT 401	Training Seminar	3	0		3		60	40
148	SM 402	B. Tech Seminar	1	0	0	2	3	60	40
149	DE 201	Discipline and Extra Curricular Activities – III	2					100	
150	DE 202	Discipline and Extra Curricular Activities – IV	2					100	
151	DE 301	Discipline and Extra Curricular Activities – V	2					100	
152	DE 302	Discipline and Extra Curricular Activities – VI	2					100	
153	DE 401	Discipline and Extra Curricular Activities – VII	2					100	
154	DE 402	Discipline and Extra Curricular Activities – VIII	2					100	
155	DI 602	M. Tech. Dissertation / Thesis	16	0	0	0		60	40

ME 201 FUNDAMENTALS OF THERMODYNAMICS C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	Basic Concepts and Properties of Pure Substances: System, Properties, State and equilibrium, Processes and cycles, Temperature and pressure, Energy and Environment, Work and heat. Properties of Pure Substance: Definition and laws of ideal gas, phases of pure substances & phase charge processes, property diagrams for phase change processes, Property tables for different state of liquid and vapour, Internal energy, Enthalpy and specific heats of ideal gas, solids and liquids .	7
II	Laws of Thermodynamics: Zeroth law of thermodynamics, temperature scale, First law of thermodynamics, steady flow energy equation, applications of steady flow energy equation, limitations of first law of thermodynamics, second law of thermodynamics , heat engine, Carnot cycle, absolute thermodynamics temperature scale, entropy, change of entropy for different process, equivalence of Kelvin-Planck and Clausius statement, Clausius inequality, second law efficiency and third law of thermodynamics.	7
III	Availability and Thermodynamic Relations: Available and unavailable energy, availability of steady flow and non-flow system. Helmholtz and Gibb's function, important mathematical relations, Maxwell relations, T-ds relations, Joule-Thomson coefficient, clausius-claperyon equation.	7
IV	Gas Power Cycle: Otto cycle, Diesel cycle, dual cycle, Stirling cycle, Ericsson cycle, Atkinson cycle, Brayton cycle, mean effective pressure and efficiencies, four stroke and two stroke petrol and diesel engine, experimental determination of IHP,BHP and volumetric efficiency.	7
V	Vapor Power Cycle: Rankine cycle, Reheat cycle, Regeneration cycle, co-generation cycle, binary vapor and trinary vapour power cycle. Calculation at efficiency, work ratio, back-work ratio, specific steam consumption rate, heat consumptions rate for vapor power cycle, vapor compression refrigeration cycle and properties of refrigerants.	7

Reference Books:

1. Engineering Thermodynamics, P.K.Nag, Tata McGraw Hill.
2. Engineering Thermodynamics, C.P.Gupta, Rajendra Prakash Nemi Chand & Bros.
3. Thermal Engineering, Mathur & Mehta.

ME 202 MACHINE DESIGN C (L, T, P) = (3, 0, 0)

Units	Contents of the Subject	Hrs.
I	Fatigue Considerations in Design: Variable load, loading pattern, Endurance stresses, influence of size, surface finite, notch sensitivity & stress concentration, Goodman line, soderberg, designof machine members subjected to combined, steady and alternating stresses. Design of finite life. Design of shafts under Variable Stresses.	7
II	Design of machine elements ; Pin cotter and keyed joints, Design of screw fastening. Design of Helical compression, torsional and leaf springs. Springs under Variable Stresses. Design of cylinder; Thin and Thick	7
III	Design of members in Torsion: Shafts and Shaft couplings. Design of weldments, welds subjected to eccentric loading and combined stresses. Design of members which are curved like crane hook, body of C-clamp, machine frame etc., Power screws like lead screw, Screw Jack.	7
IV	Design of components like crank shafts and connecting rod. Design of Gear teeth, lewis and Buckkhingam equations; wear and Dynamic load considerations, design and force analysis of spur, helical, beval and worm analysis of spur, helical, bevel and worm gears. Bearing reactions due to gear tooth forces, Detailed design of fixed ratio gear boxes.	6
V	Design of sliding & journal bearing: method of lubrication, hydrodynamic, hydrostatic, boundary etc. Minimum film thickness and thermal equilibrium. Selection of anti-friction bearings for different loads and load cycle Mounting of the bearings. Methods of lubrication, selection of oil seals.	7

List of Recommended Books:

1. Elements of Machine Design, N.C.Pandya & C.S.Shah, Charotar Book Stall, Anand.
2. Design of Machine Elements; V.B.Bhandari, Tata McGraw Hill Publishing Co. Ltd.
3. 'Mechanical Machine Design; R.C.Bahl & V.K.Goyal, Standard Publishing Distributors, Delhi
4. 'Mechanical Engineering Design; J.E.Shigley,McGraw Hill Book Co.
5. Machine Design; K.K.Puraja, B.L.Juneja & N.C.Bhandari, Dhanpat Rai & Sons, Delhi

ME 203 **MECHANICS OF SOLID** **C (L, T, P) = (3, 1, 0)**

Units	Course Contents	Hrs
I	**Stress and Strain:** Tension, compression, shearing stress and strain: Poission's ratio; Stress - strain relationship, Hooke's law; Elastic constants and their relations for a isotropic hookean material, anisotropy and orthotropy, thermal stresses, composite bars; simple elastic, plastic and visco-elastic behaviour of common materials in tension and compression test, stress - strain curve. Concept of factor of safety and permissible stress. Bolt, pin, cotter, key etc. subjected to direct stresses. Conditions for equilibrium. Concept of free body diagram; introduction to mechanics of deformable bodies.	7
II	**Members subjected to flexural loads:** Theory of simple bending, bending moment and shear force diagrams for different types of static loading and support conditions on beam. Bending stresses, Section modulus and transverse shear stress distribution in circular, hollow circular, I, Box, T, angle sections etc.	7
III	**Transverse deflection of beams:** Relation between deflection, bending moment, transverse deflection of beams and shaft under static loading area moment method, direct integration method: method of superposition and conjugate beam method. Variational approach to determine deflection and stresses in beam. Application to beam, lever, leaf spring etc.	7
IV	**Principles planes, stresses & strains:** Members subjected to combined axial, bending & Torsional loads, maximum normal and shear stresses; Concept of equivalent bending and equivalent twisting moments: Mohr;s circle of stress and strain. **Theories of Elastic Features:** The necessity for a theory, different theories, significance and comparision, applications.	7
V	**Torsion & Stability of equilibrium:** Torsional shear stress in solid, hollow and stepped circular shafts, angular deflection and power transmission capicity. Application to helical springs, shaft couplings. Instability and elatic stability. Long and short coloumns, ideal strut, Euler's formula for cripping load for columns of different ends, concept of equivalent length, ecentric loading, Rankine formulae and other empirical relations. Applications like connecting rod, piston rod, screw of screw-jack etc.	7

Reference Books:

1. Mechanics of Solids: S.H. Crandall, N.C.Dahi & T.J.Lardner, McGraw Hill International Edition
2. Strength of Materials; G.H.Ryder, ELBS Publications Co., London
3. Element of Strength of Materials. J.P.Tinnoshnko & G.H.Young. Affiliated East West Press, New Delhi
4. Solid Mechanics , G.M.A.Kazmi, Tata McGraw Hill Publishing Co.Ltd., New Delhi
5. Machanics of Solids : Dr.Ashish Dutt Sharma, Vardhan Publication

ME 204 **INDUSTRIAL ENGINEERING - I** **C (L, T, P) = (3, 0, 0)**

Units	Course Contents	Hrs
I	**Introduction To Management**: Management Theory and Functions: Evolution of management, scientific management, Contribution to scientific management: Reactions and criticisms of Taylor, Fayol, Mayo, Levels of 'Management Administration and Management, functions of management. Decision-making.	7
II	**Business Forms and Organization:** Forms of Business:(i)Single proprietorship (ii) Partnership (iii) Joint stock company (iv) Private Ltd- Companies and public limited companies Forming Joint Stock Companies (a) Registration (b) issue of Prospectus (c) Commencement Certificate (iv) co-operative Society choice of Business forms (v) State undertaking. Organization meaning. Types of organization; (i) Line organization (ii) Functional Organization (iii) Line Staff organization (iv) Line Staff Committee organization, span of control.	7
III	**Finance & Financial statements:**. Introduction, Needs of Finance, Kinds of Capital Sources of fixed capital, Shares - (i) Ordinary Shares (ii) Preference Shares. Borrow capital. Surplus profits. Sources of Working capital. Management of working capital. Financial Institutions. Introduction to Profit & Loss Statement, Balance Sheet, Financial ratio: Liquidity ratio, Profits investment ratio, equity ratio, inventory ratio.	7
IV	**Interest and Depreciation:** interest meaning, Compound interest. Annuities capital recovery Annuity present worth annuity sinking funds annuity compound Amount Annuity Nominal and effective rate of interest. Depreciation Meaning and causes. Need of Depreciation calculation, Methods of Depreciation. Straight line Methods. Sinking funds methods. Declining Balance Method, sum of years digits method (Syd Method).	7
V	**Labour relations and legislation:** Profit sharing, fringe benefits etc.Trade Unions. Methods of setting disputes (i) Collective bargaining (ii) Conciliation (iii) Mediation(iv) Arbitration industrial disputes in India, Machinery for setting disputes. Trade Disputes Acts. The factory Act 1944, payment of wages act. Workman's compensationact.	7

List of Recommended Books:

1. Works Organisation & Management, Basu & Sahu, IBH
2. Modern Production Management, Buffa, Willey
3. Industrial Organisation & Management, Bethel, Alwater, Smith & Stachmax, McGraw Hill
4. Principles of Industrial Organisation, Kimbal & Kimbal, McGraw Hill
5. Principles of Industrial Management, Alford, Ronald Press

ME 205 **MATERIAL SCIENCE** **C (L, T, P) = (3, 0, 0)**

Units	Course Contents	Hrs.
I	Engineering Materials: Effects of alloying elements in steel. Low alloy steels. Stainless , Magnetic materials for high and low temperature service. Brasses and bronzes; Aluminium base alloys. Bearing Materials.	7
II	Atomic structure of METALS: Crystal structure, crystal lattice of (i) Body centred cubic (ii) Face centred cubic (iii) Closed packed hexagonal, crystallographic Notation of atomic planes and Directions (Miller Indices), polymorphism and allotropy, Crystal imperfection.	7
III	Plastic Deformation of Metals and Alloys: Mechanism of plastic deformation, role of dislocation; slip and twining. Elementary treatment theory of work hardening, Theories of recrystallation and grain growth. Elementary treatment of creep; Fatigue and fracture.	7
IV	Phase and Phase Equilibrium: Solidification of alloys, Phase Diagrams, relationship with structure and properties; Eutectic systems. Iron Carbon alloys, Iron-Carbon equilibrium diagram.	7
V	Heat Treatment of Alloys: Phase transformation in steel. 'S' Curves Detailed study of various heat treatment Processes-hardening, annealing and tempering, case hardening. Hardenability, Precipification hardening. Heat treatment Furnaces.	7

Reference Books:

1. Material Science by I.P. Singh
2. Material Science by Narulla and Narulla
3. Material Science & Engineering by V. Raghavan. Pub. PHI
4. Engineering Materials by B.K.Agarwal. Pub. TMH
5. Material Science & Processes by S.K.Hazra; Chowdhary, Media Promotors & Publications Pvt. Ltd., Bombay
6. Engg. Metallurgy, Part - I by Raymond A. Higgins, ELBS
7. Heat Treatment Principles & Technology by T.V.Rajan, O.P. Sharma & Ashok Sharma

ME 206 **PRODUCTION PROCESSES - I** **C (L, T, P) = (3, 0, 0)**

Units	Course Contents	Hrs.
I	Importance of manufacturing, economic and technological definition of Manufacturing, survey of manufacturing processes. **Foundry Technology:** Patterns practices: Types of patterns, allowances and material used for patterns, moulding materials, moulding sands, Moulding sands; properties and sand testing; grain fineness; moisture content, clay content and permeability test, core materials and core making, core print; core boxes, chaplets, gating system design. Moulding practices**:** Green, dry and loam sand moulding, pit and floor moulding; shell moulding; permanent moulding; carbon dioxide moulding.	7
II	**Casting practices:** Fundamental of metal casting, sand casting, Shell-Mould casting, mold casting (plaster and ceramic), investment casting, vacuum casting, Permanent mould casting, slush casting, pressure casting, die casting, centrifugal casting, continuous casting, squeeze casting, casting alloys, casting defects, design of casting, gating system design, and riser design. Melting furnaces-rotary, pit electric, tilting and cupola.	7
III	**Metal Joining Processes**: Principle of welding, soldering, brazing and adhesive bonding. Survey of welding and allied processes. Arc welding: power sources and consumables. Gas welding and cutting: Processes and equipments. Resistance welding: principle and equipments. Spot, projection and seam welding process. Atomic hydrogen, ultrasonic, plasma and laser beam welding, electron beam welding, and special welding processes e.g. TIG, MIG, friction and explosive welding, welding of C.I. and Al, welding defects. Electrodes and Electrode Coatings	7
IV	**Machine Tools:** Constructional, details and main operation of Center Lathes,. Capston and Turret Lathe: Shaper and Planner, Drilling and Boring machines, Milling machines, indexing methods.	7
V	**Powder Metallurgy:** Powder manufacturing, mechanical pulverization, sintering, Electrolytic Process, chemical reduction, atomization, properties of metal powders, compacting of powders sintering, advantages and applications of P/M. **Rapid Prototyping Operations:** Introduction, subtractive processes, additive processes, Virtual Prototyping and applications	7

Reference Books:

1. Production Technology by O.P.Khanna, Dhanpat Rai Publications, New Delhi
2. Workshop Technology, Vol. I by S.K. Hazra Choudhary and A.K. Hazra Choudhary Media Promotors & Publishers Pvt. Ltd., Bombay
3. Production technology by P.C.Sharma S.Chand & Company Ltd, New Delhi
4. Manufacturing process by Begeman
5. Manufacturing Processes & Material: I.E.Doyle,Carl Kayser, Schrade, Leech.
6. Manufacturing Processes, Schey.

ME 207 **ELEMENTS OF MACHINE DESIGN** **C (L, T, P) = (3, 0, 0)**

Units	Course Contents	Hrs.
I	Materials: Properties and IS coding of various materials, Selection of material from properties and economic aspects. Manufacturing aspects in Design : Selection of manufacturing processes on the basis of design and economy, Influence of rate of production, standard size, Influence of limits, fits tolerances and surface finish. Change in the shape of the designed element to facilitate its production, Design of castings, working drawing.	7
II	Design for strength: Allowable stresses, detailed discussion on factor of safety (factor of ignorance): Stress concentration. Causes & mitigation. Introduction of various design considerations like strength, stiffness, weight, cost, space etc. Concept of fatigue failures. Design of machine elements subjected to direct stress, Pin, cotter and keyed joints, Design of screw fastening.	7
III	Design of members in Bending: Beams, levers and laminated springs.	7
IV	Design of members in torsion : Shafts and shaft couplings.	7
V	Design of shafts, brackets under combined stresses, Calculation of transverse & torsional deflections. Screw fasteners subjected to eccentric loading.	7

List of Recommended Books:

1. Elements of Machine Design, N.C.Pandya & C.S.Shah, Charotar Book Stall, Anand.
2. Design of Machine Elements; V.B.Bhandari, Tata McGraw Hill Publishing Co. Ltd.
3. 'Mechanical Machine Design; R.C.Bahl & V.K.Goyal, Standard Publishing Distributors, Delhi
4. 'Mechanical Engineering Design; J.E.Shigley,McGraw Hill Book Co.
5. Machine Design; K.K.Puraja, B.L.Juneja & N.C.Bhandari, Dhanpat Rai & Sons, Delhi

ME 208 **FLUID MECHANICS** **C (L, T, P) = (3, 1, 0)**

Units	Course Contents	Hrs.
I	Basic Definitions and Fluid Properties ; Definition of Fluid, Incompressible and compressible fluids, Fluid as a continuum, Mass, Density, specific weight, relative density, specific volume, Bulk modulus, velocity of sound Ideal fluid Viscosity. Newtonian and Non - Newtonian fluid, Kinematic viscosity, Effect of temperature and pressure on viscosity, surface tension capillarity, vapour pressure and cavitation. Fluid Statics : General differential equation, Hydrostatics Manometry, Fluid forces on submerged surfaces. Curved surfaces, submerged bodies. Floating bodies.	7
II	Kinematics and conservation of Mass : Flow classifications. Fluid velocity and acceleration, streamlines and the stream function. Pathlines and streak lines. Deformation of a fluid element, vertIcity and circulation. Irrotational and Rotational flow. Flownet, Laplace equation. Conservation of mass and the continuity equation for three dimensions. Fluid Momentum : The Momentum theorem Applications of the momentum theorem Equation of motion, Euler's equation of motion Integration of Euler's equation of motion. Bernoulli's equation. Applications of Bernoulli's Pitot tube, Equation of motion for Viscous fluid, Navier Stoke's equation.	7
III	Orifice discharging free, Jet, vena contracts, co-efficient of contraction, velocity and discharge, coefficient of resistance. Orifices and mouthpieces Nozzles and weires. Flow Through Pipes : Reynold's experiment Darcy's Weisback equation. Loss of head due to sudden enlargements, contraction, entrance, exit obstruction, bend, pipe fittings. Total and Hydraulic grandient lines, Flow through pipe line. Pipes in series, parallel Transmission of power through pipes.	7
IV	Laminar Flow: Simple solution of Navier Stokes equations. Hagen – Poiseuille flow. Plans Poiseuille flow and coutte flow. Turbulent Flow; Variation of friction factor with Reynold's number. The Prandt Mixing length hypothesis applied to pipe flow, velocity distribution in smooth pipes, Rough pipes.The Universal pipe friction laws, Colebrook. White formula. Dimensional Analysis: Buckingham variables, Model Similitude, Force ratio, Reynolds, Froude's Mach, Weber and Euler numbers and their applications. Undistorted model distorted model scale effect.	7
V	The Boundary Layer: Description of the boundary layer. Boundary Layer thickness boundary layer separation and control. The Prandtl boundary layer equation. Solution for laminar boundary layer. The momentum equation for the boundary layer. The flat plate in uniform free stream with no pressures gradients. Approximate momentum analysis laminar boundary Aerofoils Theory. Flow round a body ; Drag skin friction drag, pressure drag, combined skin friction & pressure drag (Profile drag) wave drag, lift induced drag. Flow past sphere & Cylinder.	7

Reference Books:

1. Engineering Fluid Mechanics K.L.Kumar, Eurasia Publishing House (P) Ltd.
2. Fluid Mechanics & Machine, F.M.White, John Wiley & Sons
3. Fluid Mechnaics & Machine, A.K. Jain
4. Fluid Mechanics, V.L.Streeper, McGraw Hill
5. Fluid Machanics with Applications. S.K.Gupta V.Gupta, New Age Publications

ME 209 **OBJECT ORIENTED PROGRAMMING** **C (L, T, P) = (3, 0, 0)**

Units	Course Contents	Hrs.
I	Introduction to Object Oriented Programming: Basic concepts: Class, Object, Method, Message passing, Inheritance, Encapsulation, Abstraction, Polymorphism.	7
II	Basics of C++ Environment: Variables; Operators; Functions; user defined, passing by reference, passing an array to the function, inline function, scope, overloading; Pointers: objects and lvalue, arrays and pointers, the new and delete operators, dynamic arrays, arrays of pointers and pointers to arrays, pointers to pointers and functions; Strings: String I/O, character functions in ctype.h, string functions in string.h.	7
III	Object oriented concepts using C++: Classes: Member functions, Friend functions, Constructors, Access functions, Private member functions, class destructor, static data and function members; Overloading: inline functions, this operator, overloading various types of operators, conversion operators; the String Class; Composition and Inheritance: Hierarchy and types of inheritance, protected class members, private versus protected access, virtual functions and polymorphism, virtual destructors, abstract base classes.	7
IV	Templates and Iterators: function and class templates, container classes, subclass templates, iterator classes; Libraries: standard C++ library, contents of a standard C headers, string streams, file processing: Files and streams classes, text files, binary files, classification of files, the standard template library.	7
V	Data Structures Using C++: Linked lists – Singly linked list, Doubly linked lists, Circularlists, Stacks and Queues priority Queues, Stacks, Queues.	7

ME 210 INTERNAL COMBUSTION ENGINES C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs
I	Air Standard Cycles: Internal and external combustion engines; classification of I.C. Engines, Cycles of operation in four stroke and two stroke I.C. Engines, Wankel Engines, Assumptions made in air standard cycle; Otto cycle; diesel cycle, dual combustion cycle, comparison of Otto, diesel and dual combustion cycles; sterling and Ericsson cycles; air standard efficiency, specific work output, specific weight; work ratio; mean effective pressure; deviation of actual engine cycle from ideal cycle. Problems. Carburetion, fuel Injection and Ignition systems: Mixture requirements for various operating conditions in S.I. Engines; elementary carburetor, Requirements of a diesel injection system; types of inject systems; petrol injection, Requirements of ignition system; types of ignition systems ignition timing; spark plugs. Problems.	7
II	Combustion in I.C. Engines : S.I. engines; Ignition limits; stages of combustion in S.I. Engines; Ignition lag; velocity of flame propagation; detonation; effects of engine variables on detonation; theories of detonation; octane rating of fuels; pre-ignition; S.I. engine combustion chambers, Stages of combustion in C.I. Engines; delay period; variables affecting delay period; knock in C.I. engines, Cetane rating; C.I. engine combustion chambers. Lubrication and Cooling Systems: Functions of a lubricating system, Types of lubrication system; mist, wet sump and dry sump systems; properties of lubricating oil; SAE rating of lubricants, engine performance and lubrication, Necessity of engine cooling; disadvantages of overcooling; cooling systems; air-cooling, water cooling; radiators.	7
III	Engine Testing and Performance: Performance parameters: BHP, IHP, mechanical efficiency, brake mean effective pressure and indicative mean effective pressure, torque, volumetric efficiency; specific fuel consumption (BSFC, ISFC), thermal efficiency; heat balance; Basic engine measurements; fuel and air consumption, brake power, indicated power and friction power, heat lost to coolant and exhaust gases; performance curves. Problems.	7
IV	Air pollution from I.C. Engine and Its remedies: Pollutants from S.I. and C.I. Engines, Methods of emission control; alternative fuels for I.C. Engines; the current scenario on the pollution front. Rotary Compressors: Root and vane blowers; Static and total head values; Centrifugal compressors- Velocity diagrams, slip factor, ratio of compression, pressure coefficient, pre-whirl; Axial flow compressor- Degree of reaction, polytrophic efficiency, surging, choking and stalling, performance characteristics, Problems.	7
V	Gas Turbines: Brayton cycle; Components of a gas turbine plant; open and closed types of gas turbine plants; Optimum pressure ratio; Improvements of the basic gas turbine cycle; multi stage compression with inter-cooling; multi stage expansion with reheating between stages; exhaust gas heat exchanger, Applications of gas turbines. Problems.	7

Reference Books:

1. Internal Combustion Engines –V. Ganesan, Pub.-Tata McGraw-Hill.
2. Gas Turbines - V. Ganesan, Pub.- Tata McGraw Hill.
3. Engineering fundamental of the I.C.Engine – Willard W. Pulkrabek Pub.-PHI,India
4. Internal Combustion Engines & Air pollution- Obert E.F, Pub.-Hopper & Row Pub., New York
5. Internal Combustion Engines Fundamentals- John B. Heywood, Pub.-McGraw Hill, New York

ME 212 INSTRUMENTATION AND CONTROL C (L, T, P) = (3, 1, 0)

Units	Course Contents	Hrs.
I	System configuration, basic characteristic, calibration, classification and performance characteristics of a instrumentation system, Specification and testing of dynamic response. Strain Measurement : Electric Strain Gauges - Types ; Selection and Installation, Strain gauge circuits; temperature compensation and calibration; Use of Strain Gauges on Rotating Shafts, Load Cells, Mechanical and Optical Strain Gauges.	7
II	Various Mechanical, Electro- Mechanical & Photoelectrical Sensors for sensing of Displacement, Velocity, Acceleration, Torque, Force, Temperature from Low to High Range, flow, level of fluid , pressure, angular speed, voltage, frequency and current. Introduction to Multi-Channel Data-Acquisition System, Measurement Pods, Interface Hardware, Data Analysis Software, Interfacing.	7
III	Concepts and examples of automatic control systems, systems by differential equations, transfer function, block diagram, open and feedback control systems, signal flow graphs & its constructions. Control System components, error sensing devices and servo motors.	7
IV	Control for mechanical systems & processes ; speed control system for steam/gas turbines. A constant tension ;reeling system, Electro-mechanical systems. Thermal systems, Pneumatic systems; Mathematical Models of physical systems, Feedback characteristics of Control Systems. Time response analysis; transient response analysis, time response specifications, steady state-error.	7
V	Concepts of stability, Routh- Hurwiz stability criterion, relative stability. The root locus technique, use of construction rules without any derivation. Frequency response analysis, Polar plots; stability in frequency domain, Bode / Logrithmic plots. Nyquist stability criterion.	7

Reference Books:

1. Mechanical Measurements and Instrumentation, A.K. Sawhney, Puneet Sawhney, Dhanpat Rai
2. Mechanical Measurements, Thomas G. Backwith, N. Lewis Buck, Roy, D., Marangoni, Narosa Publishing House
3. Industrial Instrumentation and Control, S.K.Singh, Tata McGraw Hill
4. Control Systems Engineering; I.J.Nagrath & M.Gopal, Wilay Eastern Limited
5. Automatic Control Engineering; Raxen, McGraw Hill, International Edition

ME 251 THERMAL ENGINEERING LAB-1 C (L, T, P) = (0, 0, 2)

(PERFORM ANY SIX EXPERIMENTS)
1. Comparative study of four stroke diesel and petrol engines.
2. Comparative study of two stroke petrol and diesel engines.
3. Studies of fuel supply systems of diesel and petrol engines.
4. Study of cooling, lubrication and ignition system in diesel and petrol engines.
5. To study various types of Boilers and to study Boiler mounting and accessories.
6. To study various types of Dynamometers.
7. To study Multi Stage Air Compressors.
8. To find the BHP, Thermal efficiency of four stroke diesel engine.
9. To prepare a comparison sheet of various automobiles (4 Wheeler and 2 Wheeler).

ME 252 MACHINE DESIGN LAB C (L, T, P) = (0, 0, 3)

(PERFORM ANY SIX EXPERIMENTS)
1. Selection of material & IS coding
2. Selecting fit & assigning tolerances
3. Examples of Production considerations.

Problems on
1. Knuckle & Cotter joints
2. Torque: Keyed joints & shaft couplings
3. Design of screw fastening
4. Bending: Beams, Levers etc.
5. Combined stresses: Shafts, brackets, eccentric loading

ME 253 STRENGTH OF MATERIAL LAB C (L, T, P) = (0, 0, 2)

(PERFORM ANY SIX EXPERIMENTS)
1. Izod Impact testing.
2. Rockwell Hardness Testing.
3. Spring Testing
4. Column Testing for buckling
5. Torsion Testing
6. Tensile Testing
7. Compression Testing
8. Shear Testing
9. Brinell Hardness Testing
10. Bending Test on UTM.
11. Study of Fatigue Testing Machine.

ME 255 MATERIAL SCIENCE LAB C (L, T, P) = (0, 0, 2)

(PERFORM ANY SIX EXPERIMENTS)
1. To study the Engineering Materials, significance and classifications.
2. Study of crystals structures, Study of Models BCC, FCC, HCP, stacking sequence, tetrahedral and Octahedral voids
3. To calculate the effective numbers of atoms, co-ordination no. packing factors, c/a ratio for BCC, FCC & HCP structures.
4. To prepare metallic samples for metallographic examination and to study the principle and construction of the Metallurgical Microscope.
5. Effect of carbon percentage on hardness of steel
6. Study of Phase Diagrams: concept of phase rule: Fe-C & Cu-Zn.
7. Study of Creep, Study of anistropy: Glass 'Fibre and Carbon' Fibre Composites.
9. Study of various types of fractures, Brittle fracture/ductile.
10. Study of Iron-Carbon Equilibrium Diagram and sketch the various structures present at room temperature.

