Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2023

1st to 6th Semester

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

SoE No. 23ME-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER (GROUP-B)															
1	1	BS	GE	23GE1102	Differential Equations, Matrices and Statistics	T	3	0	0	3	3	30	20	50	3
2	1	BS	GE	23GE1108	Engineering Physics	T	3	0	0	3	3	30	20	50	3
3	1	BS	GE	23GE1109	**Lab:** Engineering Physics	P	0	0	2	2	1		60	40	
4	1	BES	ME	23ME1101	Engineering Graphics	T	1	0	0	1	1	30	20	50	3
5	1	BES	ME	23ME1102	**Lab :** Engineering Graphics	P	0	0	4	4	2		60	40	
6	1	BES	EL	23EL1101	Basic Electrical and Electronics Engineering	T	3	0	0	3	3	30	20	50	3
7	1	BES	ME	23ME1107	**Lab :** FAB Shop	P	0	0	2	2	1		60	40	
8	1	PC	ME	23ME1105	Material Science & Metallurgy	T	3	0	0	3	3	30	20	50	3
9	1	PC	ME	23ME1106	**Lab :** Material Science & Metallurgy	P	0	0	2	2	1		60	40	
10	1	VSEC	GE	23GE1117	Get Set Go	…	…	…	…	…	2		60	40	
11	1	CC2	GE		**Liberal Learning Course (LLC2)**	…	…	…	…	…	2		60	40	
					TOTAL FIRST SEM		**13**	**0**	**10**	**23**	**22**				
MANDATORY LEARNING COURSES															
1	1	HS		GE2131	Universal Human Values (UHV)	**A**	2	0	0	2	0				
SECOND SEMESTER (GROUP-B)															
1	2	BS	GE	23GE1201	Calculus and Vector	T	3	0	0	3	3	30	20	50	3
2	2	BS	GE	23GE1204	Applied Chemistry	T	3	0	0	3	3	30	20	50	3
3	2	BS	GE	23GE1205	**Lab:** Applied Chemistry	P	0	0	2	2	1		60	40	
4	2	HS/AEC1	GE	23GE1212	Professional Communication	T	2	0	0	2	2	30	20	50	2
5	2	HS/IKS	GE	23GE1215	Indian Knowledge System	T	2	0	0	2	2	30	20	50	2
6	2	BES	CV	23CV1201	Engineering Mechanics	T	3	0	0	3	3	30	20	50	3
7	2	BES	CV	23CV1202	**Lab:** Engineering Mechanics	P	0	0	2	2	1		60	40	
8	2	BES	IT	23IT1203	Programming for Problem Solving	T	2	0	0	2	2	30	20	50	2
9	2	BES	IT	23IT1204	**Lab:** Programming for Problem Solving	P	0	0	2	2	1		60	40	
10	2	VSEC	GE	23GE1218	Functional English	…	…	…	…	…	2		60	40	
11	2	CC1	GE	23GE1216	**Liberal Learning Course (LLC1)**	…	…	…	…	…	2		60	40	
					TOTAL SECOND SEM		**15**	**0**	**6**	**21**	**22**				

Liberal Learning Course

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	2	CC2	GE	23LLC1201	Music (Vocal)
2	2	CC2	GE	23LLC1202	Music (Instrumental)
3	2	CC2	GE	23LLC1203	Indian Classical Dance
4	2	CC2	GE	23LLC1204	Other forms of Dances
5	2	CC2	GE	23LLC1205	Painting
6	2	CC2	GE	23LLC1206	Theatre and acting
7	2	CC2	GE	23LLC1207	Photography
8	2	CC2	GE	23LLC1208	Yoga
9	2	CC2	GE	23LLC1209	Chess
10	2	CC2	GE	23LLC1210	Athletics
11	2	CC2	GE	23LLC1211	Basket Ball
12	2	CC2	GE	23LLC1212	Judo
13	2	CC2	GE	23LLC1213	Elements of Japanese Language
14	2	CC2	GE	23LLC1214	Elements of German Language
15	2	CC2	GE	23LLC1215	Elements of French Language
16	2	CC2	GE	23LLC1216	Elements of Spanish Language
17	2	CC2	GE	23LLC1217	Basics of Vedic Maths
18	2	CC2	GE	23LLC1218	Skilling in Microsoft Visio and Inkscape

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B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

SoE No. 23ME-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	

Liberal Learning Course

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	1	CC1	GE	23LLC1101	Music (Vocal)
2	1	CC1	GE	23LLC1102	Music (Instrumental)
3	1	CC1	GE	23LLC1103	Indian Classical Dance
4	1	CC1	GE	23LLC1104	Other forms of Dances
5	1	CC1	GE	23LLC1105	Painting
6	1	CC1	GE	23LLC1106	Theatre and acting
7	1	CC1	GE	23LLC1107	Photography
8	1	CC1	GE	23LLC1108	Yoga
9	1	CC1	GE	23LLC1109	Chess
10	1	CC1	GE	23LLC1110	Athletics
11	1	CC1	GE	23LLC1111	Basket Ball
12	1	CC1	GE	23LLC1112	Judo
13	1	CC1	GE	23LLC1113	Elements of Japanese Language
14	1	CC1	GE	23LLC1114	Elements of German Language
15	1	CC1	GE	23LLC1115	Elements of French Language
16	1	CC1	GE	23LLC1116	Elements of Spanish Language
17	1	CC1	GE	23LLC1117	Basics of Vedic Maths
18	1	CC1	GE	23LLC1118	Skilling in Microsoft Visio and Inkscape

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

Chairperson	Dean (Acad. Matters)	July, 2023	1.00	Applicable for AY 2023-24 Onwards
		Date of Release	Version	

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B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mechanical Engineering)

B. Tech. in Mechnical Engineering

SoE No.
23 ME-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
THIRD SEMESTER															
1	3	HSSM-1	GE	23GE1301	Fundamentals of Management & Economics	T	2	0	0	2	2	30	20	50	3
2	3	VEC-II	ME	23ME1301	Computer Aided Design	T	2	0	0	2	2	30	20	50	3
3	3	CEP	ME	23ME1302	**Community Engagement Project**	P	0	0	2	4	2		60	40	
4	3	PC	ME	23ME1303	Manufacturing Processes	T	3	0	0	3	3	30	20	50	3
5	3	PC	ME	23ME1304	**LAB:** Manufacturing Processes	P	0	0	2	2	1		60	40	
6	3	PC	ME	23ME1305	Mechanics of Materials	T	3	1	0	4	4	30	20	50	3
7	3	PC	ME	23ME1306	**LAB:-** Mechanics of Materials	P	0	0	2	2	1		60	40	
8	3	PC	ME	23ME1307	Kinematics of Machineries	T	3	0	0	3	3	30	20	50	3
9	3	OE - I	OE		**Open Elective -I**	T	2	0	0	2	2	30	20	50	3
10	3	MDM - I	ME		**MD Minor Course-I**	T	2	0	0	2	2	30	20	50	3
						TOTAL	**17**	**1**	**6**	**26**	**22**				
List of Mandatory Learning Course (MLC)															
1	3	HS	T&P	MLC2123	**YCAP3 :** YCCE Communication Aptitude Preparation	**A**	3	0	0	3	**0**				

Open Elective - I

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	3	OE1	GE	23OE1301	OE-I : Combinatorics
2	3	OE1	GE	23OE1302	OE-I : Fuzzy Set Theory, Arithmetic And Logic
3	3	OE1	GE	23OE1303	OE-I : Green Chemistry & Sustainability
4	3	OE1	GE	23OE1304	OE-I : Hydrogen Fuel
5	3	OE1	GE	23OE1305	OE-I : Electronic Materials And Applications
6	3	OE1	GE	23OE1306	OE-I : Laser Technology And Applications
7	3	OE1	MGT	23OE1307	OE-I : Finance And Cost Management
8	3	OE1	MGT	23OE1308	OE-I : Operation Research Techniques
9	3	OE1	MGT	23OE1309	OE-I : Project Evaluation & Management
10	3	OE1	MGT	23OE1310	OE-I : Total Quality Management
11	3	OE1	MGT	23OE1311	OE-I : Value Engineering
12	3	OE1	MGT	23OE1312	OE-I : Maintenance Management
13	3	OE1	MGT	23OE1313	OE-I : Industrial Safety
14	3	OE1	MGT	23OE1314	OE-I : Industry 4.0
15	3	OE1	MGT	23OE1315	OE-I : Operation Management
16	3	OE1	MGT	23OE1316	OE-I : Material Management
17	3	OE1	MGT	23OE1317	OE-I : Hospitality Management
18	3	OE1	MGT	23OE1318	OE-I : Human Resource Management & Organizational Behaviour
19	3	OE1	MGT	23OE1319	OE-I : Agri-Business Management
20	3	OE1	MGT	23OE1320	OE-I : Rural Marketing
21	3	OE1	MGT	23OE1321	OE-I : Marketing Management
22	3	OE1	MGT	23OE1322	OE-I : Health Care Management
23	3	OE1	MGT	23OE1323	OE-I : Designated approved online NPTEL/KKSU Course
24	3	OE1	MGT	23OE1324	OE-I : Indian Archeology
25	3	OE1	MGT	23OE1325	OE-I : Social & Positive Psychology
26	3	OE1	MGT	23OE1326	OE-I : Seismology & Earthquake

		July, 2023	**1.00**	**Applicable for AY 2023-24 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mechanical Engineering)