ME 256 PRODUCTION PROCESS – I LAB C (L, T, P) = (0, 0, 3)

(PERFORM ANY SIX EXPERIMENTS)
1. Study of lathe machine, lathe tools cutting speed, feed and depth of cut.
2. To perform step turning, knurling and chamfering on lathe machine as per drawing.
3. Taper turning by tailstock offset method as per drawing.
4. To cut metric thread as per drawing.
5. To perform square threading, drilling and taper turning by compound rest as per drawing.
6. To study shaper machine, its mechanism and calculate quick return ratio.
7. To prepare mould of a given pattern requiring core and to cast it in aluminium.
8. Moisture test and clay content test.
9. Strength Test (compressive, Tensile, Shear Transverse etc. in green and dry conditions) and Hardness Test (Mould and Core).
10. Permeability Test.
11. A.F.S. Sieve analysis Test.

ME 258 **FLUID MECHANICS LAB.** **C (L, T, P) = (0, 0, 2)**

(PERFORM ANY SIX EXPERIMENTS)
1. Determine Metacentric height of a given body.
2. Determine Cd, Cv & Cc for given orifice.
3. Determine flow rate of water by V-notch.
4. Determine velocity of water by pitot tube.
5. Verify Bernoulli's theorem.
6. Determine flow rate of air by Venturi meter
7. Determine flow rate of air by orifice meter
8. Determine head loss of given length of pipe.
9. Determine flow rate of air by nozzle meter.

ME 259 **COMPUTER PROGRAMMING LAB** **C (L, T, P) = (0, 0, 2)**

(PERFORM ANY SIX EXPERIMENTS)
List of Programs in C++:
1. Program using basic I/O and control statements.
2. Program using class, objects, objects as function parameters.
3. Program using functions and passing reference to a function, inline functions. Program using Inheritance and virtual base class.
4. Program using pointers, arrays, dynamic arrays. Program using functions defined in ctype.h and stringh.
5. Program using constructors, destructors. Program using function and operator over loading

Mechanical App:
Turbo C Graphics: To make C programs to animate different mechanisms and system: Slider Crank Mechanism, Quick Return Mechanism, Cam Follower, Solar system, ball motion in billiard, Rolling of wheel from inclined plane, Seesaw motion, Projectile motion, motion of a wheel, etc.

ME 260 **INTERNAL COMBUSTION LAB.** **C (L, T, P) = (0, 0, 2)**

(PERFORM ANY SIX EXPERIMENT)
1. To study the constructional details & working principles of two-stroke/ four stroke petrol engine.
2. To study the constructional detail & working of two-stroke/ four stroke diesel engine.
3. Analysis of exhaust gases from single cylinder/multi cylinder diesel/petrol engine by Orsat Apparatus.
4. To prepare heat balance sheet on multi-cylinder diesel engine/petrol engine.
5. To find the indicated horse power (IHP) on multi-cylinder petrol engine/diesel engine by Morse Test.
6. To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine/diesel engine and prepare the curves (i) bhp, ihp, fhp, vs speed (ii) volumetric efficiency & indicated specific fuel consumption vs speed.
7. To find fhp of a multi-cylinder diesel engine/petrol engine by Willian's line method & by motoring method.

NOTE:
1. To perform constant speed performance test on a single cylinder/multi-cylinder diesel engine & draw curves of (i) bhp vs fuel rate, air rate and A/F and (ii) bhp vs mep, mech efficiency & sfc.
2. To measure CO & Hydrocarbons in the exhaust of 2- stroke / 4-stroke petrol engine.
3. To find intensity of smoke from a single cylinder / multi-cylinder diesel engine.
4. To draw the scavenging characteristic curves of single cylinder petrol engine.
5. To study the effects of secondary air flow on bhp, sfc, Mech. Efficiency & emission of a two-stroke petrol engine.

ME 261 **MACHINE DRAWING LAB** **C (L, T, P) = (0, 0, 3)**

(PERFORM ANY SIX EXPERIMENTS)
1. Couplings: Pin-type flexible coupling etc.
2. I.C. Engine parts: connecting rod, crank shaft, etc.
3. Boiler Mountings: Steam stop valve/ feed check-valve/ safety valve /three way stop valve blow off cock,etc.
4. Machine Tool Parts: Shaper tool head, Lathe Tail Stock, Turret Tool Post, Turret Bar feeding Mechanism / Universal Dividing Head, Swivel Machine Vice.
5. Miscellaneous: Screw jack and drill-press vice
6. Free Hand Sketches: Pipes and Pipe fittings, clutches, bearings, bearing puller, valve gear mechanisms, machine arbor and cutter, universal dividing head, jigs and fixtures, Step less drive, sliding gear box.

ME 262 INSTRUMENTATION & CONTROL LAB. C (L, T, P) = (0, 0, 2)

(PERFORM ANY SIX EXPERIMENTS)

INSTRUMENTATION LAB.

1. Displacement Measurement using Capacitive Pick - up System
2. Displacement Measurement Using Inductive Pick-up System
3. Displacement Measurement Using Light Dependent Register Set up
   (i) Displacement v/s Registance at Constant Voltage
   (ii) Voltage v/s Registance at Constant Displacement
4. Study of Speed Measurement System
   (i) Magnetic Pick-up
   (ii) Strobometer
5. Study of Load Measurement System
   Load Cell + Load Indicator
6. Calibration of Thermocouple Wire.

CONTROL LAB.

1. Block diagram reduction technique
2. Block diagram formation for Control Systems.
3. Root Locus Plot
4. Bode Plot
5. Polar plot & Nyquist Stability Criterion Experiments on
(1) Hydraulic System
(2) Control System

ME 301 PRODUCTION PROCESS - II C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	**Jigs And Fixtures:-** Introduction, definition and difference; usefulness of jigs and fixtures; design considerations; materials used; principles and methods of location; clamping elements; jig bushes; drilling jigs; fixtures for milling turning, boring and welding; assembly fixtures; indexing devices; economics of jigs and fixtures; complete design of a jig and a fixtures; complete design of a jig and a fixtures.	7
II	**Plastic Technology:** Introduction, Classification of Plastics, Ingredients of Moulding compounds, General Properties of Plastics, Plastic part manufacturing processes such as compression moulding, transfer moulding, injection moulding, extrusion moulding, blow moulding, calendaring, thermoforming, slush moulding, laminating	7
III	**Precision Measurement :** Standards of linear measurements; linear and angular measurements; screw thread measurement; measurement of effective diameter, pitch and thread angles; Gear measurement, measurement of tooth profile, tooth thickness and pitch, Measurement of surface roughness. Quantitative methods of roughness measurements, Stylus and profilograph methods. **Precision Measuring Instruments:** Comparators types; working principles applications and limitations of various comparators; optical flat; autocollimator indicators, slip gauges, bevel protector.	7
IV	**Design Of Single Point Cutting Tools:** Introduction; functions of various tool angles; design of single point turning too]; parting tool; empirical determination of force components; optimum value of tool angles..	7
V	**Design of Multipoint Cutting tool:** Introduction; angle of contact; force analysis; approach through dimensional analysis; force and power consumption; tooth forn1 and cutter design	7

Reference Books:

1. Manufacturing Science, Ghosh, A. and Mallik, A.K., Affiliated East West Press
2. Modern Machining Processes, P.C.Pandey, H.S.Shah, TMH
3. Machine Tool Design: N.K.Mehta, Tata McGraw Hill
4. Production Engineering Sciences by P.C.Pandey & C.K.Singh, Standard Publishers & Distributors Delhi
5. Production Engineering by P.C.Sharma, S.Chand & Co.Pvt, Ltd., New Delhi.
6. Fundamentals of tool design: F.W.Willson, Astme

ME 302 DYNAMICS OF MACHINE - II C (L, T, P) = (3, 1, 0)

Units	Course Contents	Hrs.
I	Governors: Watt, Porter, Proell, Hartnell and spring controlled governors, governor effort, power, stability, inertia effects.	7
II	Inertia force analysis: Velocity and acceleration of slider crank and four bar mechanism, inertia force, piston thrust and forces on connecting rod, turning moment diagram, flywheel.	7
III	Gears: Law of gearing, terminology, tooth form, standard interchangeable tooth profile, minimum number of teeth on pinion in contact with gear or rack, interference and undercutting, bevel, helical and spiral gears.	7
IV	Gear trains: Simple, compound, reverted and epicyclic gear trains, analytical, tabular, graphical and vector methods for velocity ratio, gear boxes- sliding and constant mesh for automobiles.	7
V	Balancing: Balancing of rotating masses, balancing of reciprocating masses, locomotives, IC engines, balancing machines.	7

Reference Books:

1. The Theory of Machines, Thoman Beaven, CBS publishers & Distributors, Delhi
2. Theory of Mechanisms and Machines; Jagdish lal, Metropolitian Book Co. Ltd, New Delhi
3. Theory of Machines; P.L. Ballaney, Khanna Publishers, Delhi
4. Theory of Mechanisms & Machines; A Ghosh & A.K.Malik. Affiliated East West Press Pvt. Ltd., new Delhi
5. Theory of Machines & Mechanisms; J.E.Shigley & J.J. Ulcker, McGraw Hill International Edition
6. Kinetics & Dynamics of Machines; G.H. Martin, McGraw Hill

ME 303 FLUID MACHINES C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	**Review of fundamentals -** Euler's turbine equation, principles of similarity applied to hydraulic machines, non-dimensional specific speed. Classification of turbines on the basis of non-dimensional specific speed. Unit and specific quantities. **Impact of Free Jets -** Impulse momentum principle, force exerted by the jet on stationary flat and curved plate, hinged plate, moving plate and moving curve vanes.	7
II	**Impulse Turbine -** Classification of turbine, impulse turbines, Pelton wheel, Construction, working. Work done, head, efficiency and design aspects. Governing of impulse turbine.	7
III	**Reaction Turbine -** Radial flow reaction turbine, Francis turbine: construction and working. Work done, efficiency, design aspects. **Axial flow reaction turbine -** Propeller and Kaplan turbine, bulb or tubular turbine- construction and working. Draft tube, governing of reaction turbine. Performance characteristics and comparison of all the turbines. Cavitation Phenomenon in hydraulic machines	7
IV	**Reciprocating Pumps -** Classification, component and working, single acting and double acting, discharge, work done and power required, coefficient of discharge, indicator diagram, slip, effect of friction and acceleration theory of air vessels. **Fluid system -** Hydraulic accumulator, Hydraulic intensifier, Hydraulic Press, hydraulic crane, hydraulic lift, hydraulic Ram, hydraulic coupling, hydraulic torque converter, air lift pump, jet pump.	7
V	**Rotodynamic Pump**: Classification, Centrifugal pumps, Vector diagrams, Specific speed head, power and efficiency calculations model testing performance characteristics. Experimental determination of pump characteristics, Pump Characteristics curves from flow versus specific speed Parallel and series connection of pump of common pipe line, Selection of pumps, Cavitation and abraisive wear of pumps, Non-stable operation of pump.	7

Reference Books:

1. Engineering Fluid Mechanics K.L.Kumar, Eurasia Publishing House (P) Ltd.
2. Fluid Mechanics & Machine, F.M.White, John Wiley & Sons
3. Fluid Mechnaics & Machine, A.K. Jain
4. Fluid Mechanics, V.L.Streeper, McGraw Hill
5. Fluid Machanics with Applications. S.K.Gupta V.Gupta, New Age Publications

ME 304 HEAT AND MASS TRANSFER C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	Introduction to heat transfer processes, conduction and radiation. Fourier's law of heat conduction, thermal conductivity, thermal conductivity of solids, liquids and gases, effect of temperature on thermal conductivity. Newton's law of cooling, definition of overall heat transfer coefficient. General parameters influence the value of heat transfer coefficient. **Conduction :** General 3-Dimensoinal conduction equation in Cartesian , cylindrical and spherical coordinates; different kinds of boundary conditions; nature of differential equations; one dimensional heat conduction with and without heat generation; electrical analogy; heat conduction through composite walls; critical thickness of insulation.	7
II	Heat transfer from finned surfaces; fin efficiency and effectiveness, two dimensional steady state heat conduction using analytical and numerical methods, periodic heat conduction. **Heat exchanger:** Different types of heat exchangers, arithmetic and logarithmic mean temperature differences, heat transfer coefficient for parallel, counter and cross flow type heat exchanger; effectiveness of heat exchanger, N.T.U. method, fouling factor.Constructional and manufacturing aspects of Heat Exchangers.	7
III	**Natural convection:** Dimensional analysis, Granhoff number, boundary layers in external flows (flow over a flat plate only), boundary layer equations and their solutions, heat transfer correlations. Convection: review of Navier – Stokes and energy equation, hydrodynamic and thermal boundary layers; laminar boundary layer equations; forced convection appropriate non dimensional members; effect of Prandtl number; empirical relations for flow over a flat plate and flow through pipes. **Heat transfer with change of phase**: nature of vaporization phenomena; different regimes of boiling heat transfer; correlations for saturated liquid vaporization; condensation on flat plates; correlation of experimental results, drop wise condensation.	7
IV	**Thermal Radiation:** Plank distribution law, Krichoff's law; radiation properties, diffuse radiations; Lambert's law. Radiation intensity, heat exchange between two black bodies heat exchanger between gray bodies. Shape factor; electrical analogy; reradiating surfaces heat transfer in presence of reradiating surfaces.	7
V	**Introduction to Mass Transfer:** Mass and mole concentrations. molecular diffusion, eddy, diffusion from an evaporation fluid surface. Mass transfer in laminar and turbulent convections. Raynold's analogy. Combined heat and mass transfer the wet and dry build thermometer	7

Reference Books:

1. Fundamental of heat and mass transfer, R.C.Schdeva, New Age Publication
2. Fundamental of heat and mass transfer, C.P.Kothandaraman, New Age Publication
3. Process Heat and Mass transfer, KERN, TMH
4. Heat and Mass transfer, Dr. D.S.Kumar, S.K.Kataria & Sons
5. Heat and Mass transfer, Alan J. Chapman, Macmillan Publishing company, New York
6. Heat transfer, J.P.Holman. TMH

ME 305 DYNAMICS OF MACHINE - I C (L, T, P) = (3, 1, 0)

Units	Course Contents	Hrs.
I	**Kinematics:** Element. pairs, mechanisms, four bar chain and its inversions, velocity and acceleration, Klein construction, corolis component, Instantaneous centre method, synthesis of mechanism, panto graph, Scott-Russel, Tchbeicheff staright line, indicator diagram mechanisms.	7
II	**Automotive vehicle mechanisms:** Overhead value mechanism, Davis and Ackerman steering mechanism, Triffler suspension and Hookes Joint	7
III	**Brakes and dynometers:** Band, Block and band & block brakes, braking action, absorption and transmission type dynamometers, prony, rope and hydraulic dynamometers braking system of automobiles.	7
IV	**Cams:** Types of cams, displacement, velocity and acceleration curves for different cam flowers, consideration of pressure angle and wear, analysis of motion of followers for cams with specified contours.	7
V	**Gyroscope:** Principle of gyroscope couple, effect of gyroscopic couple and centrifugal force on vehicle taking a turn, stabilization of sea vessels.	7

List of Recommended Books:

1. The Theory of Machines, Thoman Beaven, CBS publishers & Distributors, Delhi
2. Theory of Mechanisms and Machines; Jagdish lal, Metropolitian Book Co. Ltd, New Delhi
3. Theory of Machines; P.L. Ballaney, Khanna Publishers, Delhi
4. Theory of Mechanisms & Machines; A Ghosh & A.K.Malik. Affiliated East West Press Pvt. Ltd., new Delhi
5. Theory of Machines & Mechanisms; J.E.Shigley & J.J. Ulcker, McGraw Hill International Edition
6. Kinetics & Dynamics of Machines; G.H. Martin, McGraw Hill

ME 306 STEAM TURBINE AND STEAM POWER PLANT C (L, T, P) = (3, 1, 0)

Units	Course Contents	Hrs. 35
I	**Steam Turbines:** Principle and working of steam turbines, type of turbines, impulse and reactions, compounding for pressure and velocity. Velocity triangles for various types.	7
II	Stage efficiency, diagram efficiency, steam speed to blade, speed ratio for optimum performance. Energy losses in steam turbine, turbine performance at various loads and governing of steam turbines. Constructional details and description of steam turbine components in brief.	7
III	**Regenerative feed heating cycles:**Introduction : Most Ideal Regenerative feed heating cycle. Regenerative feed heating cycles and their representation on T-s and h-s Diagram. Representation of actual process on T-s and h-s Diagram Regenerative cycles. Other types of feed heating arrangements. Optimum feed water temperature and saving in Heat Rate. Feed Heaters, Direct Contact Heaters, Surface Heaters. **Reheating – Regenerative and Regenerative water – Extraction Cycles.** Reheating of steam, Practical reheating and Non- reheating cycles, advantage & disadvantages of reheating, regenerative water extraction cycles, practical feed heating arrangements.	7
IV	Governing and performance of Steam Turbines. Description of back pressure Turbines, pass-out Turbines and Mixed Pressure Turbines.	7
V	**Steam Power Plant -** Steam power plants selection of location, working medium. Fuels and fuel handling equipments, ash handling equipments. Air pre-heater, feed water treatment. Methods of combustion and various type of combustors. Types of boilers. Modern developments in steam boilers. Description of cooling tower.	7

Reference Books:

1. Steam and Gas Turbines, R. Yadav, Central Publishing House, Allahabad
2. Thermodynamics and heat Power Engineering. Vol. I, M.L.Mathur and F.S.Mehta, Jain

ME 307 FUNDAMENTALS OF AERODYNAMICS C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs. 35
I	Aerodynamic forces and moments over the body surface, concept of lift and drag, dimensionless force and moment coefficient, centre of pressure of an aerofoil, nomenclature of aerofoil, angle of attack, circulation and lift over an-aerofoil, Kutta condition, Kelvin's circulation theorem.	7
II	Blade theory; Symmetrical and non-symmetrical aerofoil. Energy transfer in terms of lift and drag, cascade nomenclature, turbine cascade nomenclature, cascade lift and drag coefficient.	7
III	Isentroic Flow: Velocity of sound; Mach angle; Mach number, steady isentropic flow through ducts; use of isentropic tables; condition for maximum discharge; choked flow; flow through convergent and convergent-divergent nozzle, supersaturated flow in nozzle.	7
IV	Adiabatic flow and flow with Heat Transfer: Adiabatic flow; Fanno line tables; entropy change; choking due to friction; flow through long ducts; Diabatic flow ; Rayleigh line; use of tables; change in entropy; effect of change in stagnation temperature.	7
V	Normal Shock: Plane stationary normal shock; Ranking-Hugoniot relations; increase in entropy; Prandtl's relations; change in stagnation pressure across the shock.	7

Reference Books:

1. Compressible Flow by S.M.Yahya
2. Gas Dynamics, R.K.Prohit
3. Fundamentals Of Aerodynamics by Anderson
4. Basic concept of fluid mechanics by R.K.Bansal

ME 308 AUTOMOBILE ENGINEERING C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	FRAME & BODY: Layout of chassis, types of chassis frames and bodies, their constructional features and materials. TRANSMISSION SYSTEM**:** Clutch; single plate, multiplate, cone clutch, semi centrifugal, electromagnetic, vacuum and hydrautic clutches. Fluid coupling.	7
II	Gear boxes, Sliding mesh, constant mesh, synchromesh and epicyclic gear boxes, Automatic transmission system; Hydraulic torque converter; overdrive, propeller shaft, universal joints, front wheel drive, differential; Rear axle drives. Hotchkiss and torque tube drives; rear axle types; Two wheel and four wheel drive. BRAKES ; Classification and function; Mechanical, hydraulic, vacuum air and self engineering brakes; Brake shoes and lining materials.	7
III	RUNNING GEAR: Types or wheels and tyres. Tyre construction; tyre inflation pressure, tyre wear and their causes; re-treading of the tyre, Steering system, steering gear boxes, Steering linkages, steering mechanism, under and over steering. Steering Geometry, effect of camber, caster, king pin inclination, toe in and toe out; power steering; integral and linkage types suspension system; objects and requirements, suspension spring, front and rear suspension systems, Independent suspension system shock absorber.	7
IV	AUTOMOTIVE ELECTRICAL SYSTEM: Battery construction, Charging and testing, battery types, Starting and Battery Charging System: Starter motor construction, types of drive, Alternator construction, regulation and rectification. Ignition System: magneto and coil ignition systems, System components and requirements, Automotive lighting : Wiring systems Electrical instruments; head lamp, electric horn, fuel level indicator.	7
V	AUTOMOTIVE AIR CONDITIONING: Introduction, Loads, Air conditioning system Components, Refrigerants, Fault Diagnosis. AUTOMOTIVE SAFETY: Safety requirements, Safety Devices, Air bags, belts, radio ranging, NVS (Night Vision System) GPS (Global Positioning System) etc.	7

Reference Books:

1. Automobile Engineering, R.K.Sharma
2. Automobile Engineering, Kirpal Singh, Vol. 1 & 2
3. Automotive Chassis and Body, P.L.Kohli, Vol.1 & 2
4. Vehicle Engine and Technology, Heisler, ELBS
5. Automotive Transmission, Mathias F., Brejcha, Prentice Hall.

ME 309 MECHANICAL VIBRATION AND NOISE ENGINEERING C (L, T, P) = (3, 1, 0)

Units	Course Contents	Hrs.
I	Sound level and subjective response to sound; Frequency dependent human response to sound, Sound pressure dependent human response. Decibel scale; Decibel addition, subtraction and averaging. Relationship among sound power, sound intensity and sound pressure level. Sound spectra. Octave band analysis. Loudness. Noise: Effects, Ratings and Regulations; Non-auditory effects of noise on people, Auditory Effects of noise, Noise standards and limits in India. Major sources of the noise; Industrial noise sources. Industrial noise control-strategies; Noise control at the source, Noise control along the path, Acoustic barriers, Noise control at the receiver.	7
II	Scope of vibration, important terminology and classification, Degrees of freedom, Harmonic motion; vectorial representation, complex number representation, addition. Derivation of equation of motion for one dimensional longitudinal, transverse and torsional vibrations without damping using Newton's second law, D' Alembert's principle and Principle of conservation of energy. Compound pendulum and centre of percussion. Damped vibrations of single degree of freedom systems. Viscous damping; under damped, critically damped and over damped systems, Logarithmic decrement. Vibration characteristics of Coulomb damped and Hysteretic damped systems.	7
III	Forced vibrations of single degree of freedom systems. Forced vibration with constant harmonic excitation. Steady state and transient parts. Frequency response curves and phase angle plot. Forced vibration due to excitation of support. Vibration Isolation and transmissibility; Force transmissibility, Motion transmissibility. Forced vibration with rotating and reciprocating unbalance. Materials used in vibration isolation.	7
IV	System with two degrees of freedom; principle mode of vibration, Mode shapes. Undamped forced vibrations of two degrees of freedom system with harmonic excitation. Vibration Absorber; Undamped dynamic vibration absorber and centrifugal pendulum absorber.Many degrees of freedom systems: exact analysis.	7
V	Many degrees of freedom systems: approximate methods; Rayleigh's, Dunkerley's, Stodola's and Holzer's methods. Vibrations of continuous systems; Transverse vibration of a string, Longitudinal vibration of a bar, Torsional vibration of a shaft.	7

Reference Books:

1. Mechanical Vibrations; G.K.Grover, Nemi Chand & Bros., Roorkee
2. Vibration Theory & Applications; W.T.Thomson
3. Vibration & Noise for Engineers; K.K.Purja, Dhanpat Rai & Sons, Delhi
4. Theory & Problems of Mechanical Vibrations; W.W.Seto, Schaum's Outline Series, McGraw Hill International Editions
5. Mechanical Vibrations, Den Hartog
6. Vibration Problems in Engineering, Timshenko

ME 310 INDUSTRIAL ENGINEERING - II C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	**EVALUATION OF WORK STUDY:** Work of F.W. Taylor, Frank and Lillian Gilbreth and others; Productivity definition, Means of increasing productivity work study, Human Factor in the application of work Study. **Motion Study; Definition, aims**; Procedure for method study: selection of jobs; Recording Techniques: Micro motion study: Therbligs; Cychography and Chronocycle graph: Principles of motion economy. design of work place layout: Analysis in the form of a chart; operation chart; flow process chart; flow diagrams; string diagram; Man Machine chart; Two hand chart; Simon chart.	7
II	**Work Measurement (Time Study):** Definition; uses; procedure; time study equipment; performance rating; allowances, number of cycles to be studied. Determination of standard time: Predetermined Motion Time Systems. **Job Evaluation:** Objective of job evaluation; Methods of Job evaluation; Non-quatative and quantative.	7
III	**Production Planning and Control:** Types of production; function of production planning and control; planning Preplanning, sales forecasting; routing; Scheduling; dispatching and control with other departments. Plant Location and Layout: Selection of site, layout contributing factors. Facilities available from Govt. and autonomous agencies, Material handling system and equipments; layout according to the manufacturing system. Procedure and techniques of layout and line balancing.	7
IV	QUALITY CONTROL: Operational and economic definition of quality control, objectives of quality control; Statistical quality control, Process capability studies: Control charts for variable, control charts for average outgoing quality	7
V	**Materials Managements:** Field and Scope of materials management material planning and Programme. ARC control policy inverter, control Economic lot size, lead time and recorder point, Inventory models (Deterministic only) **Wages and incentives:** Characteristics of a Good wage for incentive system. Methods of wage payment Concept of wage incentive schemes, financial and non financial Holsely premium plan. Merric's Multiple piece rate system.	7

Reference Books:

1. Introduction to Study, ILO Publishers.
2. Statistical Quality Control, Grant EL& Leawethwarts R.S., McGraw Hill.
3. Facility Layout& Location, Francis R.C.& White J.A.Prentice Hall.
4. Production and Operations Management, Adam Everett E& Ebert Ronald J.PHI
5. Production and operations management; E.W.S. Buffa and S.Kapoor.

ME 311 FACILITIES PLANNING & MATERIAL HANDLING C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs. 35
I	Plant Location: The ideal location. Proximity to market. Proximity to raw materials, Transportation costs. The labour supply. electric power. Water and land costs. Local Taxes. Security from attack. Specialised communities, Climate, Urban, Suburban, and small town locations, Plant location trends, Best location for small plants. Incentive offered by State Government for dispersal of industries. Planned Industrial centres Government industrial estate - public sector plants and their location, growing competition for industry amoung states to locate in their midst. centralisation v/s decentrlisation - decentralisation by horizontal and vertical methods. soures of informationconcerninglocation. Moving to a new location. Moving costs. To lease or buy or build an industrial plant.	7
II	Plant Location techniques: Euclidean distance, squared euclidean distance, rectilinear distance, linear distance methods, Prolems on multi-location. Plant layout: introduction to plant design, types of manufacturing processes. Plant location, influence of location on layout, Industrial Buildings. Influences of Buildingon Layout, Classical types of layout product layout and Process layout and practical layouts.	7
III	Planning the Layout: Various operational Research techniques for balancing of assembly lines, Fabrication line balancing. Safety Engineering; Safety in Machine shop, forging shop, carpentry shop, welding shop and foundary shop. safety in critical storage area. storing explosive materials, gases and inflammable liquids.	7
IV	MATERIAL HANDLING: Types of materials handled in an engineering plant, basic principles of material handling. Engineering and economic factors. Classifications of material handling equipment's according to operating principle, construction and nature of service. Gravity equipment's - Chutes, belt and rolling conveyers. Gravity roller spirit's Fixed systems of power driven conveyers, Belt, chain slot, apron, wire aush, Pellet, roller flight, cross bar and chain trolley type of conveyers, Arm, vertical Belt and suspended tray type of elevatos, reciprocation elevators industrial elevators, screw conveyers, ribbon conveyers, bucket elevators, etc. Skip hoists, drag scrapers, tramways and cableways, Pneumatics and hydraulic conveyers.	7
V	Cranes ; jib electric overhead travelling (E.O.T.), cantilever cranes. Track systems; Overhead track of onorail system. Industrialrailways,locomotivecranes.Portable conveyers; Hand trucks, Forkit trucks. Container systemof transport; Unit loads, standardisation of unit load handlig Co-ordination of handling with production; copntinous, repititive and intermittent type. Applicationof time and motion study. Organisational and selection of material handling system. Operation, maintenence, and safety precaution Selection of plant layout from material handling criterial.	7

Reference Books:

1. Practical Plant Layout, Muther, McGraw Hill
2. Plant Layout & Design, Immer, McGraw Hill
3. Material Handling, Immer, McGraw Hill
4. Facilities Planning, Tomphins James A & White John Wiley & Sons.
5. Facility Layout & Location, Francis R.C. & White J.A.Prentice Hall.