B. Tech. in Mechnical Engineering

SoE No.
23 ME-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
FOURTH SEMESTER															
1	4	BS	GE	23GE1402	Integral Transform	T	3	0	0	3	3	30	20	50	3
2	4	HSSM-2	GE	23GE1401	Entrepreneurship Development	T	2	0	0	2	2	30	20	50	3
3	4	**AEC-2**	GE	23GE1405 23GE1406	Marathi Language / Hindi Language	T	2	0	0	2	2	30	20	50	3
4	4	VEC - I	CV	23CV1411	Environmental Sustainability, Pollution and Management	T	2	0	0	2	2	30	20	50	3
5	4	PC	ME	23ME1401	Machining Processes	T	3	0	0	3	3	30	20	50	3
6	4	PC	ME	23ME1402	**Lab -** Machining Processes	P	0	0	2	2	1		60	40	
7	4	PC	ME	23ME1403	**Lab -** Computer Aided Design	P	0	0	2	2	1		60	40	
8	4	VSEC - III	ME	23ME1404	**Lab -** Machine Drawing	P	0	0	4	4	2		60	40	
9	4	OE - II	OE		**Open Elective -II**	T	2	0	0	2	2	30	20	50	3
10	4	MDM - II	ME		**MD Minor Course-II**	T	2	0	0	2	2	30	20	50	3
						TOTAL	**16**	**0**	**8**	**24**	**20**				
List of Mandatory Learning Course (MLC)															
1	4	HS	T&P	MLC2124	**YCAP4 :** YCCE Communication Aptitude Preparation	**A**	3	0	0	3	**0**				

Open Elective - II

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	4	OE2	GE	23OE2401	OE-II : Combinatorics
2	4	OE2	GE	23OE2402	OE-II : Fuzzy Set Theory, Arithmetic And Logic
3	4	OE2	GE	23OE2403	OE-II : Green Chem. & Sustainability
4	4	OE2	GE	23OE2404	OE-II : Hydrogen Fuel
5	4	OE2	GE	23OE2405	OE-II : Electronic Materials And Applications
6	4	OE2	GE	23OE2406	OE-II : Laser Technology And Applications
7	4	OE2	MGT	23OE2407	OE-II : Finance And Cost Management
8	4	OE2	MGT	23OE2408	OE-II : Operation Research Techniques
9	4	OE2	MGT	23OE2409	OE-II : Project Evaluation & Management
10	4	OE2	MGT	23OE2410	OE-II : Total Quality Management
11	4	OE2	MGT	23OE2411	OE-II : Value Engineering
12	4	OE2	MGT	23OE2412	OE-II : Maintenance Management
13	4	OE2	MGT	23OE2413	OE-II : Industrial Safety
14	4	OE2	MGT	23OE2414	OE-II : Industry 4.0
15	4	OE2	MGT	23OE2415	OE-II : Operation Management
16	4	OE2	MGT	23OE2416	OE-II : Material Management
17	4	OE2	MGT	23OE2417	OE-II : Hospitality Management
18	4	OE2	MGT	23OE2418	OE-II : Human Resource Management & Organizational Behaviour
19	4	OE2	MGT	23OE2419	OE-II : Agri-Business Management
20	4	OE2	MGT	23OE2420	OE-II : Rural Marketing
21	4	OE2	MGT	23OE2421	OE-II : Marketing Management
22	4	OE2	MGT	23OE2422	OE-II : Health Care Management
23	4	OE2	MGT	23OE2423	OE-II : Designated approved online NPTEL/KKSU Course
24	4	OE2	MGT	23OE2424	OE-II : Indian Archeology
25	4	OE2	MGT	23OE2425	OE-II : Social & Positive Psychology
26	4	OE2	MGT	23OE2426	OE-II : Seismology & Earthquake

		July, 2023	**1.00**	**Applicable for AY 2023-24 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

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B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mechanical Engineering)