ME 312 **MECHATRONICS** **C (L, T, P) = (3, 0, 0)**

Units	Course Contents	Hrs.
I	Introduction about Mechatronics, scope of Mechatronics, application, process control automation and N/c Machines.	7
II	**Sensors and Transducers -** Introduction, classification, specification, characteristics of transducers, type of transducers displacement, strain, vibration pressure, flow, temperature, force & torque, tactile.	7
III	**Hydraulic Pneumatic & Electrical actuators -** Pumps & Compressors, control valves & accessories, actuators, fluid power symbols, fluid power systems, switching devices, solenoids, motors.	7
IV	**Data Acquisition and Control System -** Introduction, Quantitizing theory, Analog to Digital Conversion, Digital to Analog (D/A) conversation, transfer function, transient response & frequency response & frequency response, stability criteria.	7
V	**Design of Mechatronic systems -** Introduction, Automatic front and book and cutting in steel rolling mill, lift control system, CNC lathe, temperature control of a heat treatment furnace, EOT crane control panel, Grey grain separators, electrode arm control in electric arc furnace.	7

Reference Books:

1. Mechatronics Engineering, Tomkinson, D. and Horne, J., McGraw Hill, 1996
2. Mechatronics, Bolton, W., Longman, 1995
3. Mechatronics, HMT Hand Book, 1998
4. Understanding Electro-Mechanical Engineering, Kamm, L.J., IEEE Press, New York, 2000
5. Nitaigour Premchand Mahalik, Mechatronics, Tata Mcgraw-Hill
6. J.P. Holman, Mechanical Measurements,McGraw-Hill
7. T.K.Kundra, P.N.Rao And N.K.Tewari,Numerical Control and Computer Aided Manufacturing,Tata McGraw-Hill,

ME 314 **CRYOGENIC ENGINEERING** **C (L, T, P) = (3, 0, 0)**

Units	Course Contents	Hrs.
I	Refrigeration and liquefaction principals; Joule Thomson effect and inversion curve; Adiabatic and isenthalpic expansion with their comparison. Properties of cryogenic fluids; Properties of solids at cryogenic temperatures; Superconductivity. Gas liquefaction systems: Recuperative – Linde – Hampson, Claude, Cascade, Heylandt, Kapitza, Collins, Simon.	7
II	Regenerative – Stirling cycle and refrigerator, Slovay refrigerator, Gifford-McMahon refrigerator, Vuilleumier refrigerator, Pulse Tube refrigerator; Liquefaction of natural gas. Cryogenic insulation: Vacuum insulation, Evacuated porous insulation, Gas filled Powders and fibrous materials, Solid foams, Multilayer insulation, Liquid and vapour Shields, Composite insulations.	7
III	Storage of cryogenic liquids; Design considerations of storage vessel; Dewar vessels; Industrial storage vessels; Storage of cryogenic fluids in space; Transfer systems and Lines for cryogenic liquids; Cryogenic valves in transfer lines; Two phase flow in Transfer system; Cool-down of storage and transfer systems.	7
IV	Cryogenic instrumentation: Measurement of strain, pressure, flow, liquid level and Temperature in cryogenic environment; Cryostats. Cryogenic equipment: Cryogenic heat exchangers – recuperative and regenerative; Variables affecting heat exchanger and system performance; Cryogenic compressors, Pumps, expanders; Turbo alternators; Effect of component inefficiencies; System Optimization.	7
V	Magneto-caloric refrigerator; ^{3}He-^{4}He Dilution refrigerator; Cryopumping; Cryogenic Engineering applications in energy, aeronautics, space, industry, biology, preservation Application of Cryogenic Engineering in Transport	7

Reference Books:

1. Cryogenics: Applications and Progress, A. Bose and P. Sengupta, Tata McGraw Hill.
2. Cryogenic Engineering, T.M. Flynn, Marcel Dekker
3. Handbook of Cryogenic Engineering, Editor – J.G. Weisend II, Taylor and Francis
4. Cryogenic Systems, R. Barron, Oxford University Press.
5. Cryogenic Process Engineering, K.D. Timmerhaus and T.M. Flynn, Plenum Press.
6. Cryogenic Fundamentals, G.G. Haselden, Academic Press.
7. Advanced Cryogenics, Editor – C.A. Bailey, Plenum Press.
8. Applied Cryogenic Engineering, Editors – R.W. Vance and W.M. Duke, John Wiley & sons.

ME 316 WELDING ENGINEERING C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	Welding as compared with other fabrication processes. Basic classification of welding processes. Mechanism of arc initiation and maintenance, temperature distribution in arc. Arc characteristics and forces. Fusion welding: Critical reviews of manual metal arc, TIG, MIG Co_2 & submerged arc welding electroslag & Electro gas welding.	7
II	Electrode selection, filler materials, fluxes. Specifications and characterization of various power sources in arc welding, mechanism and type of metal transfer in arc welding, factors controlling melting rate in welding processes influence of magnetic field on are welding characteristics. .	7
III	Resistance welding: Techniques & application of various resistance welding processes, Thermit welding, solid state welding, Friction, diffusion & cold pressure welding metal cladding, Modern welding processes: Ultrasonic, Electoral beam, Plasma arc; welding Metal Spraying. .	7
IV	Welding metallurgy: Weld ability, metallurgical changes occuring during fusion welding, welding of ferrous and non-ferrous metals and alloys. Effect of alloying elements in welding. Heat flow in welding peak temperature, width of heat affected zone. Cooling rates and solidification rates, weld thermal cycles, residual stresses and their measurement, weld distortion and its prevention. Thermal cutting processes: Oxygen cutting, plasma arc cutting, air carbon cutting & laser cutting techniques.	7
V	Welding defects testing & adhesive bonding. mechanism, techniques & scope of brazing, soldering and bonding processes. Weld cracking: Mechanism of cold and hot cracking, Hydrogen embrittlement, determination of hydrogen dissolved in weld metal techniques for welding without hydrogen. Specific applications of welding: Welding of pressure vessels, industrial piping, reactor metals, Storage tanks, cladding, metallizing and surfacing. Under water welding. .	7

Reference Books:

1. Welding Handbook, American Welding Society.
2. Welding Processes, Croft, Cambridge University Press.
3. Welding for Engineers, Udin Fruk & Wultf, John Wiley
4. Welding Technology, Rossi, McGraw Hill

ME – 318 Automobile and IC engine C (L, T, P) = 3(3, 0, 0)

Units	Course Contents	Hrs.
I	FRAME & BODY: Layout of chassis, types of chassis frames and bodies, their constructional features and materials. TRANSMISSION SYSTEM**:** Clutch; single plate, multiplate, cone clutch, semi centrifugal, electromagnetic, vacuum and hydrautic clutches. Fluid coupling.	7
II	Gear boxes, Sliding mesh, constant mesh, synchromesh and epicyclic gear boxes, Automatic transmission sytem; Hydraulic torque converter; overdrive, propeller shaft, universal joints, front wheel drive, differential; Rear axle drives. Hotchkiss and torque tube drives; rear axle types; Two wheel and four wheel drive. BRAKES; Classification and function; Mechanical, hydraulic, vacuum air and self engineering brakes; Brake shoes and lining materials. RUNNING GEAR: Types or wheels and tyres. Tyre construction; tyre inflation pressure, tyre wear and their causes; re-treading of the tyre, Steering system, steering gear boxes, Steering linkages, steering mechanism, under and over steering. Steering Geometry, effect of camber, caster, king pin inclination, toe in and toe out; power steering; integral and linkage types suspension system; objects and requirements, suspension spring, front and rear suspension systems, Independent suspension system shock absorber.	7
III	AUTOMOTIVE ELECTRICAL SYSTEM: Battery construction, Charging and testing, battery types, Starting and Battery Charging System : Starter motor construction, types of drive, Alternator construction, regulation and rectification. Ignition System: magneto and coil ignition systems, System components and requirements, Automotive lighting : Wiring systems Electrical instruments; head lamp, electric horn, fuel level indicator. AUTOMOTIVE AIR CONDITIONING: Introduction, Loads, Air conditioning system Components, Refrigerants, Fault Diagnosis. AUTOMOTIVE SAFETY: Safety requirements, Safety Devices, Air bags, belts, radio ranging, NVS (Night Vision System) GPS (Global Positioning System) etc.	7
IV	Air Standard Cycles: Internal and external combustion engines; classification of I.C. Engines, Cycles of operation in four stroke and two stroke I.C. Engines, Wankel Engines, Assumptions made in air standard cycle; Otto cycle; diesel cycle, dual combustion cycle, comparison of Otto, diesel and dual combustion cycles; sterling and Ericsson cycles; air standard efficiency, specific work output, specific weight; work ratio; mean effective pressure; deviation of actual engine cycle from ideal cycle. Problems. Carburetion, fuel Injection and Ignition systems: Mixture requirements for various operating conditions in S.I. Engines; elementary carburetor, Requirements of a diesel injection system; types of inject systems; petrol injection, Requirements of ignition system; types of ignition systems ignition timing; spark plugs. Problems.	7
V	Combustion in I.C. Engines : S.I. engines; Ignition limits; stages of combustion in S.I. Engines; Ignition lag; velocity of flame propagation; detonation; effects of engine variables on detonation; theories of detonation; octane rating of fuels; pre-ignition; S.I. engine combustion chambers, Stages of combustion in C.I. Engines; delay period; variables affecting delay period; knock in C.I. engines, Cetane rating; C.I. engine combustion chambers. Lubrication and Cooling Systems: Functions of a lubricating system, Types of lubrication system; mist, wet sump and dry sump systems; properties of lubricating oil; SAE rating of lubricants, engine performance and lubrication, Necessity of engine cooling; disadvantages of overcooling; cooling systems; air-cooling, water cooling; radiators.	7

Reference Books:

1. Automobile Engineering, R.K.Sharma
2. Automobile Engineering, Kirpal Singh, Vol. 1 & 2
3. Automotive Chassis and Body, P.L.Kohli, Vol.1 & 2
4. Vehicle Engine and Technology, Heisler, ELBS
5. Automotive Transmission, Mathias F., Brejcha, Prentice Hall.
6. Internal Combustion Engines –V. Ganesan, Pub.-Tata McGraw-Hill.
7. Internal Combustion Engines & Air pollution- Obert E.F, Pub.-Hopper & Row Pub., New York

ME 351 PRODUCTION PROCESS LAB-II C (L, T, P) = (0, 0, 3)

(PERFORM ANY SIX EXPERIMENTS)
1. To study of single point cutting tool geometry & to grind the tool to the given tool geometry. Write importance of various angles and to prepare a capacity chart of the Tool & cutter grinder.
2. Prepare a hexagonal/octagonal nut using indexing head on milling m/c and to cut bsw/ metrix internal threads on lathe (to meet with job).
3. To prepare the capacity chart for a lathe machine.
4. To cut multi-start square/metric thread.
5. To cut external metric threads & to mesh it with the nut (drg).
6. Prepare the process chart for the job.
7. To perpare the job by eccetric turning on lathe machine drawing.
8. To study shaper machine & its mechanism and calculate its quick return ratio.
9. To prepare a job on shaper from given mild Steel rod drawing
10. To study the effect of rake angle on chip thickness ratio and the shear angle in orthogonal machining.
11. Using drill dynamometer measure the torque and thrust force in drilling and to plot the characteristics, torque, force & power v/s speed & feeds.
12. To measure effective diameter of a screw thread by three wire method.
13. To perform alignment test on a centre lathe
14. To calibrate pneumatic comparator and measure taper of a given work peice.

ME 352 DYNAMICS OF MACHINES LAB.-II C (L, T, P) = (0, 0, 3)

(PERFORM ANY SIX EXPERIMENTS)
1. To plot. Force v/s radius and lift v/s. speed curves for governors
2. To plot pressure distribution curves on a journal bearing.
3. To Perform wheel balancing.
4. To perform static and dynamic balancing on balancing setup.
5. Study of a lathe gear box
6. Study of a sliding mesh automobile gear box.
7. Study of a planetary gear box

ME 353 FLUID MACHINES LAB. C (L, T, P) = (0, 0, 2)

(PERFORM ANY SIX EXPERIMENTS)
1. To Draw operating characteristics of Pelton wheel
2. To Draw operating characteristics of Francis turbine at 40%, 60% and full gate opening
3. To Draw operating characteristics of Kaplan turbine at different loads
4. To Draw operating characteristics of Centrifugal pump at 3 to 4 speeds
5. To plot discharge v/s lift curve for different flow rates in hydro ram
6. To Draw operating characteristics of centrifugal pump and determine surging point.

ME 354 HEAT AND MASS TRANSFER LAB. C (L, T, P) = (0, 0, 2)

(PERFORM ANY SIX EXPERIMENTS)
1. To find emissivity of a grey body relative to a given block body.
2. Perform parallel and counter flow heat exchanger.
3. To find out the Stefan Boltzmen constant.
4. To perform experiment on pin fin test rig in forced convection by neglecting radiation losses & to calculate. Convective heat transfer coefficient. (Experimentally & empirical correlation), Efficiency, Effectiveness, Comparison of experimental & theoretical temperature profile.
5. Repeat the same exercise by considering radiation losses
6. To find convectively heat transfer coefficient of a given cylinder in vertical position by neglecting radiation losses by assuring, constant surface temperature, constant heat flux & compare with experimental heat transfer coefficient by neglecting radiation losses & by considering radiation losses.
7.Perform the experiment No.5 by using cylinder in horizontal position

ME 355 DYNAMICS OF MACHINES LAB. -I C (L, T, P) = (0, 0, 3)

(PERFORM ANY SIX EXPERIMENTS)
1. To study inversion of four bar chain
2. Coupling Rod
3. Beam Engine
4. Steering Mechanism
   (a) Study of quick return mechanism.(Crank and Slotted lever mech.)
   (b) To draw velocity and acceleration diagram for Crank and slotted lever mechanism.
5. Study of inversion of Double slider chain
   Oldhan Coupling
   Scotch Yoke
   Elleptical Trammel
6. To plot displacement v/s θ curve for various cams.
7. Study of various cam- follower arrangements.
8. To determine co-efficient of friction.
9. Study of various types of dynamometers, Brakes and Clutches.
10. To determine moment of inertia of the given object using of Trifler suspension.
11. To Verify the relation T=I.W.Wp. for gyroscope.

ME 358 AUTOMOBILE ENGG. LAB. C (L, T, P) = (0, 0, 2)

(PERFORM ANY SIX EXPERIMENTS)
1. Disassembling and assembling of multi-cylinder petrol and diesel engines and study of their parts.
2. To disassemble and assemble a 2-stroke petrol engine.
3. To disassemble and assemble a 4-stroke motor cycle engine and study of various engine parts.
4. Load test on a single cylinder 4-stroke diesel engine using a rope brake dynamometer and calculate volumetric and thermal efficiency and draw a heat balance-sheet.
5. Study of carburetors and MPFI system and disassembling and assembling of their parts.
6. To calculate valve timing of a multi-cylinder petrol engine and valve tappets adjustment.
7. Disassemble all the parts of a fuel injection pump and its parts study.
8. To disassemble the governor and study its various parts.

ME 359 MECHANICAL VIBRATION LAB C (L, T, P) = (0, 0, 2)

(PERFORM ANY SIX EXPERIMENTS)
1. To verify relation $T=2\sqrt{L/g}$ for a simple pendulum.
2. To determine radius of gyration of compound pendulum.
3. To determine the radius of gyration of given bar by using bifilar suspension.
4. To determine natural frequency of Spring mass System.
5. Equivalent spring mass system
6. To determine natural frequency of free torsional vibrations of single rotor system
   (a) Horizontal rotor (b) Vertical rotor.
7. To verify the Dunkerleys rule.
8. Study of free damped torsional vibration to performing the experiment to find out damping co-efficient.
9. To conduct experiment on trifilar suspension
10. Vibration of beams concept of more than one degree of freedom Excrtation using eccentric mass.
11. Critical speed of shafts.
12. Study of vibration measuring instruments.

ME 360 INDUSTRIAL LAB. C (L, T, P) = (0, 0, 3)

(PERFORM ANY SIX EXPERIMENTS)
1. Determination of time standard for a given job using stopwatch time- study.
2. Preparation of flow process chart, operation process chart and man-machine charts for an existing setup and development of an improved process.
3. Study of existing layout of a workstation with respect to controls and displays and suggesting improved design from ergonomic viewpoint.
4. To carryout a work sampling study.
5. To conduct process capability study for a machine in the workshop.
6. To design a sampling scheme based on OC curve.
7. To conduct Shewart's experiments on known population
8. Generation of random numbers for system simulation such as facility planning, job shop scheduling etc.

ME – 362 AUTOMOBILE And IC ENGG. LAB. C (L, T, P) = (0, 0, 3)

1. Disassembling and assembling of multi-cylinder petrol and diesel engines and study of their parts.
2. To disassemble and assemble a 2-stroke petrol engine.
3. To disassemble and assemble a 4-stroke motor cycle engine and study of various engine parts.
4. Load test on a single cylinder 4-stroke diesel engine using a rope brake dynamometer and calculate volumetric and thermal efficiency and draw a heat balance-sheet.
5. Study of carburetors and MPFI system and disassembling and assembling of their parts.
6. To calculate valve timing of a multi-cylinder petrol engine and valve tappets adjustment.
7. Disassemble all the parts of a fuel injection pump and its parts study.
8. To disassemble the governor and study its various parts.

ME 401 COMPUTER AIDED DESIGN C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	Overview of Computer Graphics, Picture representation, Coordinate Systems, Output Graphcis Display devices. Raster Scan Graphics : DDA for line generation and Bresenham's algorithm for line and circle generation.	7
II	Wire frame models, Parametric representation of curves, Plane curves : line, circle, ellipse, parabola and hyperbola. Space curves : Cubic spline curve, Bezier Curve and B Spline Curves. Blending of Curves.	7
III	Surface models and entities Parametric representation of Hermite Bicubic surfaces, Bezier surfaces and B-spline surfaces. Solid Models and entities, Solid Representation : B-rep. and CSG.Comparison between three types of models**.**	7
IV	Two and three dimensional transformation of Geometric models: Translation, Scaling Reflection, Rotation and Shearing. Homogeneous Representation, Combined Transformation. Projection of Geometric models: Parallel and Perspective Projection.	7
V	Clipping : Point clipping, Line clipping, Cohen- Sutherland algorithm etc. Viewing Transformation, Hidden Line and surface Removal : Techniques and Algorithms.	7

Reference Books:

1. Mathematical Elements for Computer Graphics, Rogers and Admas.
2. CAD/CAM Theory and Practice, Zied Ibrahim, Tata McGraw Hill.
3. Computer Graphics (Schaum Series), Plastock and Kalley.

ME 402 COMPUTER AIDED MANUFACTURING C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	Introduction: Overview of manufacturing processes, types of manufacturing systems, the product cycle, computer's role in manufacturing, sources and types of data used in manufacturing. The Beginning of CAM: Historical Background, Basic components of NC systems, NC Procedure, NC coordinate system and machine motions, applications and economics of NC.	7
II	Part programming- manual and computer assisted such as APT Language. Computer Controls In NC Systems: Problems with conventional NC computer numerical control, Direct numerical control, combined CNC/ DNC systems, adaptive control machining system computer process interfacing, New development and latest trends.	7
III	Computer Aided Process Planning: Traditional Process Planning, Retrieval process planning system, Generative Process Planning, Machinability data system, computer generated time standards. Group Technology: Introduction, part families, part classification and coding, coding system and machining cells.	7
IV	Compuer Aided Production Management Systems: Introduction to computer aided PPC, Introduction to computer aided inventory management, manufacturing resource planning (MRPII), computer process monitoring and shop floor control, computer process control. Computer Aided Quality Control: Computer in quality control, contact inspection methods, Non contact inspection methods, optical and non optical computer aided testing. Computer Aided Material Handling: Computer control on material handling, conveying, picking. Ware house control, computerized material handling for automated inspection and assembly.	7
V	Computer Integrated Manufacturing Systems: Introduction, types special manufacturing systems, flexible manufacturing systems (FMS). Collaborative Engineering**:** Introduction, Faster Design throughput, Web based design, Changing design approaches, extended enterprises, concurrent engineering, Agile and lean manufacturing.	7

Reference Books:

1. Automation, Production Systems and Computer Integrated Manufacturing by M.P.Grover, PHI
2. Principal of computer integrated manufacturing by S.Kant Vajpayee.
3. Numerical control and computer aided Manufacturing; Kundra, Rao & Tiwari, TMH.

ME 403 REFRIGERATION AND AIR - CONDITIONING C (L, T, P) = (3, 1, 0)

Units	Course Contents	Hrs.
I	**Introduction -** Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle. **Vapour Compression Refrigeration System -** Analysis of simple vapour compression Refrigeration cycle by p-h and T-S diagram. Effect of operating conditions, liquid vapour heat exchangers, actual refrigeration cycle. **Multiple Evaporator and compressor system -** Application, air compressor system, Individual compressor, compound compression, cascade system. Application, air compressor systems, individual compressor, compound compression, cascade system.	7
II	**Gas cycle Refrigeration -** Limitation of Carnot cycle with gas, reversed Brayton cycle, Brayton cycle with regenerative heat exchanger. **Air cycle for air craft -** Necessity of cooling of air craft, Basic cycle, boot strap, regenerative type air craft refrigeration cycle.	7
III	**Vapour Absorption System -** Simple Vapour absorption system, Electrolux Refrigerator, Analysis of Ammonia absorption refrigeration system, Lithium Bromide Absorption Refrigeration System. **Refrigerants -** Classification, Nomenclature, selection of Refrigerants, global warming potential of CFC Refrigerants. **Refrigeration Equipments -** Compressor, condenser, evaporator, expansion devices – types & working.	7
IV	**Other Refrigeration System:** Principle and applications of steam jet refrigeration system, Performance; vortex tube refrigeration, thermoelectric refrigeration systems. **Psychrometry-** Psychrometric properties, psychometric relations, pyschrormetric charts, psychrometric processes, cooling coils, By-pass factor and air washers. **Human Comfort -** Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart.	7
V	**Cooling load calculations -** Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychometric calculation for cooling, selection of air conditioning, apparatus for cooling and dehumidification, Air conditioning system. **Distribution and Duct systems:** Distribution of air in conditioned space et location, return and exhaust grills. Duct materials and sizing, design of Supply and return air ducts.	7

Reference Books:

1. Refrigeration and Air Conditioning, C.P.Gupta
2. Refrigeration and Air Conditioning, Ballarey
3. Refrigeration and Air Conditioning, C.P.Arora
4. Modern Air Conditioning-Practice, Narman E.Harris, Tata McGraw Hill.

ME 404 POWER PLANT ENGINEERING C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	**Introduction:** Introduction to generation of electrical power, Sources of energy, comparative merits, types of power plants. Review of growth of power & development of different types of power plants in India, future possibilities. Review of Steam power plant and gas power plant.	7
II	Diesel Power Plants: General layout; elements of diesel power plants; field of use; systems of diesel power plant; comparison with steam power plants (advantages and disadvantages). combined gas and steam power plants; Advantage of combined cycle, Introduction to integrated coal gasification combined cycle power plants	7
III	Nuclear Power Plants: Elementary concept of physics of generation of nuclear energy, Nuclear materials and waste disposal; nuclear fuels, fuel cycles, coolants, moderating and reflecting materials; cladding materials, shielding materials; Disposal of nuclear waste; General components of nuclear reactor, different types of nuclear reactors, Their construction and working; Location of nuclear power plants; Comparison of nuclear plants with thermal plants. Enrichment; safety and control. Fast breeder reacors and power plants	7
IV	Hydro-elecrtic power PLant: Classification and applications of Hydro-electric plant; Measurement of stream flow; capacity calculation of hydro-power, The hydro plant and its auxiliaries; automatic and remove control of hydro-systems. MHD geothermal, tidal & wind power plants.	7
V	Power Plant Economics: Load curves; different terms and definitions; cost of electrical energy; Selection of type of generation; Performance and operating characteristics of power plants; load division combined operation of power plants; load division between stations. Different systems of tariff.	7

Reference Books:

1. Power Plant Technology, M.M.El-Wakil, McGraw Hill Book Company
2. A Course in power Plant Engineering, Arora and Domkunwar Dhanpat Rai and Co.(P) Ltd.
3. Power Plant Engineering, Black and Veatch, CBS publication.

ME 405 OPERATION RESEARCH C (L, T, P) = (3, 1, 0)

Units	Course Contents	Hrs.
I	**Linear Programming-** Introduction & Scope, Problem formulation, Linear Programming: LP formulation, graphical method, simplex method, duality and Sensitivity analysis.	7
II	Transportation Model, Assignment Model, Sequencing problems, Network Flow, constrained optimisation and Lagrange multipliers. **Dynamic Programming-** Multistage decision problems & solution, Principle of optimality.	7
III	**Decision theory-**Decision under various conditions. **Game Theory-**Minimax & maximum strategies. Application of linear programming. **Integer Programming-** Cutting Plane method and Branch & Bound method	7
IV	**Deterministic and Stochastic inventory models-** Single & multi period models with continuous & discrete demands, Service level & reorder Policy. **Replacement Models:** Capital Equipment replacement with time, group replacement of tems subjected to total failure, Industrial staff problem, replacement problems under warranty condition.	7
V	**Simulations-** Need of simulation, advantages and disadvantages of simulation method of simulation. Generation of Random numbers, Generation of normal Random numbers, Generation of random numbers with any given distribution. Use of random numbers for system simulation, Application of simulation for solving queueing Inventory Maintenance, Scheduling and other industrial problems. Simulation V/S mathematical modeling, Monte Carlo simulation, simulation language ARENA, Example & cases. **Queing models-** Introduction Model types, M.M. 1 & M/M/S system cost consideration.	7

Reference Books:

1. Introduction of Operations Research, Hiller F.S. & Liberman G.J.CBS Publishers
2. Operations Research,Taha H.A., McMillan Publishing Company
3. Foundation of Optimisdation, Heightler, C.S. & Philips D.T. Prentice Hall
4. Fundamentals of Operational Research, Sasieni, Wiley
5. Operations Research, Ravindra, A., Philips, D.T., Solberg, J.J.; John Willey

ME 406 PRODUCTION PROCESSES - III C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	**Mechanics of Metal Cutting:** Elements of a cutting process: geometry of single point cutting tool; tool angles, chip formation; types of chips; chip breakers effects of cutting parameters; Typical cutting speeds and feeds for different tool and job materials; Orthogonal and obligue cutting; Theories of mechanics of metal cutting; cutting force measurement; various types of tool dynameter; thermal aspects of metal machining measurement of chip tool interface temperature; friction in metal cutting.	7
II	**Evaluation of machinability:** Tool life; types of tool failure; mechanism of tool wear, failure and their remedies; reconditioning of tools, relationship between cutting force and power required tool life and cutting speed, surface finish; nose radius, feed; economics of metal machining - cutting tool materials; cutting fluids and methods of their application	7
III	**Gear manufacturing process:-** Introduction: methods of forming gears, hot rolling stamping, powder metallurgy, extruding of coining etc. shear cutting of gear template process, gear generating process, gear hobbing, gear shaping ,bevel gear generating , lapping, shot blasting , phosphate coating, gear testing.	7
IV	. **New Machining Methods:** Types of machining methods; hot machining; electric discharge machining (E.D.M.) ultrasonic machining (U.S.M.) ; Electron beam machining (E.B.M.) laser beam Machining (L.B.M.); abrasive jet machining (A.J.M.) ; plasma arc machining (PAM); economics of machining	7
V	. **Grinding:** Abrasives: manufacturing and selection of grinding wheels; theory of grinding; characteristic terms used in grinding; classification; constructional features; principle of working; applications and limitations of different grinding machines. Honing, lapping superfinishing, buffing and polishing processes.	7

Reference Books:

1. Production Engineering Sciences by P.C.Pandey & C.K.Singh Standard Publishers & Distributors Delhi
2. Production Engineering by P.C.Sharma, S.Chand & Company Ltd., N.Delhi
3. Production and Operations Management By S.N. Chary. T.M.H
4. Production Technology By H.M.T. T.M.H
5. Manufacturing Technology By R. Rajput Laxmi Publications

ME 407 RELIABILITY AND MAINTENANCE C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	Introduction: Maintenance Objectives and Functions; Maintenance Organisation and Administration of Maintenance Systems. Need of planned maintenance. Maintenance policies; Breakdown, time based maintenance: Block replacement, age replacement and periodic replacement policy. Corrective and preventive maintenance. Maintenance planning, Scheduled maintenance. Cost of maintenance versus Cost of equipment and production delays. Inspection: Inspection intervals, Inspection reports, card history system.	7
II	Predictive maintenance. Equipment wear records, standards. Equipment used in predictive maintenance. Computerized maintenance, Total Productive Maintenance. Methods of condition monitoring, Non-destructive testing, Liquid Penetrate, Magnetic particles, Ultrasonic testing, and Vibration analysis. Oil analysis, Radiographic testing.	7
III	Reliability: Definition, failure data analysis, Mean failure rate, mean time to failure (MTTF),mean time between failures (MTBF) , hazard rate, Bathtub curve. Use of Weibull probability chart foe assessing characteristics life, guarantee period etc.	7
IV	System reliability: Series, parallel and mixed configuration; Simple problems. Reliability improvement: Techniques, use of Pareto analysis-Design for reliability, redundancy unit and stand by redundancy, Optimization of reliability.	7
V	Spare Parts Management: Spare parts, features and categorization of spares, cost considerations, Techniques of cost reduction; Selective controls used in spare parts control; ABC analysis, FSN, XYZ, VED and other approaches. Inventory control of spares.	7

Reference Books:

1. Reliability of Machines by D.Reshetov, A.Ivanov, V.Fadeev
2. Engineering Diagnostics by I.A.Birger
3. Production Technology by R.K.Jain
4. Production and operation management by Adam and Evert ,Tata McGraw Hill.