B. Tech. in Mechnical Engineering

SoE No. 23 ME-101

SN	Sem	Type	BoS/Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIFTH SEMESTER															
1	5	PC	ME	23ME1501	Engineering Thermodynamics	T	3	0	0	3	3	30	20	50	3
2	5	PC	ME	23ME1502	Measurement, Metrology & Quality Control	T	3	0	0	3	3	30	20	50	3
3	5	PC	ME	23ME1503	**Lab :** Measurement, Metrology & Quality Control	P	0	0	2	2	1		60	40	
4	5	PC	ME	23ME1504	Fluid Mechanics	T	3	1	0	4	4	30	20	50	3
5	5	PC	ME	23ME1505	**Lab :** Fluid Mechanics	P	0	0	2	2	1		60	40	
6	5	PC	ME	23ME1506	Operation Research Technique	T	3	0	0	3	3	30	20	50	3
7	5	PE	ME		**Professional Elective - I**	T	3	0	0	3	3	30	20	50	3
8	5	PE	ME		**Lab : Professional Elective - I**	P	0	0	2	2	1		60	40	
9	5	**OE-3**	OE		**Open Elective -III**	T	3	0	0	3	3	30	20	50	3
10	5	MDM	ME		**MD Minor Course-III**	T	3	0	0	3	3	30	20	50	3
11	5	STR	ME	23ME1507	Internship and Indsutrial Visit	P	0	0	1	1	1		60	40	
					TOTAL		**21**	**1**	**7**	**29**	**26**				
List of Mandatory Learning Course (MLC)															
1	5	HS	T&P	MLC2125	**YCAP5 :** YCCE Communication Aptitude Preparation	**A**	3	0	0	3	**0**				
Professional Elective - I															
1	5	PE-I	ME	23ME1521	**PE-I :** Finite Element Methods										
2	5	PE-I	ME	23ME1522	**PE-I : Lab :** Finite Element Methods										
3	5	PE-I	ME	23ME1523	**PE-I :** Industrial Fluid Power										
4	5	PE-I	ME	23ME1524	**PE-I : Lab :** Industrial Fluid Power										
5	5	PE-I	ME	23ME1525	**PE-I :** Electric and Hybrid Vehicle										
6	5	PE-I	ME	23ME1526	**PE-I : Lab :** Electric and Hybrid Vehicle										
7	5	PE-I	ME	23ME1527	**PE-I :** Advance Welding Techniques										
8	5	PE-I	ME	23ME1528	**PE-I : Lab :** Advance Welding Techniques										
9	5	PE-I	ME	23ME1529	**PE-I :** CNC & Robotics										
10	5	PE-I	ME	23ME1530	**PE-I : Lab :** CNC & Robotics										
11	5	PE-I	ME	23ME1531	**PE-I :** Mechatronics										
12	5	PE-I	ME	23ME1532	**PE-I : Lab :** Mechatronics										
13	5	PE-I	ME	23ME1533	**PE-I :** Computer Aided Manufacturing										
14	5	PE-I	ME	23ME1534	**PE-I : Lab :** Computer Aided Manufacturing										
15	5	PE-I	ME	23ME1535	**PE-I :** Two Wheeler technology										
16	5	PE-I	ME	23ME1536	**PE-I : Lab :** Two Wheeler technology										

Open Elective - III

SN	Sem	Type	BoS/Deptt	Sub. Code	Subject	FACULTY
1	5	OE3	CSE	23OE3501	OE-III : Social Reformers in Modern Maharashtra	ARTS
2	5	OE3	CSE	23OE3502	OE-III : Independent India 1948-2010	ARTS
3	5	OE3	CT	23OE3503	OE-III : Introduction To Cognitive Psychology	ARTS
4	5	OE3	CT	23OE3504	OE-III : Introduction To Engineering Psychology	ARTS
5	5	OE3	CT	23OE3505	OE-III : Introduction To Behavioural Psychology	ARTS
6	5	OE3	CT	23OE3506	OE-III : Introduction To Emotional Psychology	ARTS
7	5	OE3	EL	23OE3507	OE-III : Elements of Public Administration	ARTS
8	5	OE3	ETC	23OE3508	OE-III : Ancient Indian History	ARTS
9	5	OE3	IT	23OE3509	OE-III : Consciousness Studies	ARTS
10	5	OE3	IT	23OE3510	OE-III : Psychology for Professionals	ARTS
11	5	OE3	IT	23OE3511	OE-III : Introduction to Sociology and Human Behavior	ARTS
12	5	OE3	GE	23OE3512	OE-III : Economics of Money and Banking	ARTS
13	5	OE3	GE	23OE3513	OE-III : Economics of Capital Market	ARTS
14	5	OE3	GE	23OE3514	OE-III : Digital Humanities	ARTS
15	5	OE3	GE	23OE3515	OE-III : Introduction to Political Science	ARTS
16	5	OE3	CT	23OE3516	OE-III : Bhagwat Geeta - An Engineer's Interpretation	ARTS - IKS
17	5	OE3	CT	23OE3517	OE-III : Artha shastra by Kautiliya	ARTS - IKS
18	5	OE3	CSD	23OE3518	OE-III : Glimpses of Ancient science and Technology	ARTS - IKS
19	5	OE3	CV	23OE3519	OE-III : Indian taxation system	COMMERCE
20	5	OE3	CV	23OE3520	OE-III : Elements of share trading	COMMERCE
21	5	OE3	EE	23OE3521	OE-III : Introduction to Fintech	COMMERCE
22	5	OE3	EE	23OE3522	OE-III : Financial Analytics	COMMERCE
23	5	OE3	ETC	23OE3523	OE-III : Fundamentals of Investments	COMMERCE
24	5	OE3	EE	23OE3524	OE-III : Lifestyle Diseases	HEALTHCARE & MEDICINE
25	5	OE3	EE	23OE3525	OE-III : Holistic Nutrition	HOME SCIENCE
26	5	OE3	EL	23OE3526	OE-III : Community Organization & Development	HOME SCIENCE
27	5	OE3	CSE	23OE3527	OE-III : Human Rights & International Laws	LAW
28	5	OE3	CSE	23OE3528	OE-III : Cyber Crime Administration	LAW
29	5	OE3	MATHS	23OE3529	OE-III : Finite Differences & Numerical Methods	SCIENCE
30	5	OE3	MATHS	23OE3530	OE-III : Business Statistics	SCIENCE
31	5	OE3	PHY	23OE3531	OE-III : Crystalline Solids: Properties and Applications.	SCIENCE
32	5	OE3	PHY	23OE3532	OE-III : Nanotechnology: Fundamental to Applications	SCIENCE
33	5	OE3	CHE	23OE3533	OE-III : Chemistry in daily life	SCIENCE
34	5	OE3	CHE	23OE3534	OE-III : Battery Systems and Management	SCIENCE
35	5	OE3	NPTEL	23OE3535	OE-III : Designated approved online NPTEL Course	NPTEL

Chairperson	Dean (Acad. Matters)	July, 2023	1.00	Applicable for AY 2023-24 Onwards
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B. Tech. in Mechnical Engineering

SoE No.
23 ME-101

SN	Sem	Type	BoS/Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
SIXTH SEMESTER															
1	6	PC	ME	23ME1601	Heat Transfer	T	3	0	0	3	3	30	20	50	3
2	6	PC	ME	23ME1602	**Lab :** Heat Transfer	P	0	0	2	2	1		60	40	
3	6	PC	ME	23ME1603	Dynamics of Machines	T	3	0	0	3	3	30	20	50	3
4	6	PC	ME	23ME1604	**Lab :** Dynamics of Machines	P	0	0	2	2	1		60	40	
5	6	PC	ME	23ME1605	Design of Machine Element	T	3	0	0	3	3	30	20	50	3
9	6	PE	ME		**Professional Elective-II**	T	3	0	0	3	3	30	20	50	3
10	6	PE	ME		**Lab : Professional Elective-II**	P	0	0	2	2	1		60	40	
11	6	PE	ME		**Professional Elective-III**	T	3	0	0	3	3	30	20	50	3
12	6	MDM	ME		**MD Minor Course-IV**	T	3	0	0	3	3	30	20	50	3
6	6	**VSEC-4**	ME	23ME1606	**Lab :** Computer Aided Engineering	P	0	0	2	4	2		60	40	
7	6	STR	ME	23ME1607	Project Phase-I	P	0	0	4	4	2		60	40	
8	6	STR	ME	23ME1608	Design Thinking and Research Methodology	T	2	0	0	2	2	30	20	50	3
					TOTAL		**20**	**0**	**12**	**34**	**27**				

List of Mandatory Learning Course (MLC)															
1	6	HS	T&P	MLC126	**YCAP6 :**	**A**	3	0	0	3	**0**				

Professional Elective - II					
1	6	PE-II	ME	23ME1621	**PE-II :** Vibration
2	6	PE-II	ME	23ME1622	**PE-II : Lab :** Vibration Lab
3	6	PE-II	ME	23ME1623	**PE-II :** Referigeration Air conditioning and Cryogenics
4	6	PE-II	ME	23ME1624	**PE-II : Lab :** Referigeration Air conditioning and Cryogenics
5	6	PE-II	ME	23ME1625	**PE-II :** Vehicle Engineering
6	6	PE-II	ME	23ME1626	**PE-II : Lab :** Vehicle Engineering
7	6	PE-II	ME	23ME1627	**PE-II :** Computer Integrated Manufacturing
8	6	PE-II	ME	23ME1628	**PE-II : Lab :** Computer Integrated Manufacturing
9	6	PE-II	ME	23ME1629	**PE-II :** I.C. Engines
10	6	PE-II	ME	23ME1630	**PE-II : Lab :** I.C. Engines
11	6	PE-II	ME	23ME1631	**PE-II :** Earth Moving Equipments
12	6	PE-II	ME	23ME1632	**PE-II : Lab :** Earth Moving Equipments
13	6	PE-II	ME	23ME1633	**PE-II :** Computational Fluid Dynamics
14	6	PE-II	ME	23ME1634	**PE-II : Lab :** Computational Fluid Dynamics
15	6	PE-II	ME	23ME1635	**PE-II :** Solar Energy and Utilization
16	6	PE-II	ME	23ME1636	**PE-II : Lab :** Solar Energy and Utilization

Professional Elective - III					
1	6	PE-III	ME	23ME1641	**PE-III :** Tool Design
2	6	PE-III	ME	23ME1642	**PE-III :** Reliability Engineering
3	6	PE-III	ME	23ME1643	**PE-III :** Advanced Manufacturing Techniques
4	6	PE-III	ME	23ME1644	**PE-III :** Total Quality Management
5	6	PE-III	ME	23ME1645	**PE-III :** Thermal Engineering Systems
6	6	PE-III	ME	23ME1646	**PE-III :** Optimization Techniques
7	6	PE-III	ME	23ME1647	**PE-III :** Project Evaluation & Management
8	6	PE-III	ME	23ME1648	**PE-III :** Fuel Cell Technology
9	6	PE-III	ME	23ME1649	**PE-III :** Design of Experiments and Taguchi Methods

Chairperson	Dean (Acad. Matters)	July, 2023 Date of Release	1.00 Version	Applicable for AY 2023-24 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2023