ME 408 PRODUCT DESIGN AND DEVELOPMENT C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	**Importance of new product-Definition-importance-Development Process -** Importance of new product for growth of enterprise. Definition of product and new product. Responsibility for new product development. Demands on product development team. Classification of products from new product development. Point of view- Need based/Market pull products, Tech. push, Platform based, Process based and customized products. New product development process and organization. Generic product development process for Market Pull Products. Modification of this process for other types of products.	7
II	**Need analysis- Problem Formulation -** Establishing economic existence of need, Need Identification and Analysis, Engineering Statement of Problem, Establishing Target Specification.	7
III	**Generation of Alternatives and Concept Selection -** Concept generation- a creative process, Creativity, Road Elects to creative thinking- Fear of criticism and Psychological set. Tools of creativity like brain storming, Analogy, Inversion etc., Creative thinking Process. Concept feasibility and Concept Selection, Establishing Engineering Specification of Products.	7
IV	**Preliminary & detailed design- Design Review -** Preliminary design- Identification of subsystems, Subsystem specifications, Compatibility. Detailed design of subsystems, component design, Preparation of assembly drawings. Review of product design from point of view of Manufacturing, Ergonomics and aesthetics.	7
V	**Management of New Product – development and Launch -** New Product Management's Challenges – Maintaining focus, Promotion of Right Culture, Management of Creativity, Top Management attention. Design Team Staffing and Organization. Setting key mile stone, Identification of Risk Areas, Project Execution and Evaluation Product Launch Strategies. Project Planning – Project Task matrix, estimation of time & resources, project scheduling.	7

Reference Books:

1. Product Design and Manufacturing, Chital AK and Gupta RC,PHI
2. Product Design and Manufacturing, Ulrich Ktand Eppinger SD McGraw Hill
3. Product Design and Manufacturing, Lind beck JR, Prentice Hall.
4. Engineering Design Method, Cross, Nigel, John Wiley & Sons.
5. Design for Strength & Production; C.Ritz and F. Koenigsbenger.
6. Human Factors in Engineering and Design; Mark S. Sanders, Ernest J. M.Cormick.
7. Engineering Design, G.E.Deiter.

ME 409 GAS TURBINE AND JET PROPULSION C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	**Gas Turbine Cycles:** Ideal Cycles; open and closed cycles; constant pressure and constant volume cycles; intercooling, reheat and reheat with heat exchange; Ericksson cycle. Compounding - different shaft arrangements, special Applications of gas turbines such as industrial aircraft, marine. Gas turbines in power generation; combined cycle power generation.	7
II	**Performance of Practical Gas Turbine Cycles:** Compressor and turbine efficiencies; pressure losses; heat exchanger thermal ratio; mechanical losses; variation of specific heat; design point performance calculation for simple cycle. Factors affecting the performance, calculation of practical gas turbine cycles; polytropic efficiency; general performance of simple cycle with losses	7
III	**Centrifugal Compressors:** Principal of operation; work done and pressure rise; slip diffuser. Design criterion; compressibility effects; non-dimensional quatities used for plotting compressor characteristics surging, choking and rotating stall gas Turbine **Axial Fow Compressors:**Basic constructional features; turbine v/s compressor blades; elementary theory; degree of reaction; vortex theory, simple design calculations; introduction to blade design; cascade test; compressibility effects; operating characteristics; stalling and surging polytropic efficiency, matching of compressure and turbine	7
IV	**Axial Fow Turbines:** Choice of blade profile. pitch and chord. stage and overall turbine performance; cooling of turbine blades; overall turbine performance: methods of improving part-loadperformance: matching procedures for twin-spool and turbofan engines: transient behaviour of gas turbine, principles of control systems.	7
V	**Jet Propulsion:** Aircraft propulsion- types of jet engines-energy flow through jet engines, study of turbojet engine components-diffuser, compressor, combustion chamber, turbine and exhaust systems, performance of turbo jet engines-thrust, thrust power, propulsive and overall efficiencies, thrust augmentation in turbo jet engines, ram jet and pulse jet engines.	7

Reference Books:

1. Gas Turbines Theory, H. Cohan, G.F.C. Roger and HIH Saravanama, Longman Scientific & Technical Pub., N.York
2. Gas Turbines and Jet and Rocket Propulsion, M.L.Mathur and R.P.Sharma, Standard Publisher & Distributor, New Delhi
3. Power Plant Technology, M.M.El-Wakil, McGraw Hill Book Company
4. A Course in power Plant Engineering, Arora and Domkunwar Dhanpat Rai and Co.(P) Ltd.

ME 411 FINITE ELEMENT ANALYSIS C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	Stress strain and deformation relations, plane - stress, planes strain, Principles of minimum Potential Energy, principle of virtual work.	7
II	Stiffness method for steady state problems of discrete systems (Bar, trusses, one dimensional heat transfer system) Element stiffness matrix, Assembly of elements, global stiffness matrix and its properties, Node numbering, Displacement and force Boundary conditions, Transformations matrix, Gauss elimination method	7
III	Displacement - Based FEM for solid mechanics; Derivation of finite element equilibrium equations, Langrangian elements (I-D & 2-D elements); CST, rectangle, aspect ratio shape functions, lumping of loads, computability and convergence requirements. Stress calculations Isopohmetric Derivation of Stiffness matrices, bar and plane bilinear elements, Seredipity elements, natural coordinates, numerical integration, Co-continuity p and h refinement	7
IV	Variational Method: Variational Approach for known functional of field problems. Weighted Reidual Methods: Point collection, subdomain collocation, methods of least square, Galerkin. Application of these methods to one dimensional boundary value problems; Structures, fluid mechanics and heat transfer.	7
V	Finite Elements in Dynamics and Vibrations: Introduction, Dynamic Equations, Mass and Damping Matrics, Mass Matrics, Consistent and Diagonal, Damping, Natural frequencies and Mode Shapes.	7

Reference Books:

1. Introduction to Finite Elements in Engineering, Tirupathi R. Chandrapatla and Ashok D. Belagundu, Prentice Hall of India. Ltd.
2. Comcept and Applications of Finite Element Analysis, Robert D. Cook. David S. Malkus. Michaiel E. Palesha, John Wiley & Sons.
3. Finite Element Procedures, Klaus Jurgan Bathe, Prentice Hall of India, New Delhi

ME 412 OPERATIONS MANAGEMENT C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	**Operations Management:** An Overview - Systems concepts in Operations Management, Objectives in Operations Management, Operations management Decisions, Productivity concepts and measurement, Types of Production Systems. Aggregate planning and master scheduling Objectives of Aggregate planning Methods, Master Scheduling, Objectives, Master Scheduling Methods.	7
II	**Forecasting Demand:** Forecasting Objectives and uses, Qualities & Quantities methods of Forecasting, Opinion and Judgmental Methods Time Series Methods, Exponential Smoothing, Regression and Correlation Methods, Time Series Analysis, Application and Control of Forecasts. Capacity Planning: Capacity Strategy, aspects of Capacity Planning, Determination of Capacity Requirement, Types of capacity, Evaluation of Alternative plant size, Traditional Economic Analysis, Cost-Volume Profit Analysis.	7
III	Materials Management: Scope of Materials Management, Purchase system and procedure, purpose of Inventories, Classification of inventory, factors effecting inventory, inventory models, probabilistic models, inventory systems classification, selective inventory control, stores management, standardization codification and variety reduction. Material and Capacity Requirements Planning Overview, MRP and CRP, MRP Underlying concepts, system parameters, MRP Logic, CRP Activities.	7
IV	Scheduling and controlling Production Activities: Introduction, PAC Objectives and Date Requirements. Scheduling Strategy and Guidelines., Scheduling Methodology, Priority Control, Capacity Control	7
V	Just in Time (JIT) in manufacturing planning & control. Major-elements, Characteristics of Just in Time System pre-requisite for JIT manufacturing, Elements of Manufacturing, Eliminating Waste, Enforced, Problem Solving and Continuous Improvements, Benefits of JIT Purchasing, The Kanban System JIT implementation in Industries. Bottleneck scheduling and theory of constraints. Issues in choosing manufacturing technologies and strategies: product life cycle, standardization, simplification, diversification, value analysis.	7

Reference Books:

1. Production and Operations Management, Adam Everett E.& Elbert Ronald J., PHI
2. production & Operation Management; S.N.Charry, TMH
3. Manufacturing planning and control systems; Berry W.L.Whybark D.C. Vollman T.E.galgotia Publication Pvt. Ltd.
4. Operations Management: Theory and Problems Monk J.G. McGraw Hill.
5. Production Systems, Riggs, J.L. Wiley Eastern

ME 413 COMPUTATIONAL FLUID FLOW & HEAT TRANSFER C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	Review of basic fluid mechanics and the governing (Navier-Stokes) equations. Types of partial differential equations-hyperbolic, parabolic and elliptic. Traditional solution methods- method of characteristics, separation of variables, Greens function method.	7
II	Preliminary computational techniques: Discretisation, converting derivatives to discrete algebraic expressions, spatial derivatives, time derivatives. Approximation of derivatives, Taylor series expansion, general techniques. Accuracy of discretisation process-higher order vs lower order formulae.	7
III	Finite difference method: conceptual implementation, application to transient heat conduction problem. Convergence, consistency and stability of FD equation.	7
IV	Weighted residual methods: General formulation, Introduction to Finite Volume method. Finite Volume method: Equations with first derivatives and second derivatives. FV method applied to Laplace's equation.	7
V	Finite Element method: Linear interpolation, quadratic interpolation, two dimensional interpolations. Application to heat transfer problems.	7

Reference Books:

1. Computational Fluid Dynamics: The Basics with Applications, John D.Anderson, Mc Graw Hill, 1995.
2. Computational Flow Moeling for Chemical Reactor Engineering, V. V. Ranade, Process Engineering Science, Volume 5, 2001.
3. Fundamentals of Grid Generation, Patrick Knupp and Stanly Steinberg, CRC Press,1994.
4. Turbulence Modelling for CFD, D.C. Wilcox 1993,
5. An Introduction to Multigrid Methods, Pieter Wesseling, John Wiley & Sons, 1992,

ME – 415 FUNDAMENTAL OF ROBOTICS C (L, T, P) =3 (3, 0, 0)

Units	Course Contents	Hrs.
I	**Introduction to Robotics -** Evolution of Robots and Robotics, Laws of Robotics, What is and What is not a Robot, Progressive Advancement in Robots, Robot Anatomy, Human Arm Characteristics, Design and Control Issues, Manipulation and Control, Sensors and Vision, Programming Robots, The Future Prospects, Notations.	7
II	**Coordinate Frames, Mapping and Transforms -** Coordinate Frames, Description of Objects in Space, Transformation of Vectors, Inverting a Homogeneous Transform, Fundamental Rotation Matrices	7
III	**Symbolic Modeling of Robots – Direct Kinematic Model -** Mechanical Structure and Notations, Description of Links and Joints, Kinematic Modeling of the Manipulator, Denavit – Hartenberg Notation, Kinematic Relationship between Adjacent Links, Manipulator Transformation Matrix. Introduction to Inverse Kinematic model	7
IV	**Robotic Sensors and Vision -** The Meaning of Sensing, Sensors in Robotics, Kinds of Sensors used in Robotics, Robotic vision, Industrial Applications of Vision-Controlled Robotic Systems, Process of Imaging, Architecture of Robotic Vision Systems, Image Acquisition.	7
V	**Robot Applications -** Industrial Applications, Material Handling, Processing Applications, Assembly Applications, Inspection Application, Principles for Robot Application and Application Planning, Justification of Robots, Robot Safety, Non-Industrial Applications.	7

Reference Books:

1. Introduction to Robotics by John J. Craig,Pearson Education
2. Robotics by K.S.Fu,R.C.Gonzalez and C.S.G.Lee,McGraw-Hill
3. Robotic Engineering by Richard D.Klafter,Thomas A.Chmielewski and Michel Negin
4. Production Engineering by R.K.Jain
5. Principles of Robot Motion by Howie, Kevin M.Lynch,Seth Hutchinson, George Kantor,Wolfram Burgard,Lydia E.Kavraki,and Sebastian Thrun, MIT Press.

ME 451 CAD LAB. C (L, T, P) = (0, 0, 2)

(PERFORM ANY SIX EXPERIMENTS)
1. Introduction & different features of the CAD Software
2. 2-D Drafting
3. 3-D Modeling
4. 3-D Advanced Modeling
5. Assembly modeling
6. Feature Modification and Manipulation
7. Detailing
8. Sheet Metal Operations
9. Surface Modeling
10. One Dimensional problems of Finite Element Method.

(These exercises may be performed by any of the following Advanced CAD Software such as Pro E /Unigraphics/ AotoCAD Inventor)

ME 452 CAM LAB. C (L, T, P) = (0, 0, 3)

CAM Lab. (any six)
1. To prepare part programming for plain turning and taper turning operation.
2. To prepare part programming for turning operation in absolute mode.
3. To prepare part program for threading operation.
4. To prepare part program for slot milling operation.
5. To prepare part program for drilling operation.
6. To prepare part program for multiple drilling operation in Z-axis.
7. To prepare part program for multiple drilling in X-axis.
8. To prepare part program for multiple drilling in X and Z axis using drilling cycle.

ME 453 REFRIGERATION AND AIR CONDITIONING LAB. C (L, T, P) = (0, 0, 2)

(PERFORM ANY SIX EXPERIMENTS)
1. Study of a vapour absorbtion refrigeration system. (Electrolux refrigerator).
2. To determne the C.O.P. of vapour compression cycle.
3. To determine actual and theopritical C.O.P. of heat pump setup.
4. To study various refrigeration accessories.
5. Three Ton air-conditioner performance test.
6. Energy analysis of parallel and counter flow heat exchanger.

ME 456 PRODUCTION PROCESS LAB-III C (L, T, P) = (0, 0, 3)

(PERFORM ANY SIX EXPERIMENTS)
1. NC - Lathe machine, Tool holders and Practice on the manual control
2. To study the capstan lathe, tool holders and attachments.
3. To prepare the given job as drawing
4. To prepare a process chart and flow diagram for the above job
5. Design a Die & Punch set for Blanking & Punching equation for the given job in drawing and prepare the job.
6. To measure flatness and surface defects in the given test piece with the help of monochromatic check light and optical flat.
7. To plot the composite errors of the given set of the gears using composite gear tester. To measure and temperature at the tool point chip thermocouple technique.
8. To perform alignment test on a centre lathe.
9. To calibrate pneumatic comparator and measure taper of a given work peice.
10. To measure the taper of a given test piece with the help of a single bar and compare it.

ME – 460 PRODUCT DESIGN AND DEVELOPMENT LAB. C (L, T, P) = (0, 0, 3)

Sessional assignment on:
Stress Analysis - Analytical/Theoretical
Stress Analysis - Experimental/Analogies
Designing for Uniform Strength.
Design for regidity and material saving - Ribs etc.
Problems on optimum design.
Design for Production; Standardization, preferred numbers
Design of different fit joints: Clearance/Transition/Interface.
Human factors in engineering design. Design of work environment.
Computer/Software in Production Design and Development
Project on Product Design and Product Development; value analysis, economics of new product design.

ME 501 DESIGN OF THERMAL SYSTEMS C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	Mathematical Modeling of thermal Systems: Development of equations based on number-processing operation and physical laws for simulation and optimization of thermal systems	**6**
II	The art of equation fitting to performance data; Development of performance equations for heat exchangers, distillation separators and turbo machinery	**6**
III	Simulation of thermal Systems: Uses of system simulation, classes of simulation; Information-flow diagrams; sequential and simultaneous calculations	**6**
IV	simulation of continuous, deterministic steady-state systems, e.g. gas turbine system; simulation of dynamic behavior of thermal systems	**6**
V	Optimization of Thermal Systems: Optimization criteria; use of Lagrange Multipliers, search methods, dynamic programming and geometric programming for optimum design of thermal systems	**6**

Reference Books:

1. W.F. Stocker; "Design of thermal Systems", McGraw Hill International, 1989.
2. B.K. Hodge, "Analysis and Design of Energy Systems", Prentice-Hall Inc., 1990.

ME 502 DESIGN OF COMBUSTION SYSTEM C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	Types Of Fuels: Composition-physical, chemical and thermodynamic properties. Proportion of reactants and cooled products: Individual hydro carbons – volumetric fuel blends gravimetric fuel and mixture calculation from product analysis-physical characteristics of mixtures and products	**6**
II	Proportions Of Hot Products: Kinetic equilibrium – equilibrium product composition in hydrocarbon combustion – Fuel rich mixture dissociation – general mixture dissociation	**6**
III	Combustion Energies: Standard energy of formation-standard energy of reaction calorific value-maximum useful work. Combustion Temperatures: Sensible energy – determination of maximum temperature in steady flow – Influence of fuel type and operating parameters. Combustion Efficiencies: Work transfer applications in now-flow – heat transfer applications in steady flow- work transfer applications in steady flow. Combustion Control Systems: Controlling fuel flow- controlling air flow- As pollution control flow	**6**
IV	Design Of Burners: Gas and oil burners- operations characteristics – calculation of gas flow rate; pressure drop efficiency	**6**
V	Design of furnaces and chimneys, steam generating devices – stokers, fluidized bed combustion – types – performance analysis	**6**

Reference Books:

1. Samir Sarkar, Fuels and Combustion, Orient Longman, 1990.
2. E.M. Goodger, Combustion Calculations, The Macmillan Press Ltd.,1977.
3. Francis G. Shinskey, Energy Conservation through Control, Academic press, 1978.

ME 503 ELECTRICAL POWER GENERATION, TRANSMISSION AND DIST. C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	Basic Concept: Power in Single Phase, AC Circuits, Complex Power, Power Triangle, Power in Balanced Three-Phase Circuit. Phasor Diagram. Types of Conductors, Skin Effect, Corona Losses, Basics of Transmission & Distribution System, Layout of substation and component of substation	6
II	Inductance of Transmission Lines, Capacitance of Transmission Lines, Representation of Power Systems, Bundle conductors. Performance of Short, Medium and Long Transmission Lines, Transmission Line Losses, Underground Cables, Voltage Regulation.	6
III	Distribution: Radial and Ring Type Distribution Systems, Kelvin's Economic Depreciation and Tariffs, economics of generation, power factor Improvement Law, Distribution Network, Distribution and feeder, Distribution losses.	6
IV	Generation: Various Method of Electrical Generation, Thermal Power Plants, Nuclear Power Plant	6
V	Major equipment of power plant, Hydroelectric Power Plants, Wind Power Plants	6

Reference Books:

1. Gupta B.R., "Power System Analysis and Design", S.Chand, New Delhi, 2003
2. Singh S.N., "Electric Power Generation, Transmission and Distribution", Prentice Hall of India, New Delhi, 2002
3. Luces M. Fualkenberry, Walter Coffer, "Electrical Power Distribution and Transmission", Pearson Education, 1996
4. Hadi Saadat, "Power System Analysis", Tata McGraw Hill Publishing Company,2003
5. Wadhwa C.L, "Electric Power Systems", New Age International (P) Ltd., 2000.
6. Turan Gonen "Electric Power Distribution Engineering", CRC Press, 2nd Edition, 2007

ME 504 WIND ENERGY UTILIZATION C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	Wind Characteristics: Sources of wind, wind hazards, sitting in flat terrain, sitting in non-flat terrain, ecological indicators of site suitability, site analysis methodology. Wind Energy System: Energy from the wind, work-energy and power, different types of rotors, over speed control, electric power generation and storage. Water pumping systems – major components – lift – transport – storage sitting and sizing	6
II	Applied Aerodynamics: Role of aerodynamics in wind power – cross wind axis machines – wind axis machines – general momentum theory – vortex strip theory, forces and moments due to vertical wind gradient	6
III	Towers And Systems Installation: Specific types of tower, Tower height, Tower and systems raising, wiring, lightning protection, Installation, maintenance of other equipments	6
IV	Energy Conversion And Storage: Synchronous inverters, dc/ac inverters, battery storage, battery characteristics, battery system installation, other types of storage systems. Wind Energy Conversion Systems: Specifications and characteristics of commercial water-pumping wind mills, electricity producing wind energy. Conversion systems, selection of systems-case study. Environmental aspects	6
V	Applications: Potential application of wind energy conversion systems, residential applications, wind power use in agriculture	6

Reference Books:

1. V. Daniel Hunt, Wind Power, Van Nostrand Reinhold Company, 1981.
2. Wind Energy Basics: A Guide to Small and Micro Wind Systems; Paul Gipe, Chelsea Green Pub Co; April 1999.

ME 505 SOLAR THERMAL ENGINEERING C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	Solar Radiation: Solar Radiation, instruments for measuring solar radiation, solar radiation geometry, empirical equations, solar radiation on tilted surfaces. Liquid Flat Plate Collectors: Basic elements, performance analysis, transmissivity - absorptive, heat transfer coefficients and correlations, collector efficiency and heat removal factors, effects of various parameters, types of other liquid flat-plate collectors, transient analysis	6
II	Solar Air Heaters: Type of air heaters, performance analysis of a conventional air heater, other types of air heater, Testing procedures. Concentrating Collectors: Type of concentrating collectors and their general characteristics, geometry, heat transfer correlations, tracking requirements performance analysis	6
III	Thermal Energy Storage: Basic methods, Sensible heat storage – liquids- solids-analysis, latent heat storage, thermo chemical storage	6
IV	Solar Pond: Basic concept and working, description, performance analysis, transmissivity, temperature distribution and collection efficiency, experimental studies and other aspects	6
V	Solar Refrigeration: Adsorption and absorption based solar refrigeration technologies	6

Reference Books:

1. Krith F. and Krelder J.F., Principles of Solar Engineering**,** McGraw hill book company, 1978.
2. John A, Duffie, William A. Beckman ; Solar Engineering of thermal processes, , John Wiley and Sons, 1991.
3. Garg H.P. and Prakash J., Solar energy fundamentals and application, TATA McGraw Hill Publishing company limited, New Delhi, 2000.
4. Sukhatme S.P., Solar Energy Principle of thermal collection and storage, TATA McGraw Hill Publishing company limited, New Delhi, 1996

ME 506 POLLUTION CONTROL TECHNOLOGIES C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	Introduction: Introduction to air pollution, classification of pollutants, their effects, impact of environment on human	6
II	Air Pollution Sources: Mobile and stationary sources, types of plume dispersion mechanisms, air quality measurement concepts	6
III	Control devices for particulate contaminants: gravitational settlement, centrifugal and wet collectors, fabric filters, cyclon separators, electrostatic precipitators. Control devices for gaseous contaminants from stationary sources: adsorption, adsorption, condensation, combustion based pollution control systems	6
IV	Automotive Emission control: Types and construction of catalytic converters, emission control through operating parameters and engine design, alternative fuels for emission reduction	6
V	Laws and regulations: National and international standards for mobile and stationary sources of air pollution	6

Reference Books:

1. Howard S. Peavy, Donald Rowe; Environmental Engineering; Tata Mc-Graw Hill, 1989.

ME 507 ALTER NATIVE FUELS IN I.C. ENGINES C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	Introduction: Need of alternative gaseous fuels, future automotive gaseous fuels, hydrogen, CNG, LNG, and Producer gas, biogas, LPG. Stochiometric air fuel ratio, Physical properties of different gaseous fuels, mode of engine operations, spark ignition and dual fuel mode, multi fuel mode, combustion and performance of engines, specific problems, safety and environmental aspects, economic aspects, production	6
II	Use of alcohol in four stroke spark ignition engines and diesel engines, use of alcohol in two stroke engines, use of bio diesels, combustion and performance of engines, stochiometric air fuel ratio, specific problems, safety and environmental aspects, economic aspects, production.	6
III	Impacts: Impact of alternative fuels on engine test and test procedures, guidelines for emission measurements, emission norms for engines using alternative fuels	6
IV	Legal Aspects: Legal aspects of blending alternative fuels into conventional liquid fuels, properties of blends, comparison of neat versus blended fuels, fuel testing	6
V	Computer simulation: Computer simulation of engines using alternative fuels	6

Reference Books:

1. Future automotive fuels, Edited by Joseph M. Colucci and Nicoles C. Gallopoulos, Plenum press, New York
2. Dual fuel engines, edited by R.L.Evans, Plenum Press, 1987
3. SAE hand book, volume III, Engines, fuels, lubricants, emissions and noise
4. Automotive fuels and fuel systems, volume II, T.K.Garrett, Pantech Press, London
5. Gaseous fuels for transportation I, proceedings of the conference held at Vancouver, british Columbia, Canada, 1987

ME 508 ENERGY CONSERVATION (ELECTRICAL) C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	Electrical Systems: Basis of Energy and its various forms: Electrical Basis-DC & AC, currents active power, reactive power and apparent power, star, delta connection, electricity billing, electrical load management, maximum demand control. Power Factor: Power factor, Power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors and energy conservation opportunities	6
II	Electric Motors: Types, losses in induction motors, motor efficiency, factor affecting motor performance, rewinding and motor replacement issues, energy saving opportunities in motors, energy efficient motors, soft starter with energy savers	6
III	Transformers and Electric Distribution: Types of transformers, transformer losses, energy efficient transformers, factor affecting the performance of transformers and energy conservation opportunities, cables, switch gears, distribution losses, energy conservation opportunities in-house electrical distribution system. Compressed Air Systems: Types of air compressors, compressor efficiency, efficient compressor operation, compressed air systems components, capacity assessment, leakage test, factors affecting the performance and energy savings opportunities	6
IV	Pumps and Pumping System: types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Fans & Blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities	6
V	Lighting System: Light source, choice of lighting, energy efficient lighting controls Luminance requirements and energy conservation avenues. Energy Conservation through: Variable Speed Drives, Occupancy Sensors, Energy Savers, Day Lighting	6

Reference Books:

1. H. Partab, 'Art and Science of Utilisation of Electrical Energy', Dhanpat Rai and Co, New Delhi, 2004.
2. Gopal.K.Dubey, 'Fundamentals of Electrical Drives', Narosa Publishing House, New Delhi, 2002.
3. C.L. Wadhwa, 'Generation, Distribution and Utilization of Electrical Energy', New Age International Pvt.Ltd, 2003.