1st Semester

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

SoE No. 23ME-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER (GROUP-B)															
1	1	BS	GE	23GE1102	Differential Equations, Matrices and Statistics	T	3	0	0	3	3	30	20	50	3
2	1	BS	GE	23GE1108	Engineering Physics	T	3	0	0	3	3	30	20	50	3
3	1	BS	GE	23GE1109	**Lab:** Engineering Physics	P	0	0	2	2	1		60	40	
4	1	BES	ME	23ME1101	Engineering Graphics	T	1	0	0	1	1	30	20	50	3
5	1	BES	ME	23ME1102	**Lab :** Engineering Graphics	P	0	0	4	4	2		60	40	
6	1	BES	EL	23EL1101	Basic Electrical and Electronics Engineering	T	3	0	0	3	3	30	20	50	3
7	1	BES	ME	23ME1107	**Lab :** FAB Shop	P	0	0	2	2	1		60	40	
8	1	PC	ME	23ME1105	Material Science & Metallurgy	T	3	0	0	3	3	30	20	50	3
9	1	PC	ME	23ME1106	**Lab :** Material Science & Metallurgy	P	0	0	2	2	1		60	40	
10	1	VSEC	GE	23GE1117	Get Set Go	…	…	…	…	…	2		60	40	
11	1	CC2	GE		**Liberal Learning Course (LLC2)**	…	…	…	…	…	2		60	40	
					TOTAL FIRST SEM		**13**	**0**	**10**	**23**	**22**				
MANDATORY LEARNING COURSES															
1	1	HS		GE2131	Universal Human Values (UHV)	**A**	2	0	0	2	0				
SECOND SEMESTER (GROUP-B)															
1	2	BS	GE	23GE1201	Calculus and Vector	T	3	0	0	3	3	30	20	50	3
2	2	BS	GE	23GE1204	Applied Chemistry	T	3	0	0	3	3	30	20	50	3
3	2	BS	GE	23GE1205	**Lab:** Applied Chemistry	P	0	0	2	2	1		60	40	
4	2	HS/AEC1	GE	23GE1212	Professional Communication	T	2	0	0	2	2	30	20	50	2
5	2	HS/IKS	GE	23GE1215	Indian Knowledge System	T	2	0	0	2	2	30	20	50	2
6	2	BES	CV	23CV1201	Engineering Mechanics	T	3	0	0	3	3	30	20	50	3
7	2	BES	CV	23CV1202	**Lab:** Engineering Mechanics	P	0	0	2	2	1		60	40	
8	2	BES	IT	23IT1203	Programming for Problem Solving	T	2	0	0	2	2	30	20	50	2
9	2	BES	IT	23IT1204	**Lab:** Programming for Problem Solving	P	0	0	2	2	1		60	40	
10	2	VSEC	GE	23GE1218	Functional English	…	…	…	…	…	2		60	40	
11	2	CC1	GE	23GE1216	**Liberal Learning Course (LLC1)**	…	…	…	…	…	2		60	40	
					TOTAL SECOND SEM		**15**	**0**	**6**	**21**	**22**				

Liberal Learning Course

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	2	CC2	GE	23LLC1201	Music (Vocal)
2	2	CC2	GE	23LLC1202	Music (Instrumental)
3	2	CC2	GE	23LLC1203	Indian Classical Dance
4	2	CC2	GE	23LLC1204	Other forms of Dances
5	2	CC2	GE	23LLC1205	Painting
6	2	CC2	GE	23LLC1206	Theatre and acting
7	2	CC2	GE	23LLC1207	Photography
8	2	CC2	GE	23LLC1208	Yoga
9	2	CC2	GE	23LLC1209	Chess
10	2	CC2	GE	23LLC1210	Athletics
11	2	CC2	GE	23LLC1211	Basket Ball
12	2	CC2	GE	23LLC1212	Judo
13	2	CC2	GE	23LLC1213	Elements of Japanese Language
14	2	CC2	GE	23LLC1214	Elements of German Language
15	2	CC2	GE	23LLC1215	Elements of French Language
16	2	CC2	GE	23LLC1216	Elements of Spanish Language
17	2	CC2	GE	23LLC1217	Basics of Vedic Maths
18	2	CC2	GE	23LLC1218	Skilling in Microsoft Visio and Inkscape

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

SoE No. 23ME-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	

Liberal Learning Course

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	1	CC1	GE	23LLC1101	Music (Vocal)
2	1	CC1	GE	23LLC1102	Music (Instrumental)
3	1	CC1	GE	23LLC1103	Indian Classical Dance
4	1	CC1	GE	23LLC1104	Other forms of Dances
5	1	CC1	GE	23LLC1105	Painting
6	1	CC1	GE	23LLC1106	Theatre and acting
7	1	CC1	GE	23LLC1107	Photography
8	1	CC1	GE	23LLC1108	Yoga
9	1	CC1	GE	23LLC1109	Chess
10	1	CC1	GE	23LLC1110	Athletics
11	1	CC1	GE	23LLC1111	Basket Ball
12	1	CC1	GE	23LLC1112	Judo
13	1	CC1	GE	23LLC1113	Elements of Japanese Language
14	1	CC1	GE	23LLC1114	Elements of German Language
15	1	CC1	GE	23LLC1115	Elements of French Language
16	1	CC1	GE	23LLC1116	Elements of Spanish Language
17	1	CC1	GE	23LLC1117	Basics of Vedic Maths
18	1	CC1	GE	23LLC1118	Skilling in Microsoft Visio and Inkscape