ME 509 FINITE ELEMENT METHODS C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	Introduction to FEM and its applicability, Review of mathematics : Matrix algebra, Gauss elimination method, Uniqueness of solution, Banded symmetric matrix and bandwidth. Structure analysis : Two-force member element, Local stiffness matrix, coordinate transformation, Assembly, Global stiffness matrix, imposition of Boundary conditions. Properties of stiffness matrix.	8
II	**One-dimensional Finite Element Analysis :** Basics of structural mechanics : stress and strain tensor, constitutive relation. Principle of minimum Potential. General steps of FEM, Finite element model concept / Discretization, Derivation of finite elements, equations using potential energy approach for linear and quadratic 1-D bar element, shape functions and their properties, Assembly, Boundary conditions, Computation of stress and strain.	8
III	**Two dimensional Finite Element Analysis :** Finite element formulation using three nodded triangular (CST) element and four nodded rectangular element, Plane stress and Plain strain problems. Shape functions, node numbering and connectivity, Assembly, Boundary conditions. Isoparametric formulation of 1-D bar elements, Numerical integration using gauss quadrature formula, computation of stress and strain.	8
IV	**Finite Element Formulation from Governing Differential Equation :** Method of Weighted Residuals : Collocation, Subdomain method, Least Square method and Galerkin's method. Application to one dimensional problems, one-dimensional heat transfer, etc. introduction to variational formulation (Ritz Method.)	8
V	Higher order elements, Lagrange's interpolation formula for one and two independent variable. Convergence of solution, compatibility, element continuity, static condensation, p and h methods of mesh refinement, Aspect ratio and element shape. Application of FEM, Advantages of FEM. Introduction to concept of element mass matrix in dynamic analysis.	8

Reference Books:

1. The Finite Element Method: Linear static and Dynamic Finite Element Analysis, Thomas J.R. Hughes
2. Schaum's Outline of Finite Element Analysis by George Buchanan
3. Finite Element Methods for Engineers by Roger T. Fenner
4. Finite Element Procedures by K.J. Bathe
5. The Finite Element Method: Its Basic and Fundamentals, by O.C. Zienkiewicz
6. Numerical Solution of Partial Differential Equations by Claes Johnson

ME 510 ENERGY MANAGEMENT C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	Introduction to Energy Management: Aims and approaches of auditing, types of energy audit, energy indices in residential, commercial and industrial sector, data collection	**6**
II	Energy in Manufacturing: Energy and environmental analysis of products, energy consumption in manufacturing, laws of energy and materials flow. Energy in Residential Sector: Supply of energy for rural and urban housing, fuel substitution, efficiency improvement of domestic appliances	**6**
III	Instrumentation for Energy Management: Measurement of heat flux, radiation, psychometric variables, fluid flow & velocities, data analysis	**6**
IV	Life Cycle Analysis: LCA of energy systems, concept of life cycle costing and its use	**6**
V	Demand Side Management: Principles of DSM, rules and tools of DSM, fundamentals of demand response, DSM tools and practices	**6**

Reference Books:

1. C.B. Smith, Energy Management Principles, Pergamon Press, New York, 1981.
2. Hamies, Energy Auditing and Conservation: Methods, Measurements, Management & case study, hemishpere, Washington, 1980.
3. Diamant R.M.,Total Energy, Pergamon Press, Oxford, 1970.

ME 511 ADVANCE MANUFACTURING PROCESS C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	**Principles of Casting -** Principles of Casting – metals, alloys, eutectics and plastics; Mechanism of melting and solidification, grain growth and structure, shrinkage defects. Mold filling – fluidity and turbulence, filling under gravity and pressure; filling defects; gating design, Injection Molding, Simulation of Mold filling and Solidification.	8
II	**Fundamentals of Fusion Welding -** Fundamentals of fusion welding processes – analysis of heat source, types of metal transfer, weld pool characteristics, solidification mechanisms in fusion zone, heat affected zone characteristics, types of weld joint, distortion and residual stresses, weld defects, destructive and non-destructive testing of welds.	8
III	**Non Conventional Machining Processes -** Introduction and need of Non-conventional machining processes, Principle, Theory of material removal, Process parameters, Advantages, limitations and applications of Ultrasonic machining, Electro discharge machining, Laser beam machining and Electrochemical machining. **Special processes:** Micro machining, Nano-technology, molecular dynamic analysis, dry electro discharge machining, electro discharge chemical machining, vacuum coating, Ballistic machining, unit head machining, hot machining.	8
IV	**Advances in Material Forming -** Macroscopic plasticity and yield criteria, plastic instability, strain rate and temperature ,slab analysis, upper bound analysis, slip line field theory, plastic anisotropy, numerical analysis of material forming processes	8
V	**Unconventional forming processes -** High energy rate forming, electromagnetic forming, explosive forming, high speed hot forging, high velocity extrusion, high speed forming machines, peen forming, study of various process parameters.	8

Reference Books:

1. B.H. Amsteal, Philip F. Ostwald and Myron L. Begeman, Manufacturing Processes", John Wiley & Sons, eighth edition.
2. G.F. Benidict "Advanced Manufacturing processes", Marcel Deker Publisher
3. Lancaster,J. F., Metallurgy of welding, brazing and soldering, George Allen & Unwin, London, 1985
4. Degarmo, "Materials and Processes in Manufacturing", 9th edition, Wiley Students Edition.
5. P. N. Rao, "Manufacturing Technology", Tata McGraw Hill.
6. Regis Blondeau, "Metallurgy and Mechatronics of Welding", ISTE.
7. American Soc. For Metals, Metals Handbook, 10th Edition, Vol 15, on Metal Forming, ASM, Metals Park, Ohio, 1989.
8. Eary, D. F., and Reed, E. A., Techniques of Press working Sheet metal and Engineering,
9. Willium F. Hosfford and Robert Caddell, Metal forming: Mechanics and Metallurgy,
10. Raj, Shankar, Bhandari, "Welding Technology for Engineers", Narosa Publication House Pvt. Limited.

ME 512 ENGINEERING ECONOMICS & ACCOUNTING (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	**Introduction:** Definition, nature and scope of Managerial Economics, Managerial Economics and Microeconomics – Managerial, Economics and Macro-economic - Applications of Economics. **Demand Analysis:** Determinants of Market Demand – Law of Demand - Elasticity of Demand - Measurement and its use - Demand Forecasting – Techniques of Demand Forecasting.	8
II	**Pricing and output determination -** Pricing decisions under different market forms like perfect competition, monopoly, oligopoly -Pricing Methods - Pricing in Public Sector, Pricing Methods - Pricing in Public Sector undertakings and co-operative societies.	8
III	**Cost Benefit Analysis -** Steps in cost benefit analysis - Justification for the use of cost benefit analysis, Private Vs. Public Goods - Government investment, Overall resource allocation.	8
IV	**Cost management -** Classification of cost, type of costing, absorption and marginal costing, break even analysis, standard cost accounting, cost-volume profit analysis.	8
V	**Investment appraisal methods -** Types of investment proposals, project report, methods of appraisal, discounted cash flow, net present value method, internal rate of return, profitability index, depreciation, limitation of appraisal method, forecasting business changes, use of index number and growth analysis.	8

Reference Books:

1. D.Salvatore , "Managerial Economics in a global economy" Tata McGraw Hill
2. Reckie and Crooke., " Managerial Economics" Prentice Hall; 4 edition.
3. Khan M.Y., Jain P.K , "Management Accounting", Tata Mc Graw Hill, 1995.
4. Horngren C.T., Datar S.M., Foster G.M., "Cost Accounting : a managerial emphasis", Pearson Education, 2002.

ME 513 METAL FORMING ANALYSIS & TECHNOLOGY C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	**Introduction:** Stress-strain relations in elastic and plastic deformations, yield criteria for ductile metals, work hardening and anisotropy in yielding. Flow curves, elements of theory of plasticity, application of theory of plasticity for solving metal forming problems using slab method, upper and lower bound methods, slip line field theory, extremism principles, and effect of temperature and strain rate in metal working.	8
II	**Tube making:** Tube making and deep drawing: introduction, plug drawing with a conical die, load determination, tandem drawing of tubes on a mandrel, tube sinking, concept of tube production by rolling and extrusion methods. **Exclusion:** Extrusion: round bar extrusion through a conical die, flat strip extrusion through dies of constant angles, impact extrusion, and hot extrusion of steels.	8
III	**Rolling:** Rolling of flat slabs and strip: Cold rolling and hot rolling, roll-pressure determination, rolling with no external tensions, rolling with front and back tensions. **Forging:** Forging: Introduction, determination of plain strain compression load, weight friction condition, inclined platen, thin strip, load evaluation for forging a flat circular disc.	8
IV	**Frictions lubrication:** Friction and lubrication in metal working, introduction, influences of friction in metalworking processes, lubricants used for different metalworking processes. **Unconventional Forming:** Introduction to unconventional forming processes like hydrostatic extrusion, hydro-forming of sheets and tubes, powder forming.	8
V	**Drawing:** Drawing of a flat strip and round bar, determination of drawing load, drawing with wedge shaped dies, cylindrical dies, cylindrical rod drawing with a conical die analysis of the processes and maximum possible reduction.	8

Reference Books:

1. Principles of Industrial Metal working Processes, G. B. Rowe, CBS.
2. Manufacturing Science, Ghosh & Malik, East West.
3. Foundry, forming and welding, P.N. Rao, TMH.

ME 514 RESEARCH METHODOLOGIES C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	**Introduction -** Nature and objectives of research. Methods of Research: historical, descriptive and experimental, research process, research approaches, criteria for good research. **Research Design -** Meaning of research design, need of research design, features of good design, different research designs, and basic principles of experimental designs, design of experiments.	8
II	**Data collection -** Types of data, methods and techniques of data collection, primary and secondary data, meta analysis, historical methods, content analysis, devices used in data collection, pilot study and pretest of tools, choice of data collection methods.	8
III	**Processing and analysis of data -** Use of statistics for data analysis, measures of central tendency, dispersion, skewness and relationship. Sampling distributions, sampling theory, determination of sample size, chisquare test, analysis of variance, multiple regression analysis.	8
IV	**Decision making techniques -** Application of various decision making techniques such as Analytical Hierarchy Process (AHP), TOPSIS, neural networks, graph theory, simulated annealing, genetic algorithms, data envelope analysis (DEA).	8
V	**Interpretation and report writing:** Techniques of interpretation, precautions in interpretation, significance of report writing, different steps in report writing, layout of research report, mechanics of writing research report.	8

Reference Books:

1. C.R Kothari, Research Methodology, Wishwa Prakashan
2. P.G Triphati, Research Methodology, Sultan Chand & Sons, N.Delhi
3. Fisher, Design of Experiments, Hafner
4. Stoufferetal, Measurement and Prediction, Wiley, N.York
5. J.W Bames, Statistical Analysis for Engineers and Scientists, McGraw Hill, N.York
6. Donald Cooper, Business Research Methods, Tata McGraw Hill, N.Delhi
7. Bhanwar Lal Garg, Renu Kavdia, Sulochana Agrawal and Umesh Kumar Agrawal, An Introduction to Research Methodology. RBSA Publications,
8. Rao S. S., "Optimization", Wiley Eastern, New Delhi, 1995.
9. Montgomery D.C., "Design and analysis of experiments", Wiley publications.

ME 515 QUALITY ENGINEERING AND MANAGEMENT C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	Statistical concepts in quality control, Graphical representation of ground data, Continuous & discrete probability distributions, central limit theorem, Chi-square test, Introduction to quality control, process control and product control, chance and assignable causes of quality variation, advantages of Shewart control charts.	8
II	Process control charts for variables, Fixation of control limits, Type I and Type II errors Theory of runs, interpretation of out of control points, Probability limits, initiation of control charts, trial control limits, determination of aimed-at value of process setting, rational Method of sub grouping, control chart parameters, control limits and specifications limits, natural tolerance limits, relationship of process in control to upper and lower specifications limits, process capability studies.	8
III	Control charts: Special control charts for variables, Group control charts, Arithmetic moving X ad R charts, Geometric Moving charts, X control charts with reject limits, Steady trend in process average with cost dispersion, trend chart with sloping limits, variable subgroup size CUSUM or cumulative sum control chart.	8
IV	Sampling plans: Probability theory, hyper-geometric, Binomial and Poisson distributions, Acceptance inspection 100% inspection, no Inspection and sampling inspection, Operating characteristic curve, effect of sample size and acceptance number. Type a and Type B ,O.C curves, single, Double and multiple sampling plans, Sequential sampling plans, Acceptance/rejection ad acceptance/rectification plans, procedure's risk ad consumer's risk, difference quality level, Average outgoing quality curve, average outgoing quality limit, quality protection offered by a sampling plan. average sample number, Design of single, double and sequential plans.	8
V	Quality systems: Economics of product inspection. real point, selection of economic sampling plans, Product quality ad reliability, failure data analysis ad life testing, elements of total quality control quality assurance, ISO9000 quality system.	8

Reference Books:

1. Statistical Quality Control, Grant & Leaveworth, McGraw Hill
2. Quality Control & Industrial Statistics, Duncan, Irwin Press
3. Quality Control Handbook, Juran, McGraw Hill
4. Quality Control, Hansen, Prentice Hall
5. An Introduction to reliability & control, Thomason, Machinery Publishing
6. Total Quality Control, A.V. Taylor, McGraw-Hill
7. Quality Control Systems, J.R. Taylor, McGraw-Hill

ME 516 MANUFACTURING MANAGEMENT C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs. 40
I	**Scope of Manufacturing Management** History and development of Manufacturing Management - Contribution of various pioneers beginning from Division of Labor to Quality Revolution and Environmental Control. Manufacturing Management - Nature, Scope, Importance and Functions. **Production Planning & Control** Functions of Production Planning & Control (PPC), Scheduling techniques - Gantt Charts, analytical techniques, Documentation - Production Work Order. Introduction to PERT/CPM, Network Crashing.	8
II	**Advanced Topics in Production Management** Concept of world-class manufacturing, quality management system, manufacturing challenges of information age, lean and agile manufacturing, reconfigurable manufacturing, green production, computerized production management system.	8
III	**Organizational Behaviour** Definition - Importance - Historical Backgrourud, Fundamental Concepts of OB - 21st Century corporate - Different models of OB i.e. autocratic, custodial, supportive, collegial and SOBC Personality & Attitudes - Meaning of personality - Development of personality Nature and dimensions of attitude - Job Satisfaction - Organizational Commitment.	8
IV	**Motivation and Leadership** Motivation - Motives - Characteristics - Classification of motives - Primary Motive, Secondary motives - Morale - Definition and relationship with productivity – Morale Indicators; Theories of Work Motivation - Maslow's theory of need hierarchy Herzberg's theory of job loading Leadership - Definition -Importance - Leadership Styles - Models and Theories of Leadership Styles.	8
V	**Group Dynamics and Team Working:** Theories of Group Formation - Formal and Informal Groups, their interaction - Importance of teams - Formation of teams - Team Work. Conflict management - Traditional vis-à-vis Modern view of conflict - Stress management, Conflict Process - Strategies for encouraging constructive conflict - Strategies for resolving destructive conflict.	8

Reference Books:

1. Fred Luthans, Organizational Behaviour
2. Saxena, Principles and Practices of Management
3. Krajewski, Operations Management, 5th Ed.
4. Panneerselvam, Production & Operations Management
5. Adam & Ebert, Production & Operations Management

ME 518 INDUSTRIAL AUTOMATION C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	**Automation of assembly lines** - Concept of automation, mechanization and automation, Concept of automation in industry, mechanization and automation, classification, balancing of assembly line using available algorithms. Transfer line-monitoring system (TLMS) using Line Status, Line efficiency. Buffer stock Simulation in assembly line.	8
II	**Automation using hydraulic systems** - Design aspects of various elements of hydraulic systems such as pumps, valves, filters, reservoirs, accumulators, actuators, intensifiers etc. Selection of hydraulic fluid, practical case studied on hydraulic circuit design and performance analysis. Servo valves, electro hydraulic valves, proportional valves and their applications.	8
III	**Automation using pneumatic systems** - Pneumatic fundamentals - control elements, position and pressure sensing -logic circuits -switching circuits - fringe conditions modules and these integration - sequential circuits -cascade methods - mapping methods – step counter method - compound circuit design -combination circuit design. Pneumatic equipments - selection of components – design calculations -application - fault finding – hydro pneumatic circuits - use of microprocessors for sequencing - PLC, Low cost automation - Robotic circuits.	8
IV	**Automation using electronic systems** - Introduction, various sensors, transducers, signal processing, servo systems, programming of microprocessors using 8085 instruction, programmable logic controllers. **Automated work piece handling** Working principles and techniques, job orienting and feeding devices. Transfer mechanisms-automated feed cut of components, performance analysis. Uses of various types of handling systems including AGV and its various guiding technologies.	8
V	**Introduction to robot technology** - Robot physical configuration and basic robot motions, Types of manipulators-constructional features, servo and non servo manipulators. Feedback systems and sensors- encoders and other feedback systems, vision, ranging systems, tactile sensors. Programming languages- description of VAL and other languages. Artificial intelligence- legged locomotion and expert systems.	8

Reference Books:

1. Groover, M.P., CAD/CAM- Prentice Hall
2. Yoram Koren, Robotics for Engineers- McGraw Hill 1992
3. Paul, R.P., Robot Manipulators- MIT Press 1993
4. Pressman R.S, Numerical Control and CAM-. John Wiley 1993 Williams
5. Shearer P., Fluid Power Control John Wiley
6. Antony Espossito, " Fluid power with Applications ", Prentice Hall, 1980.
7. Dudleyt, A.Pease and John J.Pippenger, " Basic Fluid Power ", Prentice Hall, 1987.
8. Andrew Parr, " Hydraulic and Pneumatics ", (HB), Jaico Publishing House, 1999.
9. Bolton. W. " Pneumatic and Hydraulic Systems ", Butterworth - Heineman, 1997.

ME 519 CAD/CAM/CIM C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	**Computer aided design:** Geometric modeling, model structure organization, database creation, wire frame modeling, solid modeling, surface modeling, parametric modeling, variational modeling, hybrid modeling. Types and mathematical representation of curves, surfaces and solids. Geometric transformations, visual realism, computer animation, mechanical assembly, mass property calculations.	8
II	**Computer aided manufacturing:** Revision to NC/CNC/DNC and its role in flexible manufacturing systems and CIMS, Elements of CNC systems, CNC part programming, computer assisted part programming, NC program generation from CAD models, tool path generation and verification, recent developments in CNC machine tools.	8
III	**Computer aided engineering analysis:** Introduction to finite element analysis, need for finite element analysis in CAD/CAM system, Steps in finite element analysis, second order differential equation in one dimension applications such as discrete systems, heat transfer, fluid mechanics, plane trusses. Introduction to advance topic in finite element analysis such as three-dimensional problems and non-linear problems. Use of engineering analysis software.	8
IV	**Computer aided process planning:**Advantages of CAPP, variant type CAPP system, generative approach, hybrid approach, geometric modeling for process planning, computer programming languages for CAPP. **Computer aided shop floor control:** Computer aided production planning and control, computer aided material requirement planning, factory data collection system, computer process monitoring, computer aided quality control.	8
V	**Computer Integrated manufacturing - Cellular manufacturing system:** Introduction to GT, benefits, part families, part classification and coding, product flow analysis, cellular manufacturing systems, virtual cell system, quantitative analysis in cellular manufacturing. **Flexible manufacturing system:** Building blocks of FMS, applications, benefits, FMS layout, FMS planning and implementation issues, quantitative analysis of FMS. Computer aided material handling system, computer control system.	8

Reference Books:

1. Mikell P. Grover, “Automation, Production Systems and Computer-Integrated Manufacturing”, Pearson Education, New Delhi.
2. P. Radhakrishnan and S. Subramanyan “CAD/CAM/CIM” Willey Eastern Limited, New Delhi.
3. Michael Fitzpatrick, “Machining and CNC Technology”, Tata McGraw Hill.
4. Mikell P. Grover and Enory W. Zimmers Jr. “CAD/CAM”, Pearson Education, New Delhi.
5. Steve Krar, Arthar Gill “CNC Technology and Programming”, McGraw Hill Pub. Company, New Delhi.
6. P.N. Rao N.K. Tewari et al “CAM” Tata Mc Graw Hill Pub. New Delhi.
7. David Bedworth, "Computer Integrated Design and Manufacturing", TMH, New Delhi
8. Zeid Ibrahim, “CAD/CAM Theory and Practices”, McGraw Hill International Edition.

ME 520 SUPPLY CHAIN MANAGEMENT C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	**Introduction -** Objectives of Supply Chain Management (SCM), key components of supply chain i.e. sourcing, distribution strategy, customer service strategy; supply chain. Management as Integrated logistics, generic activities, architecture of supply chain, future potential of SCM. **Supply chain strategies -** Evaluation of supply chain strategies, supply chain performance measures, vendor management, JIT, Link to supply chain, evaluation of SCM strategies, customer focus in SCM, inventory and logistics management, vendor management, Just-in- Time (JIT). Supply chain design considerations.	8
II	**Logistic Management -** Logistical operation, integration, network design, logistical performance cycle, customer service global logistics, logistical resources, logistic planning.	8
III	**Warehouse and transport management -** Concept of strategic storage, warehouse functionality, warehouse operating principles, developing warehouse resources, material handling and packaging in warehouse, transportation management, transport functionality and principles, transport infrastructure, transport economics and pricing, transport decision making.	8
IV	**Inventory management -** Cost associated with inventory decisions, selective control, economic order quantity, safety stock and service level, P and Q system, probabilistic models. Recent Trends in SCM:	8
V	**Recent Trends in SCM -** Tierisation of supplies, Reverse logistics, JIT II, Milk Round System (MRS), bar coding, Hub and Spoke Concept and other latest concepts. IT – enabled supply chain: Electronic data interchange, enterprise resource planning (ERP), Application of IT, Scope of emerging distributed cooperative tele-manufacturing over internet.	8

Reference Books:

1. Chopra, "Supply Chain Management", Pearson Education Asia, New Delhi
2. Christopher, "Logistics and Supply Chain Management", Pearson Education Asia, New Delhi
3. Taylor and Brunt, "Manufacturing Operations and Supply Chain Management (The Lean Approach)", Business Press Thomson Learning, NY.
4. Arjan J. Van Weele, "Purchasing and Supply Chain Management (Analysis Planning and Practice)", Engineering, Business Press, Thomson Learning NY.
5. Donald B., "Logistic Management - The Integrated Supply Chain process", McGraw Hill,

ME 521- AUTOMOTIVE CHASSIS: C (L, T, P) = 3 (3, 0, 0)

UNIT – I, INTRODUCTION - Types of chassis layout with reference to power plant locations and drives, vehicle frames, various types of frames, constructional details, materials, testing of vehicle frames, unitized frame body construction.
UNIT – II, FRONT AXLE AND STEERING SYSTEM - Types of front axles, construction details, materials, front wheel geometry: castor, camber, king pin inclination, toe-in. conditions for true rolling motion of wheels during steering, steering geometry, Ackermann and Davis steering system, constructional details of steering linkages, different types of steering gear boxes, steering linkages and layouts, turning radius, wheel wobble, power assisted steering, steering of crawler tractors.
UNIT – III, DRIVE LINE - Effect of driving thrust and torque reactions, Hotchkiss drive, torque tube drive and radius rods, propeller shaft, universal joints, front wheel drive, different types of final drive, double reduction and twin speed final drives, differential principle, construction details of differential unit, non-slip differential, differential locks, differential housings, construction of rear axles, types of loads acting on rear axles, fully floating, three quarter floating and semi floating rear axles, rear axle housing, construction of different types of axle housings, multi axle vehicles.
UNIT – IV, SUSPENSION SYSTEM - Need of suspension system, types of suspension, suspension springs, constructional details and characteristics of leaf, coil and torsion bar springs, independent suspension, rubber suspension, pneumatic suspension, shock absorbers.
UNIT – V, BRAKING SYSTEM - Classification of brakes, drum brakes and disc brakes, constructional details, theory of braking, concept of dual brake system, parking brake, material, hydraulic system, vacuum assisted system, air brake system, antilock braking, retarded engine brakes, eddy retarders.

TEXT BOOK

1. Heldt.P.M.- "Automotive Chassis"- Chilton Co., New York- 19902. K.K.Ramalingam – "Automobile Engineering" – Scitech Publication, Chennai - 2001.

REFERENCES

1. Steed W - "Mechanics of Road Vehicles"- Illiffe Books Ltd., London- 1960
2. Newton Steeds and Garrot- "Motor Vehicles"- Butterworths, London- 2000.
3. Judge A.W- "Mechanism of the Car"- Chapman and Halls Ltd., London- 1986
4. Giles.J.G- "Steering, Suspension and tyres"- Iiiffe Book Co., London- 1988.
5. Crouse W.H- "Automotive Chassis and Body"- McGraw-Hill, New York- 1971.

ME - 522. Advanced Engine Design C (L, T, P) = (3, 0, 0)

UNIT 1: Basic design of internal combustion engines. Design techniques for engine manifolds.
UNIT 2: - Introduction, methods for calculating the unsteady flow of a compressible gas in a pipe, design of engine gas flow systems, numerical simulation of unsteady flows in internal combustion engine silencers and prediction of tail pipe noise. Case studies further developments.
UNIT 3: - Main components of electronic fuel injection system. Design of electronic fuel injection system. Throttle body injection, port injection and direct fuel injection techniques. Pollution from internal combustion engines.
UNIT 4: - Mechanism of pollution formation in internal combustion engines. Design of catalytic converters and filters for pollution control from I C engines. .
UNIT 5: - Engine performance with alternative fuels like hydrogen, CNG, LPG, Non edible vegetable oils, bio-diesel etc. engine modifications for alternative fuels.

Recommended books:

1. Design Techniques for Engine manifolds wave action methods for I C Engines
2. Fundamentals Of IC Engines by J B Heywood
3. AA Book of Car by Readers Digest

ME- 523. Engine Modeling and Simulation C (L, T, P) = 3 (3, 0, 0)

UNIT 1: Fundamentals, Basic principles, Homentropic flow, the solution of non-steady flow equations by the method of characteristics, graphical solution of non steady flow problems with boundary conditions on the state diagram.
UNIT 2: Graphical solution of non-steady flow problems: single cylinder engines withflow through valves and ports., numerical solution of non-steady flow problems.
UNIT 3: Non-homentropic flow , numerical solution of non steady flow problems with simple boundary conditions, boundary conditions with in pipe systems, turbine and centrifugal compressor boundary conditions.
UNIT 4: In-cylinder processes, calculation of non-steady flows using filling and emptying methods and quasi-steady flow models , flow processes in cylinders, heat transfer in the cylinder and porting, , combustion and cycle calculations in compression ignition engines
UNIT 5: Unsteady reacting flows: numerical solution of non steady flows with variable specific heats and chemical reactions., pressure exchangers and pressure exchange engines, Completes engine simulation models , quasi-steady models, engine simulation models with filling and emptying methods, wave action simulation models, transient performance

Recommended books:

1. Thermodynamics and Gas Dynamics of Internal Combustion Engines Vol-I &II by Ronald Benson Edited by Horlock And Winenetr bone

ME 524. EMBEDDED AUTOMOTIVE SYSTEMS C (L, T, P) = (3, 0, 0)

UNIT 1: Current trends in Automobiles, open loop and closed loop systems - components for electronic engine management system. Electromagnetic interference suppression.
UNIT 2: Electromagnetic compatibility, Electronic dashboard instruments, onboard diagnostic system , security and warming system. Electronic management of chassis systems. Vehicle motion control. Sensors and actuators, and their interfacing.
UNIT 3: Basic sensor arrangement, types of sensors such as- oxygen sensors, crank angle position sensors- Fuel metering/ vehicle speed sensors and destination sensors, Attitude sensor, Flow sensor, exhaust temperature, air mass flow sensors. Throttle position sensor, solenoids, stepper motors, relays.
UNIT 4: Electronic ignition systems. Types of solid state ignition systems and their principle of operation. Digital engine control system. Open loop and closed loop control system, Engine cranking and warm up control. Acceleration enrichment. Deceleration learning and ideal speed control, Distributor less ignition – Integrated engine control system, Exhaust emission control engineering.
UNIT 5: Automotive Embedded systems. PIC, Freescale microcontroller based system. Recent advances like GLS,GPSS,GMS. Multiprocessor communication using CAN bus. Case study- cruise control of car. Artificial Intelligence and engine management.