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

Chairperson	Dean (Acad. Matters)	July, 2023	1.00	Applicable for AY 2023-24 Onwards
		Date of Release	Version	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech SoE and Syllabus 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mathematics & Humanities)

B.Tech First Year

SoE No. 23FY-101

I SEMESTER

23GE1102 : Differential Equations, Matrices and Statistics

Course Outcomes
The students will be able to
1. Use appropriate Methods to solve first order and higher order differential equations and apply it to find solution of engineering problems.
2. Use Matrix method to solve linear system of equations, evaluate eigen values - eigen vectors and its applications.
3. Make use of probability distributions to solve real life problems.
4. Inspect scientific data, use proper curve fitting and find correlation, regression of variables.

Unit I: Differential Equations I	**(7 Hrs.)**
Linear differential equations of first order and first degree, Differential equation reducible to linear form, Exact differential equations (excluding the case of integrating factor) and their applications to various fields. **(Contemporary Issues related to Topic)**	
Unit II: Differential Equations II	**(7 Hrs.)**
Higher order linear differential equations with constant coefficients, Complementary functions and Particular Integral for different cases, Method of variation of parameters, Examples on application to various fields. **(Contemporary Issues related to Topic)**	
Unit III: Differential Equations III	**(6 Hrs.)**
Cauchy's homogeneous linear differential equations, Legendre's linear differential equation, Applications of differential equations to various fields (only up to second order). **(Contemporary Issues related to Topic)**	
Unit IV: Partial Differential Equations	**(6 Hrs.)**
Partial Differential Equations of first order, first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve first and second order partial differential equations. **(Contemporary Issues related to Topic)**	
Unit IV: Matrices	**(7 Hrs.)**
Rank of a matrix, Consistency of system of equations using rank, Characteristics equations, Eigen values and Eigen vectors, Cayley Hamilton Theorem (without proof) statement and verification, Sylvester's theorem-statement and its application. **(Contemporary Issues related to Topic)**	
Unit VI: Statistics	**(6 Hrs.)**
Fitting of straight line, $y = a + bx$, a parabola $y = a + bx + cx^2$, exponential curves and power curves by method of least squares; Lines of regression and correlation; Rank correlation. **(Contemporary Issues related to Topic)**	
Total Lecture	**39 Hours**

			July,2023	1.00	Applicable for AY 2023-24 Onwards
Chairperson	Dean (Acad. Matters)	Dean OBE	Date of Release	Version	

Textbooks:	
1.	Erwin Kreyzig, Advance Engineering Mathematics, 6th Edition, John Wiley and Sons, INC.
2.	H.K. Dass, Engineering Mathematics, 11th revised edition, S. Chand, Delhi.
3.	H.K. Dass, Advanced Engineering Mathematics, 8th revised edition, S. Chand, Delhi.
4.	Dr. B.S. Grewal, Higher Engineering Mathematics, 42th edition, Khanna Publishers.
5.	P.N.Wartikar and J.N.Wartikar, Applied Mathematics, 4th Edition, Vidyarthi GrihaPrakashan.

Reference Books:	
1.	G B Thomas and R L Finney, Calculus and Analytical Geometry, 9th edition, Addison-Wesley, 1999.
2.	N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, 10th edition, Laxmi Prakashan.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Applied%20Sciences%20&%20Humanities/Mathematics%20and%20Humanities/

MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/111103070
2.	https://onlinecourses.nptel.ac.in/noc19_ma28/preview
3.	https://nptel.ac.in/courses/111/106/111106100/

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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B. Tech SoE and Syllabus 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Physics)

B.Tech First Year

SoE No. 23FY-101

I SEMESTER

23GE1108 : Engineering Physics

Course Outcomes :

Upon successful completion of the course the students will be able to

1. Correlate fundamentals of quantum mechanics to solve problems dealing with quantum particles.
2. Assess the characteristics of semiconductor materials in terms of crystal structures, charge carriers and Energy bands.
3. Examine the intensity variation of light due to interference, diffraction, laser and its applications.
4. Analyze the motion of charged particles in electric and magnetic field and its applications to electron optic devices.
5. Illustrate the nature and characterization of magnetic materials and superconductors for engineering applications.