References:
1. William B. Riddens, “Understanding Automotive Electronics”, 5th Edition, Butterworth Hennimann Woburn, 1998.
2. Young A.P. & Griffiths, “ Automotive Electrical Equipment” , ELBS & New Press-1999.
3. Tom Weather Jr. & Cland c. Ilunter, “ Automotive computers and control system” , Prentice Hall Inc., New Jersey.
4. Crouse W.H., “ Automobile Electrical Equipment” , Mc Graw Hill Co. Inc., New York ,1995.
5. Bechhold, “ Understanding Automotive Electronic”, SAE,1998.
6. Robert Bosch,” Automotive Hand Book”, SAE (5TH Edition),2000.

ME 525 MECHANICAL SYSTEM DESIGN C (L,T,P) = 3 (3,0,0)

UNIT-I Engineering process and System Approach - Basic concepts of systems, Attributes characterizing a system, system types, Application of system concepts in Engineering, Advantages of system approach, Problems concerning systems, Concurrent engineering, A case study- Viscous lubrication system in wire drawing 4 Problem Formulation. Nature of engineering problems, Need statement, hierarchical nature of systems, hierarchical nature of problem environment, problem scope and constraint, A case study: heating duct insulation system, high speed belt drive system.
UNIT-II System Theories - System Analysis, Black box approach, state theory approach, component integration approach, Decision process approach, A case study- automobile instrumentation panel system. System modeling Need of modeling, Model types and purpose, linear systems, mathematical modeling, concepts, A case study compound bar system
UNIT-III - Graph Modeling and Analysis Graph Modeling and analysis process, path problem, Network flow problem, A case study: Material handling system. Optimization Concepts Optimization processes, Selection of goals and objectives-criteria, methods of optimization, analytical, combinational, subjective. A case study: aluminum extrusion system.
UNIT-IV - System Evaluation Feasibility assessment, planning horizon, time value of money, financial analysis, A case study: Manufacture of maize starch system. Calculus Method for Optimization Model with one decision variable, model with two decision variables, model with equality constraints, model with inequality constraints, A case study: Optimization of an insulation system.
UNIT-V - Decision Analysis Elements of a decision problem, decision making, under certainty, uncertainty risk and conflict probability, density function, Expected monetary value, Utility value, Baye’s theorem, A case study: Installation of machinery System Simulation Simulation concepts, simulation models, computer application in simulation, spread sheet simulation, Simulation process, problem definition, input model construction and solution, limitation of simulation approach, A case study: Inventory control in production plant

Books/References-
1. Design and Planning of Engineering systems-DD Reredith, KV Wong, RW Woodhead, and RR Worth man, Prentice Hall Inc., Eaglewood Cliffs, New Jerse
2. Design Engineering-JR Dixon, TMH, New Delhi
3. An Introduction to Engineering Design Method-V Gupta and PN Murthy, TMH, New Delhi
4. Engineering Design-Robert Matousck, Blackie and son ltd. Glasgow
5. Optimization Techniques-SS Rao

ME 526. COMPUTER AIDED VEHICLE DESIGN C (L, T, P) = (3, 0, 0)

UNIT 1: Vehicle Frame and Suspension: Study of Loads-Moments and Stresses on Frame Members. Computer Aided Design of Frame for Passenger and Commercial Vehicles. Computer Aided Design of Leaf Springs-Coil Springs and Torsion Bar Springs.
UNIT2: Front Axle and Steering Systems: Analysis of Loads-Moments and Stresses at different sections of Front Axle. Determination of Bearing Loads at Kingpin Bearings. Wheel Spindle Bearings. Choice of Bearings. Determination of Optimum Dimension and Proportions for Steering Linkages ensuring minimum error in Steering.
UNIT 3: Drive Line and Read Axle : Computer Aided Design of Propeller Shaft. Design of Final Drive Gearing. Design details of Full-floating., Semi-floating and Three Quarter Floating, Rear Axle Shafts and Rear Axle Housings.
UNIT 4: Clutch: Torque capacity of Clutch. Computer Aided Design of Clutch Components. Design details of Roller and Sprag Type of Clutches.
UNIT 5: Gear Box : Computer Aided Design of Three Speed and Four Speed Gear

Text Books :
1. Dean Averns,Automobile Chassis Design, llliffe Books
2. Heldt, P.M., Automotive Chassis, Chilton Co., New York Reference Books:
1. Steeds.W., Mechanics of Road Vehicles, llliffee Books Ltd., London
2. Giles, J.G. Steering, Suspension and Tyres, llliffee Books Ltd., London,.
3. Newton, Steeds & Garret, Motor Vehicle, llliffee Books Ltd., London,.
4. Heldt, P.M. Torque Converter, Chilton Book Co., New York,

ME 527. Control System Engineering C(L,T,P) = 3 (3,0,0)

UNIT 1: Introduction: Scope of control, Parts of a control system, Multidisciplinary nature, Scope of present course. Mathematical modeling of physical systems :Differential equation, Difference equation, and State variable representations; Examples of modeling different types (e.g. electrical, mechanical, chemical, biological, social etc.) of systems, Equivalence between the elements of different types of systems. Linear systems and their s-domain representations: Linearity and linearization, Convolution integral, Laplace domain representation of signals and systems, Transfer function and its interpretation in terms of impulse and frequency responses, Block-diagram and signal flow graph manipulations.
UNIT 2: Characterization of systems: Stability -- concept and definition, poles, Routh array, internal stability of coupled systems, Time domain response -- damping coefficient, natural frequency, overshoot, settling time, rise time; Frequency domain response -- peak and peaking frequency, bandwidth and cut-off rate; Link between time and frequency domain response features.
UNIT 3: Advantages of closed loop operation: Sensitivity and complementary sensitivity, Disturbance and noise reduction, Structured and unstructured plant uncertainties. Analysis of closed loop systems: Stability and relative stability using root-locus approach, Nyquist stability criterion, Steady state errors and system types
UNIT 4: Compensation techniques: Performance goals -- Steady-state, transient and robustness specifications, PID, lag-lead and algebraic approaches for controller design. Sampled-data systems : Necessity of sample and hold operations for computer control, Sampling theorem z-transform, Stability and response of sampled-data systems, Controller design, Special features of digital control systems.
UNIT 5: Introduction to Fuzzy control: Fuzzy sets and linguistic variables, the fuzzy control scheme, Fuzzification and defuzzufication methods, Examples, Comparison between conventional and fuzzy control.

ME 528. EMERGING AUTOMOTIVE TECHNOLOGIES C (L, T, P) = (3, 0, 0)

UNIT 1: The Future Of The Automotive Industry : Challenges and Concepts for the 21st century. Crucial issues facing the industry and approaches to meet these challenges. Fuel Cell Technology For Vehicles : What is fuel cell, Type of fuel cell, Advantages of fuel cell. Current state of the technology. Potential and challenges. Advantages and disadvantages of hydrogen fuel.
UNIT 2: Latest Engine Technology Features : Advances in diesel engine technology. Direct fuel injection Gasoline engine. Diesel particulate emission control. Throttling by wire. Variable Valve Timing, Method used to effect variable Valve Timing. Electromagnetic Valves, Camless engine actuation. 42 Volt System : Need, benefits, potentials and challenges. Technology Implications for the Automotive Industry. Technological evolution that will occur as a result of the adoption of 42 volt systems.
UNIT 3: Electrical And Hybrid Vehicles : Types of hybrid systems, Objective and Advantages of hybrid systems. Current status, Future developments and Prospects of Hybrid Vehicles
UNIT 4: Integrated Starter Alternator: Starts stop operation, Power Assist, Regenerative Braking. Advanced lead acid batteries, Alkaline batteries, Lithium batteries, Development of new energy storage systems, Deep discharge and rapid charging ultra capacitors. X-By Wire Technology : What is X-By Wire, Advantage over hydraulic systems. Use of Automotive micro controllers. Types of censors. Use of actuators in an automobile environment.
UNIT 5: Vehicles Systems : Constantly Variable Transmission, Benefits, Brake by wire, Advantages over power Braking System. Electrical assist steering, Steering by wire, Advantages of Steering by wire. Semi-active and fully-active suspension system. Advantages of fully active suspension system.

Text & Reference Books :
1. Advanced Vehicle Technologies by Heinz Heisler-SAE International Publication.
2. Electric and Hybrid Electric vehicles by Ronald K. Jurgen.- SAE InternationalPublication
3 .Electronic Braking, Traction and Stability control-SAE Hardbound papers.
1. Electronics steering and suspension systems- SAE Hardbound papers.
2. 42 Volt system by Daniel J. Holt- SAE International Publication
3. Diesel Particulate Emission by J.H. Johnson- SAE Hardbound papers.
4. Fuel Cell Technologies for vehicles by Richard Stobart- SAE Hardbound papers.

ME 551. THERMAL ENGINEERING LAB C (L, T, P) = (0, 0, 2)

List of Experiments:

1. To study and prepare report on the constructional details, working principles and operation of the following Automotive Engine Systems & Sub Systems.
   (a) Multi-cylinder: Diesel and Petrol Engines.
   (b) Engine cooling & lubricating Systems.
   (c) Engine starting Systems.
   (d) Contact Point & Electronic Ignition Systems.
2. To study and prepare report on the constructional details, working principles and operation of the following Fuels supply systems:
   (a) Carburetors
   (b) Diesel Fuel Injection Systems
   (c) Gasoline Fuel Injection Systems.
3. To study and prepare report on the constructional details, working principles and operation of the following Automotive Clutches.
   (a) Coil-Spring Clutch
   (b) Diaphragm – Spring Clutch.
   (c) Double Disk Clutch.
4. To study and prepare report on the constructional details, working principles and operation of the following Automotive Transmission systems.
   (a) Synchromesh – Four speed Range.
   (b) Transaxle with Dual Speed Range.
   (c) Four Wheel Drive and Transfer Case.
   (d) Steering Column and Floor – Shift levers.
5. To study and prepare report on the constructional details, working principles and operation of the following Automotive Drive Lines & Differentials.
   (a) Rear Wheel Drive Line.
   (b) Front Wheel Drive Line.
   (c) Differentials, Drive Axles and Four Wheel Drive Line.
6. To study and prepare report on the constructional details, working principles and operation of the following Automotive Suspension Systems.
   (a) Front Suspension System.
   (b) Rear Suspension System.
7. To study and prepare report on the constructional details, working principles and operation of the following Automotive Steering Systems.
   (a) Manual Steering Systems, e.g. Pitman –arm steering, Rack & Pinion steering.
   (b) Power steering Systems, e.g. Rack and Pinion Power Steering System.
   (c) Steering Wheels and Columns e.g. Tilt & Telescopic steering Wheels, Collapsible Steering Columns.
8. To study and prepare report on the constructional details, working principles and operation of the following Automotive Tyres & wheels.
   (a) Various Types of Bias & Radial Tyres.
   (b) Various Types of wheels.
9. To study and prepare report on the constructional details, working principles and operation of the Automotive Brake systems.
   (a) Hydraulic & Pneumatic Brake systems.
   (b) Drum Brake System.
   (c) Disk Brake System.
   (d) Antilock Brake System.
   (e) System Packing & Other Brakes.
10. To study and prepare report on the constructional details, working principles and operation of Automotive Emission / Pollution control systems.

ME 552. AUTOMOBILE DESIGN & CAM LAB C (L, T, P) = (0, 0, 2)

1. To prepare part programming for plain turning and taper turning operation.
2. To prepare part programming for turning operation in absolute mode.
3. To prepare part program for threading operation.
4. To prepare part program for slot milling operation.
5. To prepare part program for drilling operation.
6. To prepare part program for multiple drilling operation in Z-axis.
7. To prepare part program for multiple drilling in X-axis.
8. To prepare part program for multiple drilling in X and Z axis using drilling cycle.

AND

1. Design vehicle frame.
2. Design suspension system.
3. Design front axle.
4. Design steering system.
5. Design drive line.
6. Design axle system for automobile.
7. Design clutch system.
8. Design gear box.

ME 601 ENERGY CONSERVATION TECHNOLOGIES C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	Radiant Heating Equipment: Panel of heaters - steam - water, electrical radiant heaters, tubular radiant heaters, reflectors, heat transfer, comfort conditions, reduction of heat loss, installation. Prime Movers And Generators: Energy conversion and efficiency, steam turbines, gas turbines, diesel and gas engines, electrical motors and DG-sets. Selection, factors affecting performance, load matching, PF improvement, maintenance practice	6
II	Heat Pumps: General principles, appropriate conditions for using heat pumps, theoretical and practical COP, refrigerants, absorption heat pump, applications of heat pumps; gas driven heat pumps. Heat Recuperators: Basic concepts, liquid/liquid heat exchangers, liquid/gas and gas/liquid heat exchangers, gas/gas exchangers, heat transfer calculations and area determination	6
III	Heat Regenerators: Thermal wheel - basic principle- construction - flue gas as energy source - preheating combustion air - installation, regenerative heat recovery, double-effect operation and coupling of columns	6
IV	Heat Pipes: Basic concepts, design of heat pipes - heat transfer rate - thermodynamic efficiency - influencing factors- wick design - heat recovery from exhaust air, classification of heat pipes, practical applications. Heating Ventilation And Air Conditioning: Comfortable environment, effective temperature, heating and cooling systems, reheat systems, variable air volume, dual duct system, air water system, design considerations	6
V	Cogeneration: Application for cogeneration, types of cogeneration processes- topping cycle plant- bottoming cycle plant. Choice of configuration, effect of legislation-case studies	6

Reference Books:

1. R.M.E. Diamant, Energy Conservation Equipment, The Architectural Press, 1984.
2. S. David Hu, Hand Book of Industrial Energy Conservation; Van Nostrand,Reinhold Pub., 1983.

ME 603 DIRECT ENERGY CONVERSION C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	Fuel Cells: Thermodynamics of fuel cells; free energy change and cell potentials; effects of temperature and pressure on cell potential; energy conversion efficiency; factors affecting conversion efficiency; polarization losses; important types of fuel cells (hydrogen-oxygen, organic compounds-oxygen, carbon or carbon monoxide-air, nitrogen compounds-air); electrode types; electrolytes for fuel cells; applications	6
II	Thermo-Electric Sysems: Thermo-electric phenomena; Thomson, Peltier and Seeback effects; Kelvin's relations; basic thermo-electric engine materials; typical layout of engines; design of thermo-electric generators; thermo-electric cooling	6
III	Thermionic Systems: Thermionic emission; work function and energy distribution of electrons in metals; Richardson-Dushman equation; types of thermionic energy converters and their performance	6
IV	Photovoltic Systems: Photovoltaic effects; photo energy; general theory of junction-type cells; solar cells; operating characteristics of photovoltaic cells; conversion efficiency.	6
V	Magneto hydrodynamic Systems: Conversion process; ionization process; gaseous conduction and Hall effect; formulation of M.H.D. performance; analysis of constant area and verifying area M.H.D. engines	6

Reference Books:

1. Energy Conversion, Chang, Prentice Hall
2. Direct Energy Conversion, Soo ,Prentice Hall
3. Direct Conversion of Heat to Electricy, Kay & Welsh (Eds.), Wiley
4. Fuel Cells, Bockris & Srinivasan, McGraw Hill
5. Magneto hydrodynamics, Kulikovsky & Lyubimov Addison

ME 605 MODELING & PLANNING OF ENERGY SYSTEM C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs. 30
I	Introduction: Energy policy analysis; need for energy modeling; classification of energy models; types of computer based tools for energy planning; national and rural energy planning; sect oral energy planning.	6
II	Input-Output Models: Types and Characteristics of I-O models; use of I-O models; I-O transaction tables; method of estimation and sources of data; mathematical expression on the methodology of construction of I-O tables; case studies. Econometric Models: Statistical estimation techniques; time series; regression analysis; advantages and limitations of econometric models; elastic ties of energy demand; case studies	6
III	Optimization Models: Linear and non-linear optimization models; advantage and limitation of optimization models; case studies of linear optimization models for national and rural energy planning	6
IV	Process Analysis Models: End-use models; process analysis models for industrial, domestic and transport energy conservation; advantage and limitations of process analysis models; case studies	6
V	System Dynamic and Other Simulation Models: Concept of closed system; causal loop diagram; flow diagram and system equations; dynamic behavior of energy systems; advantages and limitations of simulation models; case studies	6

Reference Books:

1. Richard de Nenfville, " Applied Systems Analysis" Mc Graw Hill International Eds. 1990.
2. J.P. Weyant & T. A. Kuczmowski "Engineering- Economy Modeling: Energy Systems" Energy-The International Issue (Special issue an energy modeling), Pergaman Press. Vol. 15, No. ¾ PP 145-715, 1990.
3. J. W. Forrester, " Principle of Systems" MIT Press, 1982.
4. Rene Codoni, Hi- Chun Park, K.V. Ramani, " Integrated Energy Planning: A Manual" Volume on policy planning, Asian & Pacific Development Center, Kuala Lumpur 1985.

ME 607 MACHINE TOOL DESIGN C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	**Introduction to Machine tool Design and Mechanisms:** Working and Auxilary motions in Machine tool parameters defining the working motion of a machine tool, machine tool devices, hydraulic transmission and its elements. General requirements of machine tool design.	7
II	**Regulation of speed and Feed Rates:** Aim of speed and feed rate regulation, stepped regulation of speed; Design of speed box; structural diagrams, general conditions for developing the gearing diagram steeples regulation of speed and feed rates.	7
III	**Design of Machine tool structure:** Functions of Machine tool structures and their requirements. Design criteria for machine tool structures, materials of Machines tool structures, static and dynamic, structure profiles of machine tool structures. Basic design procedure fro machine tool structure.	7
IV	**Design of Spindles:** Functions of spindle unit and Requirements, Materials of spindles, Design Calculations of spindles.	7
V	**Dynamics of Machine Tools:** Dynamic characteristics of elements and systems, Dynamic characteristics of Equivalent Elastic system. Dynamic characteristics of the cutting process, Stability analysis.	7

Reference Books:

1. Machine Tool Design: N.K.Mehta, Tata McGraw Hill
2. Design of Machine Tools, S.K.Basu & D.K.Pal, Oxford & IBH Publishing Co.
3. Machine Tool Design, G.C. Sen and A. Bhattacharya

ME 609 RELIABILITY AND FAILURE ANALYSIS C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs. 40
I	**Introduction:** Basic Probability-concept and various distributions, Concept of Reliability and analysis of various configurations of assemblies and sub-assemblies. Series, Parallel and other grouping. System reliability, Set theory, optimal Cut Set and Tie Set, 'stardelta' method, matrix method etc.	8
II	**Product Failure Theory:** System reliability through 'Even Tree' analysis and Fault Tree Analysis (FTA),Failure Modes and Effects Analysis (FMEA), Failure Modes, Effect and Criticality Analysis (FMECA).R.P.N, Graph theory, etc.	8
III	**Reliability Prediction Models:** Series and parallel systems – RBD approach-Standy systems – m/n configuration – Application of Baye's theorem – cut and tie set method – method – Markov analysis. Optimal allocation of component reliability to achieve maximum system reliability – various techniques and methods such as Proportional, Conditional, Agree, Arinc, etc.	8
IV	**Reliability evaluation:** Concept of loading roughness, probability in design including evaluation of safety margin. Reliability of Engineering Design; Mean, Median & K statistics for Reliability evaluation (non parametric, Short Sample).	8
V	**Reliability Management:** Reliability testing – Reliability growth monitoring - Non parametric methods – Reliability and life cycle costs – Reliability allocation - Replacement model. **Case Studies:** CDiagnostic maintenance through ferrography, Vibration Signature, SOAP and other programme. Case studies done in Indian perspectives using Short Sample, nonparametric reliability.	8

Reference Books:

1. Gupta AK, Reliability engineering and tero-technology, Macmillan India Ltd, Delhi
2. Srinath LS, Reliability Engineering, Affiliated East-West Press Pvt Ltd.Delhi
3. O'Connor PDT,Practical Reliability Engineering, John Wiley & Sons Ltd, Singapore
4. Modarres, "Reliability and Risk analysis", Mara Dekker Inc., 1993.
5. John Davidson, The Reliability of Mechanical system, The Institution of Mechanical Engineering, London, 1998.
6. Smith C.O." Introduction to Reliability in Design" McGraw Hill, London."Reliability Engineering and Risk Analysis",2nd edition Taylor & Francis.

ME 611 TOOL AND CUTTER DESIGN C (L, T, P) = (3, 0, 0)

Unit	Course Contents	Hrs.
I	**Classification of cutting tools:** Various machining operations and the tools required to carry out these operations: principle elements of various cutting tools; single point cutting tool geometry in ASA, ORS & NRS systems. **Tool Materials:** Properties of cutting tool materials, development of cutting tool materials, composition, production process and application of different cutting tool materials viz. High carbon steel, HSS, carbides, Ceramics, CBN, UCON, diamond, etc.	8
II	**Design of Single point cutting tools:** Cutting parameters of a lathe, different turning operations and cutting tools used for these operations. Classification of single point cutting tools: solid, carbide tipped tools, geometrical parameters of a single point cutting tool, design procedure of single point cutting tool, re-sharpening of single point cutting tools. **Form Tools:** Purpose and types, design procedure and their sharpening.	8
III	**Drill design:** Drilling operations, Cutting parameters of drilling operations, different drilling operations and cutting tools used for these operations, Types of drills, solid, carbide tipped drills, geometrical parameters of a twist drill, design procedure of a twist drill, resharpening of the twist drill.	8
IV	**Milling Cutter Design:** Milling operations, milling cutting parameters, different milling operations and cutting tools for these operations, Types of milling cutters, solid, and carbide tipped cutter; geometrical parameters of a milling cutter, design procedure of a disc type milling cutter, re-sharpening of the cutters.	8
V	**Broach design:** Broaching operation and its advantages, broaching cutting parameters, types of broaches, solid, and carbide tipped broaches; design procedure of a broach, resharpening of the broach. **Hob design:** Gear nomenclature, construction of involutes profile, hobbing operation and its advantages, geometrical parameters of a hob, design procedure of a hob.	8

Reference Books:

1. Tool Design, Donaldson, McGraw Hill
2. Cutting tools, Prakash Joshi, Wheeler Publishing
3. Metal Cutting theory & practice, Arschinow & Alearoev, Mir publication

ME 613 POLLUTION CONTROL TECHNOLOGIES C (L, T, P) = (3, 0, 0)

UNIT 1: Introduction: Introduction to air pollution, classification of pollutants, their effects, impact of environment on human
UNIT 2: Air Pollution Sources: Mobile and stationary sources, types of plume dispersion mechanisms, air quality measurement concepts
UNIT 3: Control devices for particulate contaminants: gravitational settlement, centrifugal and wet collectors, fabric filters, cyclon separators, electrostatic precipitators Control devices for gaseous contaminants from stationary sources: adsorption, adsorption, condensation, combustion based pollution control systems
UNIT 4: Automotive Emission control: Types and construction of catalytic converters, emission control through operating parameters and engine design, alternative fuels for emission reduction
UNIT 5: Laws and regulations: National and international standards for mobile and stationary sources of air pollution

Reference Books:
Howard S. Peavy, Donald Rowe; Environmental Engineering; Tata Mc-Graw Hill, 1989.

ME 615. VEHICLE DYNAMICS C (L, T, P) = (3, 0, 0)

UNIT – I INTRODUCTION - Single degree of freedom, two degree of freedom, free, forced and damped vibrations modeling and simulation studies, model of an automobile, magnification factor, transmissibility, vibration absorber.
UNIT – II MULTI DEGREE FREEDOM SYSTEMS - Closed and coupled far system, orthogonally of mode shapes, modal analysis.
UNIT – III STABILITY OF VEHICLES - Load distribution, stability on a curved track slope and a banked road, calculation of tractive effort and reactions for different drives.
UNIT – IV SUSPENSION TYRES AND VEHICLES HANDLING - Requirements, sprung mass frequency, wheel hop, wheel wobble, wheel shimmy, choice of suspension spring rate, calculation of effective spring rate, vehicle suspension in fore and aft, roll axis and vehicle under the action of side forces, tyre, dynamics, ride characteristics power consumed by a tyre. Oversteer, under steer, steady state cornering, effect of braking, driving torques on steering, effect of camber, transient effects in cornering.
UNIT – V NUMERICAL METHODS - Approximate methods for determining fundamental frequency, Dunkerleys lower bound, Rayleighs upper bound, Holzer method for closed coupled system and branched system.

TEXT BOOKS
1. Giri N.K – Automotive Mechanics, Khanna Publishers, 2002.
2. Rao J.S and Gupta. K "Theory and Practice of Mechanical Vibrations", Wiley Eastern Ltd., New Delhi -2, 2002.

REFERENCES
1. Heldt.P.M -"Automotive Chassis"- Chilton Co., New York- 1992
2. Ellis.J.R - "Vehicle Dynamics"- Business Books Ltd., London- 1991
3. Giles.J.G.Steering - "Suspension and Tyres", Illiffe Books Ltd., London- 1998
4. Ham B, Pacejka - Tyre and Vehicle Dynamics - SAE Publication - 2002.
5. Gillespie T.D, "Fundamentals of Vehicle Dynamics", SAE USA 1992.

ME 617 DESIGN OF COMBUSTION SYSTEM C (L, T, P) = (3, 0, 0)

UNIT 1: Types of Fuels: Composition-physical, chemical and thermodynamic properties. Proportion of reactants and cooled products: Individual hydro carbons – volumetric fuel blends gravimetric fuel and mixture calculation from product analysis-physical characteristics of mixtures and products
UNIT 2: Proportions Of Hot Products: Kinetic equilibrium – equilibrium product composition in hydrocarbon combustion – Fuel rich mixture dissociation – general mixture dissociation
UNIT 3: Combustion Energies: Standard energy of formation-standard energy of reaction calorific value-maximum useful work. Combustion Temperatures: Sensible energy – determination of maximum temperature in steady flow – Influence of fuel type and operating parameters. Combustion Efficiencies: Work transfer applications in now-flow – heat transfer applications in steady flow- work transfer applications in steady flow. Combustion Control Systems: Controlling fuel flow- controlling air flow- As pollution control flow
UNIT 4: Design Of Burners: Gas and oil burners- operations characteristics – calculation of gas flow rate; pressure drop efficiency
UNIT 5: Design of furnaces and chimneys, steam generating devices – stokers, fluidized bed combustion – types – performance analysis

Reference Books:
1. Samir Sarkar, Fuels and Combustion, Orient Longman, 1990.
2. E.M. Goodger, Combustion Calculations, The Macmillan Press Ltd., 1977.

Francis G. Shinskey, Energy Conservation throug

EC 201 ELECTRONIC CIRCUITS & DEVICES. C(L,T,P) =4(3,1,0)

Unit	Course Contents	Hrs.
1	**SEMICONDUCTOR PHYSICS:** Mobility and conductivity, charge densities in a semiconductor, Fermi Dirac distribution, carrier concentrations and fermi levels in semiconductor, Generation and recombination of charges, diffusion and continuity equation, Mass action Law, Hall effect.	7
II	Junction diodes, Diode as a ckt. element, load line concept, clipping and clamping circuits, Voltage multipliers. Construction, characteristics and working principles of UJT	7
III	Transistor characteristics, Current components, Current gains: alpha and beta. Operating point. Hybrid model, h-parameter equivalent circuits. CE, CB and CC configuration. DC and AC analysis of CE,CC and CB amplifiers. Ebers-Moll model. Biasing & stabilization techniques. Thermal runaway, Thermal stability.	7
IV	JFET, MOSFET, Equivalent circuits and biasing of JFET's & MOSFET's. Low frequency CS and CD JFET amplifiers. FET as a voltage variable resistor.	7
V	**SMALL SIGNAL AMPLIFIERS AT LOW FREQUENCY:** Analysis of BJT and FET, DC and RC coupled amplifiers. Frequency response, midband gain, gains at low and high frequency. Analysis of DC and differential amplifiers, Miller's Theorem. Cascading Transistor amplifiers, Darlington pair. Emitter follower, source follower.	7
	Total	35

Reference Books

J Millman & C.C. Halkias - Integrated Electornics; Tata Mc-Graw Hill. Pearson Education.
Rebert Boylestad & L. Nashelsky - Electronic Devices and Circuit Theory.
Sedra Smith-Micro Electronic Circuits. Oxford Press, India.
Floyd-Electronic Devices, Pearson Education.
.Shur - Physics of Semiconductor Devices. Prentice Hall of India

EC 204 DIGITAL HARDWARE DESIGN C(L,T,P) =4(3,1,0)

Unit	Course Contents	Hrs.
1	**NUMBER SYSTEMS, BASIC LOGIC GATES & BOOLEAN ALGEBRA:** Binary Arithmetic & Radix representation of different numbers. Sign & magnitude representation, Fixed point representation, complement notation, various codes & arithmetic in different codes & their inter conversion. Features of logic algebra, postulates of Boolean algebra. Theorems of Boolean algebra. Boolean function. Derived logic gates: Exclusive-OR, NAND, NOR gates, their block diagrams and truth tables. Logic diagrams from Boolean expressions and vica-versa. Converting logic diagrams to universal logic. Positive, negative and mixed logic. Logic gate conversion.	7
II	**DIGITAL LOGIC GATE CHARACTERISTICS:** TTL logic gate characteristics. Theory & operation of TTL NAND gate circuitry. Open collector TTL. Three state output logic. TTL subfamilies. MOS & CMOS logic families. Realization of logic gates in RTL, DTL, ECL, C-MOS & MOSFET. Interfacing logic families to one another.	7
III	**MINIMIZATION TECHNIQUES:** Minterm, Maxterm, Karnaugh Map, K map upto 4 variables.Simplification of logic functions with K-map, conversion of truth tables in POS and SOP form. Incomplete specified functions. Variable mapping. Quinn-Mc Klusky minimization techniques.	7
IV	**COMBINATIONAL SYSTEMS:** Combinational logic circuit design, half and full adder, subtractor. Binary serial and parallel adders. BCD adder. Binary multiplier. Decoder: Binary to Gray decoder, BCD to decimal, BCD to 7-segment decoder. Multiplexer, demultiplexer, encoder. Octal to binary, BCD to excess-3 encoder. Diode switching matrix. Design of logic circuits by multiplexers, encoders, decoders and demultiplexers.	7
V	**SEQUENTIAL SYSTEMS:** Latches, flip-flops, R-S, D, J-K, Master Slave flip flops. Conversions of flip-flops. Counters: Asynchronous (ripple), synchronous and synchronous decade counter, Modulus counter, skipping state counter, counter design. Ring counter. Counter applications. Registers: buffer register, shift register.	7
	Total	35

Reference Books: A.P. Malvino & D.P. Leach-Digital Principles & Applications, Tat aMc-graw Hill, Delhi.
Morris Mano-Digital Circuit & Logic Design; Prentice Hll of India.
Tocci-Digital Systems, Pearson Education

EC 208 TELECOMMUNICATION ENGINEERING C(L,T,P) =3(3,0,0)

Unit	Course Contents	Hrs.
1	**TRANSMISSION LINE:** Types of transmission lines, general transmission line equation, line constant, equivalent circuits, infinite line, and reflection on a line, SWR of line with different type of terminations. Distortion less and dissipation less lines, Coaxial cables, Transmission lines at audio and radio frequencies, Losses in transmission line,. Characteristics of quarter wave, half wave and lines of other lengths,	7
II	**TRANSMISSION LINE APPLICATIONS:** Smith chart and its application. Transmission line applications, Impedance matching Network. Single & double Stub matching. Measurement of parameters of transmission line, measurement of attenuation, insertion loss, reflection coefficient and standing wave ratio.	7
III	**ATTENUATORS & FILTERS:** Elements of telephone transmission networks, symmetrical and Asymmetrical two port networks. Different Attenuators, ð-section & T-section attenuators, stub matching, Transmission equalizers Filters, constant K-section, Ladder type, ð-section, T-section filter, m-derived filter sections, Lattics filter section.	7
IV	**TELEPHONE TRANSMISSION:** Telephone set, Touch tone dial types, two wire/ four wire transmission, Echo suppressors & cancellors, cross talk. Multi-channel systems: Frequency division & time division multiplexing.	7
V	**AUTOMATIC TELEPHONY & TELEGRAPHY:** Trunking concepts, Grade of service, Traffic definitions, Introduction to switching networks, classification of switching systems. Principle of Electronic Exchange, EPABX and SPC Digital telephone Exchange, Numbering Plan, Facsimile services.	7
	Total	35

Reference Books: W. Fraser-Telecommunications (BPB Publication)
I. Vishvanathan- Telecommunication switching systems & Networks. Prentice Hall of India.
Cole- Introduction to Telecommunication. Pearson Educatino

EC 253 ELECTRONIC DEVICES & CIRCUITS LAB C(L,T,P) =2(0,0,3)

S. No.	List of Experiments
1.	Study the following devices:
	(a) Analog & digital multimeters
	(b) Function/ Signal generators
	(c) Regulated d. c. power supplies (constant voltage and constant current operations)
	(d) Study of analog CRO, measurement of time period, amplitude, frequency & phase angle using Lissajous figures.
2.	Plot V-I characteristic of P-N junction diode & calculate cut-in voltage, reverse saturation current and static & dynamic resistances.
3.	Plot V-I characteristic of zener diode and study of zener diode as voltage regulator. Observe the effect of load changes and determine load limits of the voltage regulator.
4.	Plot frequency response curve for single stage amplifier and to determine gain bandwidth product.
5.	Plot drain current - drain voltage and drain current – gate bias characteristics of field effect transistor and measure of Idss & Vp
6.	Application of Diode as clipper & clamper
7.	Plot gain- frequency characteristic of two stage RC coupled amplifier & calculate its bandwidth and compare it with theoretical value.
8.	Plot gain- frequency characteristic of emitter follower & find out its input and output resistances.
9.	Plot input and output characteristics of BJT in CB, CC and CE configurations. Find their hparameters.
10.	Study half wave rectifier and effect of filters on wave. Also calculate theoretical & practical ripple factor.
11.	Study bridge rectifier and measure the effect of filter network on D.C. voltage output & ripple factor.

EC 254 DIGITAL HARDWARE DESIGN LAB C(L,T,P) = 2(0,0,2)

S. No.	List of Experiments
1.	To study and perform the following experiments. (a) Operation of digital multiplexer and de-multiplexer. (b) Binary to decimal encoder. (c) Characteristics of CMOS integrated circuits.
2.	To study and perform experiment- Compound logic functions and various combinational circuits based on AND/NAND and OR/NOR Logic blocks.
3.	To study and perform experiment -Digital to analog and analog to digital converters.
4.	To study and perform experiment- Various types of counters and shift registers.
5.	To study and perform experiment - Interfacing of CMOS to TTL and TTL to CMOS ICs.
6.	To study and perform experiment- BCD to binary conversion on digital IC trainer.
7.	To study and perform experiment – (a) Astable (b) Monostable (c) Bistable Multivibrators and the frequency variation with different parameters, observe voltage waveforms at different points of transistor.
8.	To study and perform experiment -Voltage comparator circuit using IC-710.
9.	To study and perform experiment- Schmitt transistor binary circuit.
10.	Design 2 bit binary up/down binary counter on bread board.

EC 302 MICROPROCESSOR C(L,T,P) =4(3,1,0)

Unit	Course Contents	Hrs.
1	**INTRODUCTION**: CPU, address bus, data bus and control bus. Input/ Output devices, buffers, encoders, latches and memories.	7
II	**8085 MICROPROCESSOR ARCHITECTURE**: Internal data operations and registers, pins and signals, peripheral devices and memory organization, interrupts. CISC and RISC architecture overview.	7
III	**8085 MICROPROCESSOR INSTRUCTIONS**: Classification, format and timing. Instruction set.Programming and debugging, 8 bit and 16 bit instructions.	7
IV	**8085 MICROPROCESSOR INTERFACING**: 8259, 8257, 8255, 8253, 8155 chips and their applications. A/D conversion, memory, keyboard and display interface (8279).	7
V	**8086/8088 MICROPROCESSOR:** Hardware specifications, architecture, address spaces, clock generator, bus controller and arbiter, Minimum and maximum mode. System Bus Timing. Assembly language programming, addressing mode and instructions of 8086/8088, linking and execution of programs. MACRO programming, assembler directives and operators.	7
	Total	35

Reference Books:

R. Gaonkar- Microprocessor Architecture, Programming and Applications, Wiely Eastern Ltd.
Dougtas V.Hall- Microprocessors & Interfacing: Programming and Hardware, Tata Mc-Graw Hill.
Barry B. Brey- The Intel Microprocessors: Architecture, Programming & Interfacing, Pearson Education Asia.

EC 305 LINEAR INTEGRATED CIRCUITS C(L,T,P) =4(3,1,0)

Unit	Course Contents	Hrs.
1	**OPERATIONAL AMPLIFIERS**: Basic differential amplifier analysis, Single ended and double ended configurations, Op-amp configurations with feedback, Op-amp parameters, Inverting and Non- Inverting configuration, Comparators, Adder.	7
II	**OPERATIONAL AMPLIFIER APPLICATIONS:** Integrator, Differentiator, Voltage to frequency & Frequency to voltage converters. Oscillators: Phase shift, Wein bridge, Quadrature, square wave, triangular wave, saw tooth oscillators. Voltage controlled oscillators.	7
III	**ACTIVE FILTERS:** Low pass, high pass, band pass and band reject filters, All pass filter, Switched capacitor filter, Butterworth filter design, and Chebyshev Filter design.	7
IV	**PHASE-LOCKED LOOPS**: Operating Principles of PLL, Linear Model of PLL, Lock range, Capture range, Applications of PLL as FM detector, FSK demodulator, AM detector, frequency translator, phase shifter, tracking filter, signal synchronizer and frequency synthesizer, Building blocks of PLL, LM 565 PLL.	7
V	**LINEAR IC's**: Four quadrant multiplier & its applications, Basic blocks of linear IC voltage regulators, Three terminal voltage regulators, Positive and negative voltage regulators. The 555 timer as astable and monostable multivibrators. Zero crossing detector, Schmitt trigger.	7
	Total	35

Reference Books:

R.A. Gayakwad-Op-amplifiers & Linear ICs, Prentice Hall of India.
Taubay-Operational Amplifiers.
K.R. Botkar-Integrated Circuits. Pearson Education.

EC - 311 Signal & Networking C(L,T,P) =3(3,0,0)

Unit	Course Contents	Hrs.
1	**INTRODUCTION OF SIGNALS:** Continuous time and discrete time systems, Properties of systems. Linear time invariant systems - continuous time and discrete time. Properties of LTI systems and their block diagrams. Convolution, Discrete time systems described by difference equations FOURIER SERIES REPRESENTATION OF SIGNALS: Fourier series representation of continuous periodic signal & its properties, Fourier series representation of Discrete periodic signal & its properties, Continuous time filters & Discrete time filters described by Diff. equation.	8
II	**FOURIER TRANSFORM:** The continuous time Fourier transform for periodic and aperiodic signals, Properties of CTFT. Discrete time Fourier transform for periodic and aperiodic signals. Properties of DTFT. The convolution and modulation property.	7
III	**NETWORK THEOREMS AND ELEMENTS:** Thevenin's, Norton's, Reciprocity, Superposition, Compensation, Miller's, Tellegen's and maximum power transfer theorems. Networks with dependent sources. Inductively coupled circuits – mutual inductance, coefficient of coupling and mutual inductance between portions of same circuits and between parallel branches. Transformer equivalent, inductively and conductively coupled circuits.	6
IV	**TRANSIENTS ANALYSIS:** Impulse, step, ramp and sinusoidal response Analysis of first order and second order circuits. Time domain & transform domain (frequency, Laplace) analysis. Initial and final value theorems. Complex periodic waves and their analysis by Fourier analysis. Different kind of symmetry. Power in a circuit.	7
V	**NETWORK FUNCTIONS:** Terminals and terminal pairs, driving point impedance transfer functions, poles and zeros. Procedure of finding network functions for general two terminal pair networks. Stability & causality. Hurwitz polynomial, positive real function.	7

Reference Books:

Kuo, Franklin F - Netwrok analysis and sysnthesis, II Ed, 1999, Jhon Wiley & sons.
Desoer, C. And Duh, E.S-E.s. Basic circuit theory, Mc Graw Hill.
Van Valkenburg, M.E. - Network Analysi, Prentice Hall, India.
Schaum's Outling series on circuit analysis.
Hayt; W, and Kinmmerly - Engineering circuit analysis, Mc Graw Hill, Inc.
Sudhakar, A and Chyam Mohan S.P. - Circuits and Networks, Tata Mc Graw Hill. India.
.V. Oppenheim, A.S. Willsky and I.J. Young-"Signals & Systems", Prentice Hall of India Ltd.
Tabub & Schilling-"Principles of Communication System", Tata Mc-graw Hill.
Prokins & Manolakis-Digital Signal Processing: Principles algorithms *Applications, Prentice Hall Pvt. Ltd.

EC – 312 COMMUNICATION SYSTEMS C(L,T,P) =4(3,1,0)

Units	Contents of the Subject	Hrs.
1	**INTRODUCTION:** Introduction to communication systems, signals and spectra, electromagnetic spectrum and its usage, communication channels and propagation characteristics	8
2	**Modulation Techniques & Noise:** amplitude modulation and demodulation - spectra, circuits and systems, frequency modulation/demodulation, frequency division multiplexing, radio transmitters and receivers, sampling theory, pulse modulation and demodulation, types of noise spectra, circuits & systems, circuit noise, performance of analogue communication systems in AWGN and fading channels	7
3	**Introduction to Satellite Systems**; Orbiting satellites, satellite frequency bands, communication satellite systems, satellite modulation and multiple access formats; Satellite uplink and downlink analyses in C, Ku and Ka bands; multiple beam, frequency reuse; Satellite transponder; Satellite front end.	7
4	**Digital Transmission**: Introduction, pulse modulation, PCM – PCM sampling, signal to quantization noise rate, commanding – analog and digital – percentage error, delta modulation, adaptive delta modulation, differential pulse code modulation, pulse transmission , data modems, - Asynchronous modem, Synchronous modem, low-speed modem, medium and high speed modem, modem control.	8
5	**Digital Modulation techniques:** Introduction to ASK, FSK, PSK, QPSK and DPSK.QAM and PAM modulation techniques.	7

Recommended Books:

1. Analog and digital communication by Lathi, Oxford Publication.
2. Analog and digital communication by Symons Hykins

EC 353 ELECTRONIC ENGINEERING DESIGN LAB C(L,T,P) =3(0,0,3)

S. No.	List of Experiments
	To design the following circuits, assemble these on bread board and test them. Simulation of these circuits with the help of appropriate software.
1.	Op-Amp characteristics and get data for input bias current, measure the output-offset voltage and reduce it to zero and calculate slew rate.
2.	Op-Amp in inverting and non-inverting modes.
3.	Op-Amp as scalar, summer and voltage follower.
4.	Op-Amp as differentiator and integrator.
5.	Design LPF and HPF using Op-Amp 741
6.	Design Band Pass and Band reject Active filters using Op-Amp 741.
7.	Design Oscillators using Op-Amp (i) RC phase shift (ii) Hartley (iii) Colpitts
8.	Design (i) Astable (ii) Monostable multivibrators using IC-555 timer
9.	Design Triangular & square wave generator using 555 timer.
10.	Design Amplifier (for given gain) using Bipolar Junction Transistor.

EC 354 MICROPROCESOR LAB C(L,T,P) =3(0,0,3)

S. No.	List of Experiments
1.	Study the hardware, functions, memory structure and operation of 7085 microprocessor kit.
2.	Program to perform integer division: (i) 8-bit by 8-bit (ii) 16-bit by 8-bit.
3.	Transfer of a block of data in memory to another place in memory in the direct and reverse order.
4.	Searching a number in an array and finding its parity.
5.	Sorting of array in: (i) Ascending (ii) Descending order
6.	Programme to perform following conversion: (i) BCD to ASCII (ii) BCD to Hexadecimal
7.	Programme to multiply two 8-bit numbers.
8.	Programme to generate and sum 15 fibanocci numbers.
9.	Programme for rolling display of message “INDIAN”.
10.	To insert a number at correct place in a sorted array.
11.	Serial and Parallel data transfer on output port 8155 & 8255 & designing of disco light, running light, and sequential lights on off by above hardware.
12.	Generation of different waveform on 8253/ 8254 programmable timer.

EC 401 ANTENNA & WAVE PROPAGATION C(L,T,P) =3(3,0,0)

Unit	Course Contents	Hrs.
1	**ANTENNA FUNDAMENTALS** - Antenna parameters, Radiation from a current element in free space. Quarter & half wave antenna. Reciprocity theorem. Resonant and non-resonant antenna. Effective length and aperture, gain, beam width, directivity, radiation resistance, efficiency, polarization, impedance and directional characteristics of antenna, antenna temperature.	7
II	**ANTENNAS** - V and Rhombic antennas, Folded dipole, Yagi-Uda antenna, Frequency independent antennas, Log-periodic antennas, UHF and Microwave antennas- Antenna with parabolic reflectors, Horn and Lens antennas, Helical antennas, Square and Circular loop antennas, Fundamentals of Slot and Micro strip antennas.	7
III	**ANTENNA ARRAYS** - Two element array, N-element linear arrays, Broadside, End fire, collinear and combination arrays, Multiplication of patterns, Binomial arrays. Effect of ground on antennas, Antenna loading. **Antenna Measurements** - Antenna impedance, radiation pattern, gain, directivity, polarization and phase measurements	7
IV	**RADIO WAVE PROPAGATION** - Mechanism of radio wave propagation, Reflection, Refraction interference and diffraction of radio waves. Theory of ground wave, space wave and sky wave propagation. Plane earth reflection, Reflection factors for horizontal and vertical polarizations. Duct propagation and troposphere scattering.	7
V	Various Ionospheric layers. Characteristics of ionosphere and its effects on wave propagation. Critical frequency, Virtual height, skips zone & maximum usable frequency. Multiple hop transmission. Oblique & vertical incidence transmission. Effect of earth's magnetic field, solar activity and meteorological conditions on wave propagation.	7
	Total	35

Reference Books:J.D. Kraus, 'Antennas', Mc-Graw Hill.
C.A. Balanis, 'Antenna Theory', Harper & Row.
K.D. Prasad, 'Antenna and Wave Propagation', SATYA Prakashan, New Delhi.
E.C. Jordan and K.g. Balmain, 'Electromagnetic waves and Radiating Systems', Prentice hall of India.
R.e. Collin, 'Antennas & Radio Wave Propagation', Mc-Graw Hill.

EC 403 WIRELESS COMMUNICATION C(L,T,P) =3(3,0,0)

Unit	Course Contents	Hrs.
1	PROPAGATION PHENOMENA - Fundamentals of fading, Multipath channels, Spread Spectrum signals: Direct-sequence spread spectrum signals, p-n sequences, Frequency-hopped spread spectrum signals, Code-division multiplexing.	7
II	LINE OF SIGHT MICOWAVE COMMUNICATION- Link Engineering, Frequency planning, Free space loss, Fresnel zone clearance bending of radio beam, Effective earth radius, Building blocks of Transmitter & Receiver.	7
III	MULTIPLE ACCESS TECHNIQUES - FDMA, TDMA and CDMA with reference to mobile radio and satellite systems. TDMA based networks. CDMA based networks,	7
IV	CELLULAR WIRELESS NETWORKS-, GSM: Introduction, overview of the GSM systems, GSM codec, channel coding and interleaving, radio like control. Cordless systems and WLL, Mobile IP, Wireless access protocol. Wireless LAN's: Technology, IEEE 702.11 standards and Blue tooth., Broadband Wireless 702.16	7
V	SATELLITE COMMUNICATION - Elements of satellite communication: Frequency bands, Transmission and multiplexing. Modulation, Multiple access. Satellite orbit and description- orbital period and velocity, effects of orbital inclination, Azimuth and elevation, Coverage angle and slant range, Geostationary orbit, Satellite description. Earth Station antenna, high-power amplifier, low-noise amplifier, up converter, down converter, monitoring and control, reliability. Satellite Link: basic link analysis,	7
	Total	35

Reference Books:
Reppaport-Wireless Communication, Pearson Education.
William Stallings- Wireless communication & Networks, LPE, Pearson Education, Asia.
Tri. T. Ha.- Digital Satellite Communications, Mc-Graw Hill International.
Dr.Kamilo Feher-Digital Wireless Communication, Prentice Hall of India.
William C.Y. Le-Mobile Cellular Telecommunications, Mc-Graw Hill Interational Edition.
Richharia M-Satellite Communication System, Mac Millan.

EC – 404 DIGITAL SIGNAL PROCESSING C(L,T,P) =4(3,1,0)

Unit	Course Contents	Hrs.
1	**SAMPLING** - Discrete time processing of Continuous-time signals, continuous-time processing of discrete-time signals, changing the sampling rate using discrete-time processing.	7
II	**TRANSFORM ANALYSIS OF LTI SYSTEMS** - Introduction, The frequency response of LTI systems, System functions for systems characterized by LCCD (Linear Constant Coefficient Difference) equations, All-pass system, Minimum-Phase systems, Linear systems with linear phase.	7
III	**STRUCTURES FOR DISCRETE-TIME SYSTEMS**- Block diagram and signal flow graph representation of LCCD (LCCD – Linear Constant Coefficient Difference) equations, Basic structures for IIR and FIR systems, Transposed forms.	7
IV	**FILTER DESIGN TECHNIQUES** - Introduction, Analog filter Design: Butterworth & Chebyshev.IIR filter design by impulse invariance & bilinear transformation. Design of FIR filters by Windowing: Rectangular, Hanning, Hamming & Kaiser.	7
V	The Discrete Fourier transforms (DFT), Properties of the DFT, Linear Convolution using DFT. Efficient computation of the DFT: Decimation–in-Time and Decimation-in frequency FFT Algorithms. Processing of speech signals: Vocoders, linear predictive coders.	7
	Total	35

EC 405 MICROCONTROLLER C(L,T,P) =4(3,1,0)

Unit	Course Contents	Hrs.
1	**THE 8051 MICROCONTROLLER:** Introduction, The 8051 microcontroller hardware. I/O pins, Port, External memory. Counters and Timers, Serial data. Interputs.	7
II	**8051 ASSEMBLY LANGUAGE PROGRAMMING:** Addressing modes, External data moves, push and pop opcides, Logical operations, Byte level and bit level logival operations. Arithmetic operations, Jump and call instructions, Interrupts & returns.	7
III	**REAL WORLD INTERFACING:** Interfacing of LCD, ADC to 8051.	7
IV	**INTRODUCTION TO REAL TIME OPERATING SYSTEMS:** Round robin with interrupts, RTOS Architecture, Task and task states, Semphores and shared data.	7
V	**BASIC DESIGN USING RTOS:** Encapsulating Semaphores and Queues, Saving Memory Space, Saving power.	7
	Total	35

Reference Books:

K.N. Ayala-The 8051 Microcontroller. Penram International.
M.A. Mazidi and J.G. Mazidi-The 8051 Microcontroller and Embedded Systems, Pearson Education Asia.
David simon-An Embedded software Primer. Pearson Education Asia.
J.W. Valvano Brooks/Cole-Embedded Microcomputer Systems Thomson LearningTM

EC 406 VLSI DESIGN C(L,T,P) =4(3,1,0)

Unit	Course Contents	Hrs.
1	INTRODUCTION TO MOS TECHNOLOGY- Basic MOS transistors, Enhancement Mode transistor action, Depletion Mode transistor action, NMOS and CMOS fabrication.	7
II	BASIC ELECTRICAL PROPERTIES OF MOS CIRCUITS- Ids versus Vds relationship, Aspects of threshold voltage, Transistor Transconductance gm. The nMOS inverter, Pull up to Pull-down ratio for a NMOS Inverter and CMOS Inverter (Bn/Bp), MOS transistor circuit Model, Noise Margin.	7
III	CMOS LOGIC CIRCUITS- The inverter, Combinational Logic, NAND Gate NOR gate, Compound Gates, 2 input CMOS Multiplexer, Memory latches and registers, Transmission Gate, Gate delays, CMOS-Gate Transistor sizing, Power dissipation.	7
IV	Basic physical design of simple Gates and Layout issues. Layout issues for inverter, Layout for NAND and NOR Gates, Complex Logic gates Layout, Layout optimization for performance.	7
V	Introduction to VHDL, Prolog & other design tools. VHDL Code for simple Logic gates, flip-flops, shift registers.	7
	Total	35

Reference Books:

Stephen Brown and Zvonlo Veranesic-Fundamentals of Digital Logic with VHDL Design, Tata Mc-Graw Hill.
Neil H.E. Weste, Kamran Eshraghian-Principles of CMOS VLSI Design.
Douglas A. Pucknell, Kamran Eshraghian-Basic VLSI Design.
Michael John, Sebastian Smith-Application specific Integrated Circuit.
Behzad Razavi-Design of Analog CMOS Integrated Circuits, Mc-Graw Hill.

EC 410 IMAGE PROCESSING C(L,T,P) =3(3,0,0)

Unit	Course Contents	Hrs.
1	INTRODUCTION: Imaging in ultraviolet and visible band. Fundamental steps in image processing. Components in image processing. Image perception in eye, light and electromagnetic spectrum, Image sensing and acquisition using sensor array.	7
II	DIGITAL IMAGE FUNDAMENTALS: Image sampling and quantization, Representing digital images, Spatial and gray-level resolution, Aliasing and Moiré patterns, Zooming and Shrinking digital images.	7
III	IMAGE RESTORATION: Image restoration model, Noise Models, Spatial and frequency properties of noise, noise probability density functions, Noise - only spatial filter, Mean filter Statistic filter and adaptive filter, Frequency domain filters - Band reject filter, Band pass filter and Notch filter.	7
IV	IMAGE COMPRESSION: Compression Fundamentals - Coding Redundancy, Interpixel redundancy, Psycho visual redundancy and Fidelity criteria. Image Compression models, Source encoder and decoder, Channel encoder and decoder, Lossy compression and compression standards. color space formats, scaling methodologies (like horizontal, vertical up/down scaling). Display format (VGA, NTSC, PAL).	7
V	EXPERT SYSTEM AND PATTERN RECOGNITION: Use of computers in problem solving, information representation, searching, theorem proving, and pattern matching with substitution. Methods for knowledge representation, searching, spatial, temporal and common sense reasoning, and logic and probabilistic inferencing. Applications in expert systems and robotics	7
	Total	35

Reference Books:

Rafael C. Gonzalez-Digital Image Processing, Pearson Edcation Asia.
Kenneth R. Castleman-Digital Image Processing, Pearson Education Asia.
Nick Effard-Digital Image Processing, Pearson Education Asia.
Jain A.K.-Digital Image Processing, Prentice hall of India.
Sonka, Hlavac & Boyle-Image Processing. analysis and machine Vision, Thomas Learning.

EC 453 MICROCONTROLLER LAB C(L,T,P) =3(0,0,3)

S. No.	List of Experiments
1.	Write a program to add two 2-byte numbers with a 3-byte sum.
2.	Write a program to add an array of 8 numbers using loop.
3.	Write a program to convert temperature from Fahrenheit to Centigrade.
4.	Implement a sequencer traffic light controller.
5-6.	Implement real time interrupt.
7-8.	Interface microcontroller with stepper motor and move motor by given steps.
9-10.	Interface, test and control LED display with Microcontroller.
11-12.	Implement a watchdog timer and test the same to check infinite loop.

EC 454 SIGNAL PROCESSING LAB C(L,T,P) =2(0,0,3)

S. No.	List of Experiments
	Simulation in MATLAB Environment:
1.	Generation of continuous and discrete elementary signals (periodic and non-periodic) using mathematical expression.
2.	Generation of Continuous and Discrete Unit Step Signal.
3.	Generation of Exponential and Ramp signals in Continuous & Discrete domain.
4.	Continuous and discrete time Convolution (using basic definition).
5.	Adding and subtracting two given signals. (Continuous as well as Discrete signals)
6.	To generate uniform random numbers between (0, 1).
7.	To generate a random binary wave.
8.	To generate random sequences with arbitrary distributions, means and variances for following: (a) Rayleigh distribution (b) Normal distributions: N (0, 1). (c) Gaussian distributions: N (mx, óx2)
9.	To plot the probability density functions. Find mean and variance for the above distributions

EC 601 EMBEDDED SYSTEM DESIGN C(L,T,P) =3(3,0,0)

UNIT	Course Contents	Hrs.
1	**EMBEDDED COMPUTING-** Microprocessors, embedded design process, system description formalisms. Instruction sets- CISC and RISC; CPU fundamentals- programming I/Os, co-processors, supervisor mode, exceptions, memory management units and address translation, pipelining, super scalar execution, caching, CPU power consumption.	7
II	**EMBEDDED COMPUTING PLATFORM-** CPU bus, memory devices, I/O devices, interfacing, designing with microprocessors, debugging techniques., Program design and analysis- models of program, assembly and linking, compilation techniques, analysis and optimization of execution time, energy, power and size.	7
III	**PROCESSES AND OPERATING SYSTEMS-** multiple tasks and multiple processes, context switching, scheduling policies, inter-process communication mechanisms.	7
IV	**HARDWARE ACCELERATORS-** CPUs and accelerators, accelerator system design. Networks- distributed embedded architectures, networks for embedded systems, network-based design, Internet-enabled systems.	7
V	**SYSTEM DESIGN TECHNIQUES-** design methodologies, requirements analysis, system analysis and architecture design, quality assurance.	7
	Total	35

Reference Books:

1. Wolf, W. Computers as components- Principles of embedded computing system design. Academic Press (Indian edition available from Harcourt India Pvt. Ltd., 27M Block market, Greater Kailash II, New Delhi-110 048.)

EC 613 WIRELESS SENSOR NETWORKS C(L,T,P) =4(3,1,0)

UNIT	Contents of the Subject	Hrs
1	**WIRELESS SENSOR NETWORKS**: Introduction, Smart environments, the physical layer in WSN, WSN medium access control and link layer protocols	7
II	**COMMUNICATION NETWORKS:** Network architecture, Network Topology, Communication Protocols and Routing, Power Management, Network Structure and Hierarchical Networks, Historical Development and Standards	7
III	**SMART SENSORS:** IEEE 1451 and Smart Sensors, Transducers and Physical Transduction Principles, Sensors for Smart Environments, Commercially Available Wireless Sensor Systems,	7
IV	**WSN SERVICES:** Self-Organization and Localization, topology control and routing, data-centric and content-based routing, Quality of Service and transport protocols, in-network aggregation and WSN security.	7
V	**SIGNAL PROCESSING AND DECISION-MAKING:** signal processing and decision-making, Signal Conditioning, Digital Signal Processing, Decision-Making and User Interface, Building and Home Automation,	7
	Total	35

Reference Books:

1. R. Frank, Understanding Smart Sensors, 2nd Ed., Artech House, Norwood, MA, 2000.
2. Ivan Stojmenovic Wireless Sensor Networks: Challenges and Opportunities
3. C.W. de Silva, Control Sensors and Actuators, Prentice-Hall, New Jersey, 1989.
4. F.L. Lewis, Optimal Estimation, Wiley, New York, 1986.
5. F.L. Lewis, Applied Optimal Control and Estimation, Prentice-Hell, New Jersey, 1992.
6. F.L. Lewis, C.T. Abdallah, and D.M Dawson, Control of Robot Manipulators, Macmillan, New York, Mar. 1993.
7. Murthy & Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols," ISBN 0-13-147023-X, Pearson 2004
8. William Stallings, “Wireless Communications & Networks”, ISBN: 0131918354, Prentice Hall; 2nd edition, November 12, 2004.

EC 617 MICRO-ELECTRO-MECHANICAL-SYSTEMS (MEMS) C(L,T,P) =4 (3,1,0)

UNIT	Contents of the Subject	Hrs
1	Micro electro mechanical system (MEMS) origins. MEMS impetus/ motivation.	7
II	Material for MEMS. The toolbox: processes for micro machining.	7
III	MEMS fabrication technologies. Fundamentals MEMS device physics: Actuation. Fundamental	7
IV	MEMS devices: The cantilever beam. Microwave MEMS applications:	7
V	MEM switch design considerations. The micro-machined transmission line. MEMS-based microwave circuit and system.	7
	Total	35

Reference Books:

1. Microelectromechanical (MEM) Microwave Systems by Hector J.De Los Santos, Artechhouse
2. An Introduction to Microelectromechanical System by Nadim Maluf, Artechhouse

EE-205 ELECTRO MECHANICAL ENERGY CONVERSION- I C(L.T.P) = 3(3,0,0)

UNIT	COURSE CONTENTS	Hrs.
I	**Electromechanical Energy Conversion:** Basic principles of electromechanical energy conversion. Basic aspects and physical phenomena involved in energy conversion. Energy balance.	**6**
II	**DC generators**: Construction, Types of DC generators, emf equation, lap and wave windings, equalizing connections, armature reaction, commutation, methods of improving commutations, demagnetizing and cross magnetizing mmf, interpoles, characteristics, parallel operation. Rosenberg generator.	**6**
III	**DC Motors:**Principle, back emf, types, production of torque, armature reaction and interpoles, characteristics of shunt, series and compound motor, DC motor starting. Speed Control of DC Motor: Armature voltage and field current control methods, Ward Leonard method. Braking, losses and efficiency, direct and indirect test, Swinburne's test, Hopkinsion test, field and retardation test, single-phase series motor.	**8**
IV	**Transformers:** Construction, types, emf equation. No load and load conditions. Equivalent circuits, Vector diagrams, OC and SC tests, Sumpner's back-to-back test, efficiency. Voltage regulation, effect of frequency, parallel operation, autotransformers, switching currents in transformers, separation of losses.	**8**
V	**Polyphase Transformers:** Single unit or bank of single-phase units, polyphase connections, Open delta and V connections, Phase conversion: 3 to 6 phase and 3 to 2 phase conversions, Effect of 3-phase winding connections on harmonics, 3-phase winding transformers, tertiary winding.	**8**

References:

1.) P.S.Bimbhra, Electrical Machinery, 2000, Khanna publishers New Delhi.
2.) J.Nagrath and D.P.Kothari, Electrical Machines 2000, TATA MCGRAW HILL Publication New Delhi.
3.) P.S.Bimbhra, Generalized theory of Electrical Machine, 1996, Khanna publishers, New Delhi.
4.) Gopal K.Dubey, Fundamental of Electrical Drives, 2001 Narosa Publishing House, New Delhi
5.) Fitzrald,Kingsley and umans Electrical Machines 2000, TATA MCGRAW HILL Publication New Delhi.
6.) Advance Electrical Technologies by H.Cotton

EE – 253 ELECTRO-MECHANICAL ENERGY CONVERSION –I LAB *C (L, T, P) = (0, 0, 3)*

1 Speed control of D.C. shunt motor by (a) Field current control method and plot the curve for speed vs field current. (b) Armature voltage control method and plot the curve for speed vs armature voltage.
2 Speed control of a D.C. Motor by Ward Leonard method and to plot the curve for speed vs applied armature voltage.
3 To determine the efficiency of D.C. Shunt motor by loss summation (Swinburne's) method.
4 To determine the efficiency of two identical D.C. Machine by Hopkinson's regenerative test.
5 To perform O.C. and S.C. test on a 1-phase transformer and to determine the parameters of its equivalent circuit its voltage regulation and efficiency.
6 To perform back-to-back test on two identical 1-phase transformers and find their efficiency and parameters of the equivalent circuit.
7 To perform parallel operation of two 1-phase transformers and determine their load sharing.
8 To determine the efficiency and voltage regulation of a single-phase transformer by direct loading.
9 To perform OC and SC test on a 3-phase transformer and find its efficiency and parameters of its equivalent circuit.
10 To perform parallel operation of two 3-phase transformers and determine their load sharing.
11 To study the performance of 3-phase transformer for its various connections, i.e. star/star star/delta delta/star and delta/delta and find the magnitude of 3rd harmonic current.

EE310 INDUSTRIAL ELECTRONICS C(L,T,P) =3(3,0,0)

Unit	Course Contents	Hrs.
1	**SEMICONDUCTOR POWER DEVICES:-**Characteristic of power diodes, power transistor, IGBTS,TRIAC, DIAC, SUS , SBS, and SCS. **SCR**:- Construction and its characteristics. Methods of turning on and turning off. Rating and rating extension by series/parallel operation. Specification and ratings. String efficiency. Simple firing circuit using UJTs. Protection of SCRs against overcurrent and voltages surges.	7
II	**CONTROLLED RECTIFIERS**:-Single and Three phase half wave and full wave controlled rectifiers. Double –Y type rectifier with interphase transformer, three phase bridge rectifier circuits .Effect of flywheel diode	7
III	**COMMUTATION CIRCUITS**:- Line commutation and different commutation circuits, Mcmurray-Bedford commutation(center tapped and bridge circuits),commutation by auxiliary thyristors.	7
IV	**CONVERTERS**:- One ,two and four quadrant converters, overlap, regulation, input current waveforms and power factors. Inverters:- Single phase Tapped and Bridge inverter circuits, 3 phase bridge inverter. Voltage sourced and current sourced inverters.	7
V	**CHOPPERS AND CYCLOCONVERTERS**:- Basic chopper circuits , 2 and 4 quadrant choppers. Principle of operation of cycloconverter. Single phase to single phase ,three phase to single phase and three phase to three phase cycloconverter circuits.	7
	Total	35

Reference Books

1. Power Electronics – By P.C. Sen
2. Power Electronics- By Dubey
3. Power Electronics- Ramamurthy
4. Industrial Electronics-By G.K. Mittal
5. Power Electronics Systems- By Agarwal (Pearson Education Indi

EE 402 ELECTRICAL DRIVES C(L,T,P) = 4(3,1,0)

UNIT	COURSE CONTENTS	Hrs.
I	**Dynamics of Electric Drives:** Fundamental torque equations, speed-torque conventions and multi-quardant operation, equivalent values of drive parameters, nature and classification of load torques, steady state stability, load equalization, close loop configurations of drives.	**6**
II	**DC Drives:** Speed torque curves, torque and power limitation in armature voltage and field control, Starting. **Braking-**Regenerative Braking, dynamic braking and plugging. **Speed Control**-Controlled Rectifier fed DC drives, Chopper Controlled DC drives.	**6**
III	**Induction Motor Drives-I: Starting. Braking-**Regenerative braking, plugging and dynamic braking. **Speed Control**-Stator voltage control, variable frequency control from voltage source, Voltage Source Inverter (VSI) Control.	**8**
IV	**Induction Motor Drives-II:** Variable frequency control from current source, Current Source Inverter (CSI) Control, Cycloconverter Control, Static rotor resistance control, Slip Power Recovery- Stator Scherbius drive, Static Kramer drive.	**8**
V	**Synchronous Motor Drive**: Control of Synchronous Motor-Separately Controlled and VSI fed Self-Controlled Synchronous Motor Drives. Dynamic and Regenerative Braking of Synchronous Motor with VSI. Control of Synchronous Motor Using Current Source Inverter (CSI)	**8**

References:

1) G K Dubey Fundamentals of Electrical Drives,Narosa Publishing House, New Delhi,1995.
2) V Subrahmanyam:Thyristor control of electric Drives,Tata McGraw Hill, New Delhi, 1988.
3) V Subrahmanyam:Electric Drives-Concepts and Applications,Tata McGraw Hill,New Delhi.
4) S K Pillai:A first course on electrical Drives,Wiley Eastern limited,India.
5) B K Bose:Power electronics and A. C. Drives, Prentice Hall.

CP 216 OBJECT ORIENTED PROGRAMMING C(L,T,P) =3(3,0,0)

Unit	Course Contents	Hrs.
1	**OOP FUNDAMENTALS:** Concept of class and object, attributes, public, private and protected members, derived classes, single & multiple inheritance,	7
II	**PROGRAMMING IN C++:** Enhancements in C++ over C, Data types, operators and functions. Inline functions, constructors and destructors. Friend function, function and operator overloading. Working with class and derived classes. Single, multiple and multilevel inheritances and their combinations, virtual functions, pointers to objects. Input output flags and formatting operations. Working with text files.	7
III	**JAVA:** Variation from C++ to JAVA. Introduction to Java byte code, virtual machine, application & applets of Java, integer, floating point, characters, Boolean, literals, and array declarations.	7
IV	**OPERATORS AND CONTROL STATEMENTS:** Arithmetic operators, bit wise operators, relational operators, Boolean logic operators, the assignment operators, ?: operators, operator precedence. Switch and loop statements.	7
V	**PACKAGE AND INTERFACES:** Packages, access protection, importing & defining packages. Defining and implementing interfaces.	7
	Total	35

Reference Books:

Folk-File Structre: An Object Oriented Approach to C++, Pearson Education.
Patric Naughton: Java 2, Tat Mc-Graw Hill.
C Gottfried: Programming in C, Schaum Series, Tata Mc-Grtaw Hill.
Balaguruswamy: Object Oriented Programming in C++, Tata Mc-Graw Hill.
Booch G: Object Oriented Analysis & Design, Benamin-Commings.
Rumbaugh J.Et. al.: Object Oriented Modelling & Design, Prentice Hall of India.
Deitel: Java: Haw to Programme, Pearson Education.
Kelley: A Book on C, Pearson Education.

CP 260 ADVANCED COMPUTER PROGRAMMING LAB C(L,T,P) =2(0,0,3)

S. No.	List of Experiments
	PART I: Programs in C++
1.	Write a program to perform the complex arithmetic.
2.	Write a program to perform the rational number arithmetic.
3.	Write a program to perform the matrix operations. (Transpose, addition, subtraction, multiplication, test if a matrix is symmetric/ lower triangular/ upper triangular)
4.	Implement Morse code to text conversion and vice-versa.
5.	To calculate Greatest Common Divisor of given numbers.
6.	To implement tower of Hanoi problem.
	PARET II: Program in Java
7.	To implement spell checker using dictionary.
8.	To implement a color selector from a given set of colors.
9.	To implement a shape selector from a given set of shapes.
10.	By mapping keys to pens of different colors, implement turtle graphics.
11.	To implement a calculator with its functionality.
12.	To implement a graph and display BFS/DFS order of nodes.

CP 301 DATA BASE MANAGEMENT SYSTEM C(L,T,P) =3(3,0,0)

Unit	Course Contents	Hrs.
1	Introduction Need, purpose and goals of DBMS. DBMS Architecture, Concept of keys, Generalization and specialization, Introduction to Relational data model, ER Modeling, Relational algebra.	7
II	**DATABASE DESIGN:** Conceptual Data Base design. Theory of normalization, Primitive and composite data types, concept of physical and logical databases, data abstraction and data independence,. Relational calculus.	7
III	SQL: DDL and DML. Constraints assertions, views, data base security. Application Development using SQL: Host language interface, embedded SQL programming. GL's, Forms management and report writers. Stored procedures and triggers.	7
IV	**INTERNAL OF RDBMS -** Physical data organization in sequential, indexed, random and hashed files. Inverted and multilist structures.	7
V	Transaction processing, concurrency control, Transaction model properties and state serialisability. Lock base protocols, two phase locking, Log based recovery Management.	7
	Total	35

Reference Books:

1. Korath H., Silberschatz A. : Database system Concepts, Second Edn., McGraw-Hili, 1991. .
2. 2. R.Elmasri and S.B. Navathe: Fundamentals of Data base Systems, Benjamin Cummins.

CP – 307 COMPUTER GRAPHICS C(L,T,P) =3(3,0,0)

UNIT	CONTENTS OF THE SUBJECT	Hrs.
I	Introduction to interactive computer graphics, picture analysis, overview of programmer's model of interactive graphics. Fundamental problems in geometry, Hardware for Computer Graphics.	7
II	**BASIC RASTER GRAPHICS -** Scan conversion algorithms for line, Circle, Ellipse, Filling algorithms, Line Clipping and Polygon clipping.	7
III	**GEOMETRIC MANIPULATION:** 2 D and 3 D Transformation, Composite Transformations, Concept of Homogenous Coordinates Viewpoints.	7
IV	**ELEMENTRY 3 D GRAPHICS** – Types of Projections, Vanishing Points, specification of 3 D View, Matrices for Parallel and Perspective Projections. Visibility ; Image and object precision, z-buffer algorithms, area based algorithms, floating horizon.	7
V	**RENDERING -** Ray tracing, ant aliasing, Gourard and Phong Shading. Curves and Surfaces: Parametric Representation, Bezier and B-Spline curves. Interactive Computer Graphics	7

Recommended Books:

1. D.Rogers and Adams: Mathematical Elements of Computer Graphics, Mc-Graw Hill.
2. J.Foley, A Van dam, S.Feiner, J.Hughes: Computer Graphics-Princxiples and Practice. Addison Weslev.
3. D.Hearn and Baker: Computer Graphics. Prentice Hall of India.
4. Krihsnamurthy N: Introduction to computer Graphics, Tata Mc Graw Hill Edition.
5. Zhigang X. & Plastock R.a.: Theory and problems of Computer Graphics (Schaum's Outline), Tata Mc Graw Hill.
6. Giloi, W.K.: Interactive Computer Graphics, Prentice-Hall.

CP – 316 **Multimedia** **C (L, T, P) = 3(3, 0, 0)**

Unit	CONTENTS OF THE SUBJECT	Hrs
1	**MEDIA AND DATA STREAMS:** Medium, Properties of Multimedia, Data stream characteristics of continuous media information units.	7
II	**MUSIC AND GRAPHICS:** Audio formats, MIDI, Speech Image format, Graphics format, disthering, computer Image Processing.	7
III	**VIDEO AND ANIMATION:** Basic concepts, computer-based Animation, JPEG, MPEG, H.261, DVI, Hybrid coding, CD-ROM Technology. Compact disk digital audio.	7
IV	**MULTIMEDIA OPERATING SYSTEMS:** Real time, Process management Rate monotonic algorithm, Earliest deadline first algorithm and Multimedia file systems.	7
V	**DOCUMENTS:** Hypertext, Hypermedia, MHEG. **SYNCHRONIZATION:** Intra and Inter object synchronization. Live and Synthetic synchronization, Lip synchronization requirements, pointer synchronization requirements, Elementary media synchronization.	7

Recommended Books:

1. Ralf Steinmetz & Klara Nahrstedt: Multimedia computing Communication & Application, Pearson Education Asia.
2. Prabhat K. Andleigh-Multimedia System Design, Prentice Hall, Kiran Thaukrar.

CP 407 **ARTIFICIAL INTELLIGENCE** **C(L,T,P) =3(3,0,0)**

Unit	Course Contents	Hrs.
1	**INTRODUCTION TO AI KNOWLEDGE-** Importance of AI, Knowledge Base System Knowledge organization & manipulation, Conceptual Introduction to LISP and other AI programming Languages.	7
II	**KNOWLEDGE REPRESENTATION-** Syntax Semantics, Inference Rules, Non-deductive Inference methods, and representations using rules, forward chaining and backward chaining. Fuzzy Logic & Natural languages computations. Probabilistic Reasoning. Object Oriented Representations.	7
III	**KNOWLEDGE ORGANIZATION & MANIPULATION-** Search & control strategies, matching techniques, knowledge organization & management, Genetic Algorithms based search techniques.	7
IV	**KNOWLEDGE SYSTEMS ARCHITECTURE-** Rule based, non-production, uncertainty knowledge system building tools.	7
V	**KNOWLEDGE ACQUISITION-** General Concepts, learning by induction.	7
	Total	35

Reference Books:

AI & ES- Dan W.Patterson, Prentice Hall of India.
Luger- Artificial Intelligence, Pearson Education.
Jockson- Introduction Expert Systems, Pearson Education Rich & Knigh- Artifical Intelligence, Tata Mc-Graw Hill.

CP 415 **NEURAL NETWORKS** **C(L,T,P) =3(3,0,0)**

Unit	Course Contents	Hrs.
1	INTRODUCTION: Introduction to Neural Networks, Biological basis for NN, Human brain, Models of a Neuron, Directed Graphs, Feedback, Network architectures, Knowledge representation, Artificial intelligence & Neural Networks.	7
II	LEARNING PROCESSES: Introduction, Error –Correction learning, Memory –based learning, Hebbian learning, Competitive learning, Boltzmann learning, Learning with a Teacher & without a teacher, learning tasks, Memory, Adaptation.	7
III	SINGLE LAYER PERCEPTRONS: Introduction, Least-mean-square algorithm, Learning Curves, Learning rate Annealing Techniques, Perception, and Perception Convergence Theorem.	7
IV	MULTI LAYER PERCEPTRONS: Introduction, Back-Propagation Algorithm, XOR Problem, Output representation and Decision rule, Feature Detection, Back-Propagation and Differentiation, Hessian Matrix, Generalization.	7
V	RADIAL-BASIS FUNCTION NETWORKS & SELF-ORGANISING MAPS: Introduction to Radial basis function networks, Cover's Theorem on the Separability of Patterns, Interpolation Problem, Generalized Radial-Basis function networks, XOR Problem. Self-Organizing map, Summary of SOM, Algorithm, Properties of the feature map.	7
	Total	35

Reference Books:

Freeman / Skapura - Networks, Pearson Education.

CP – 605 INFORMATION SECURITY SYSTEM (L,T,P) =3(3,0,0)

Unit	Course Contents	Hrs.
1	Introduction to security attacks, services and mechanism, introduction to cryptography. Conventional Encryption: Conventional encryption model, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stereography, stream and block ciphers. Modern Block Ciphers: Block ciphers principals, Shannon's theory of confusion and diffusion, fiestal structure, data encryption standard(DES), strength of DES, differential and linear crypt analysis of DES, block cipher modes of operations, triple DES, IDEA encryption and decryption, strength of IDEA, confidentiality using conventional encryption, traffic confidentiality, key distribution, random number generation.	7
II	Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat's and Euler's theorem, primality testing, Euclid's Algorithm, Chinese Remainder theorem, discrete logarithms. Principals of public key crypto systems, RSA algorithm, security of RSA, key management, Diffle-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elganel encryption.	7
III	Message Authentication and Hash Function: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions and MACS, MD5 message digest algorithm, Secure hash algorithm(SHA). Digital Signatures: Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm.	7
IV	Authentication Applications: Kerberos and X.509, directory authentication service, electronic mail security-pretty good privacy (PGP), S/MIME.	7
V	IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Web Security: Secure socket layer and transport layer security, Secure Electronic Transaction (SET). System Security: Intruders, Viruses and related threads, firewall design principals, trusted systems.	7
	Total	35

Reference Books:

INFORMATION SECURITY SYSTEM -Atul Kahate-TMH
Cryptography & Network Security-William Stallings-TMH

MA 201 Integral Transforms & Complex Analysis C(L,T,P) =4(3,1,0)

Unit	Course Contents	Hrs.
1	**BOUNDARY VALUE PROBLEMS: –** Method of separation of variables in the solution of Boundary VALUE Problems (Wave equation, Diffusion and Laplace equation)	7
II	**LAPLACE TRANSFORM -** Laplace transform with its simple properties, applications to the solution of ordinary and partial differential equations having constant co-efficient with special reference to the wave and diffusion equations.	7
III	**FOURIER TRANSFORM -** Complex form of Fourier Transform and its inverse, Fourier sine and cosine transform and their inversion. Applications of Fourier Transform to solution of partial differential equations having constant co-efficient with special reference to heat equation and wave equation.	7
IV	**COMPLEX VARIABLES -** Analytic functions, Cauchy-Riemann equations, Elementary conformal mapping with simple applications, Line integral in complex domain, Cauchy;s theorem. Cauchy's integral formula	7
V	**COMPLEX VARIABLES -**Taylor's series Laurent's series poles, Residues, Evaluation of simple definite real integrals using the theorem of residues. Simple contour integration	7
	Total	35

Reference Books

Advanced Mathematics for Engineers by Chandrika Prasad
Higher Engineering Mathematics by BS Grewal
Higher Engineering Mathematics by YN Gaur
Higher Engineering Mathematics by KC Jain

MA 205 ADVANCE ENGG.MATHEMATICS- III C (L, T, P) = (3, 1, 0)

Units	Course Contents	Hrs.
I	**Boundary value problems:** Method of separation of variables - in the solution of wave equation in one dimension, Laplace's equation in two dimensions, Diffusion equation in one dimension.	7
II	**Transform calculus :** Laplace transform with its simple properties, applications to the solutions of ordinary and partial differential equations having constant co-efficient with special reference to wave and diffusion equation.	7
III	**Complex Variable:** Analytic functions, Cauchy Riemann equations, Elementary conformal mapping with simple applications line integral in complex domain, Cauchy's Theorem, Cauchy's integral formulae.	7
IV	**Complex variable:** Taylor's series, Laurent's series, poles, residues. Evaluations of simple definite real integrals using the theorem of residues. Simple contour integration.	6
V	**Numerical Methods:** Finite differences and interpolation Numerical Differentiation and Integration. Solution of Algebraic and transcendental equations by graphical method, trisection method, regula – falsi method and Newton raphson method	7

Reference Books:

1. Advanced Mathematics for Engineers by Chandrika Prasad.
2 Higher Engineering Mathematics by B.S.Grewal
3. Higher Engineering Mathematics by Y.N.Gaur and C.L.Koul.
4. Higher Engineeringh Mathematics by K.C.Jain and M.L.Rawat.

MA – 301 COMPUTER ORIENTED MATHEMATICAL METHODS C (L, T, P) = (3, 0, 0)

UNIT	CONTENTS OF THE SUBJECT	Hrs.
1	**MATRIX COMPUTATION:** Algebra of matrix, Inverse of a matrix, Rank of a matrix, Matrix inversion by Gauss elimination, Computer programs for matrix inversion.	7
II	**SOLUTION OF LINEAR EQUATIONS:** Cramer's rule, Gauss elimination, Gauss Jordan elimination and Gauss Seidal iterative method and their implementation in C.	7
III	**SOLUTION OF NON-LINEAR EQUATIONS:** Interval bisection method, Secant method, Regula- Falsi method, Curve fitting, Method of least squares and their implementation in C.	7
IV	**SOLUTION OF DIFFERENTIAL EQUATIONS:** Euler's method, Modified Euler's method, Runge Kutta method of fourth order, Solution of partial differential equation with special reference to heat equation, Laplace equation and wave equation Milne's and their implementation in C.	7
V	**STATISTICAL METHODS:** Curve fitting methods – method of least squares, fitting a straight line, parabola. Correlation and Linear regression.	7

Recommended Books:

1. V.Rajaraman-Computer Oriented Numerical Methods, Prentice Hall of India.
2. B.S. Grewal-Higher Engineering Mathematics
3. J.L. Bansal-Numerical Analysis
4. Balasubramanyam-Numerical Methods.

BM 449 ENTREPRENEURSHIP DEVELOPMENT C (L, T, P) = (3, 0, 0)

Units	Course Contents	Hrs.
I	Need scope and characteristics nature of entrepreneurship ventures in India economic and industrial heritage and entrepreneurship development; current economic and industrial environment with special reference to enterpreneurial ventures and economic growth. Understanding Human Behaviour time management, group dynamics, conflict and stress management	7
II	Small, medium and large industrial sectors, Industrial potential and identification of opportunities, demand and resource based industries, service sector, corporate entrepreneurship, entrepreneurship and technocrat entrepreneurship. **SSI:** definition and legal frame planning for small enterprise; major policies, organization of SSI units, reservation of items for SSI units, role of SIDO, NSIC and SSI corporate.	7
III	Marketing and Price distribution Methods of sales promotion state and central government purchase procedures: promotional and advertising methods, marketing research policies & Strategies, price determinate expert policies Financing of small scale industries, tax concession to SSI units. Machinery on Hire Purchases, Controlled & Scarce Raw Materials.	7
IV	Production Planning: Elements of production process managing production life cycle, PERT, CPM; managing production support services, product licensing, patenting; certification agencies, ISO 9000, and 14000, CS 8000 series; Testing facilities, Quality Control.	7
V	Project identification, decision making area money, market, machinery and material; Project planning and executing; working capital management sources and uses of funds; ration analysis; break even analysis, cost control; time control; Evaluation and preparation of project report	7

Reference Books:

1. Organization & Management of Small Scale Industries: Desai, J.V. Himalaya, Bombay, 1985
2. Management of Small Scale Industries: 3rd Himalaya, Bombay, 1986
3. The Story of an Entrepreneur: M.Nath, IMT Monographs
4. Small Industry Entrepreneurs Handbook: Mohan, K.K. Bombay Productivity Services International
5. Handbook of Entrepreneurship: Rao & Pareek. New Delhi: Learning System, 1978