Unit I: Quantum Physics	**(7 Hrs.)**
Wave-particle duality, de-Broglie's hypothesis, Wave packet, Heisenberg's uncertainty principle: significance and applications, Wave function and its probability interpretation, Schrodinger Equation, Particle in infinite potential well. **(Contemporary Issues related to Topic)**	
Unit II: Semiconductor Physics	**(7 Hrs.)**
Formation of energy bands in solids; Classification of solids, Energy band diagram of Si and Ge, Intrinsic and extrinsic semiconductors, Conductivity, Law of mass action, Fermi function, Fermi level in intrinsic and extrinsic semiconductors, Dependence of Fermi level on impurity concentration and temperature, Hall effect. **(Contemporary Issues related to Topic)**	
Unit III: Geometrical Optics	**(7 Hrs.)**
Interference: Interference in thin films, Wedge shaped film, Newton's rings, Applications of interference Diffraction: Fraunhofer diffraction from a single slit. **(Contemporary Issues related to Topic)**	
Unit IV: Laser	**(6 Hrs.)**
Coherence and its types, Interaction of radiation with matter, Population Inversion, Pumping: methods and schemes, Optical resonant cavity, Ruby laser, Semiconductor diode laser, Properties and engineering applications of laser. **(Contemporary Issues related to Topic)**	
Unit V: Electron Ballistics	**(7 Hrs.)**
Motion of a charged particle in uniform electric and magnetic field, Cross field configuration; Electron refraction, Electron lens. Cathode ray oscilloscope and its application. **(Contemporary Issues related to Topic)**	
Unit VI: Magnetic Materials & Superconductors	**(6 Hrs.)**
Introduction to magnetic materials, Interpretation of Hysteresis curves, Superconductors: Type-I and Type-II, Meissner effect, Applications. **(Contemporary Issues related to Topic)**	
Total Lecture	**40 Hours**

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Chairperson	Dean (Acad. Matters)	Dean OBE	Date of Release	Version	

Textbooks	
1	M. N. Avadhanulu, P.G.Kshirsagar, A Textbook of Engg. Physics, S.Chand and Company.
2	Hitendra K Malik , A K Singh , Engineering Physics, 2nd Edition, Tata McGraw Hill Education Private Limited,

Reference Books	
1	David Halliday, Robert Resnick and Jerle Walker, John-Wiley India, Fundamentals of Physics, 10th John Wiley & Sons Inc.
2	Brijlal and Subramanyam, Text Book of Optics, Revised edition, S. Chand and Company.
3	M.N. Avadhanulu, 2nd Edition, Laser, S.Chand and Company.
4	A.Beiser, Concept of Modern Physics, 6th Edition, Laser, Tata McGraw-Hill.
5	Thyagarajan K. and Ghatak A.K, LASERS: Theory and Applications, 2nd Edition, Macmillan Publication
6	S.O.Pillai, Solid State Physics, 9th Edition, New Edge International Publishers.
7	Palanisamy, Solid State Physics, 8th Edition, New Edge International Publishers.
8	C. Kittel, Solid State Physics, 8th Edition, Willey Publication.
9	B. K. Pandey, S. Chaturvedi, Engineering Physics, 1st Edition, Cengage Learning.
10	John Allision, Electronic Engineering Materials and Devices, TMH edition, 10th reprint, Tata McGraw Hill.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Applied%20Sciences%20&%20Humanities/Physics/Eisberg%20&%20Resnick%20-%20Quantum%20Physics.pdf
2	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Applied%20Sciences%20&%20Humanities/Physics/2016_Book_ThePhysicsOfSemiconductors.pdf
3	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Applied%20Sciences%20&%20Humanities/Physics/Dekker%20-%20Solid%20State%20Physics.pdf

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/115106066 - Quantum Physics
2	https://archive.nptel.ac.in/courses/115/105/115105121/ -CRO
3	www.digimat.in/nptel/courses/video/115102124/L36.html- Laser

I SEMESTER
23GE1109 : Lab. Engineering Physics

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Correlate fundamentals of quantum mechanics to solve problems dealing with quantum particles. 2. Assess the characteristics of semiconductor materials in terms of crystal structures, charge carriers and Energy bands. 3. Examine the intensity variation of light due to interference, diffraction, laser and its applications. 4. Analyze the motion in electric field and magnetic field and its applications to electron optic devices. 5. Illustrate the nature and characterization of magnetic materials and superconductors for engineering Applications.

List of Experiments :

Sr. No.	Experiments based on
1	Determination of Planck's constant.
2	Study of Tunnel Diode.
3	Determination of Hall coefficient and density of charge carriers using Hall effect.
4	Dependence of Hall coefficient on temperature.
5	Determination of Band gap in a semiconductor by four probe method.
6	Determination of Band gap in a semiconductor using reverse biased p-n junction diode.
7	Determination of radius of curvature of Plano convex lens using Newton's rings.
8	Determination of thickness of thin paper using air wedge.
9	Determination of wavelength of sodium light using diffraction grating.
10	Determination of wavelength of laser using diffraction grating.
11	Determination of divergence of laser beam.
12	Determination of amplitude and frequency of sinusoidal signal using CRO.
13	To measure the phase shift introduced by a phase shift network using Dual beam CRO.
14	Determination of the velocity of Ultrasonic waves in a non -electrolytic liquid by ultrasonic interferometer.

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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B. Tech SoE and Syllabus 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mechanical Engineering)

B.Tech in Mechanical Engineering

SoE No. 23ME-101

I SEMESTER

23ME1101 : Engineering Graphics

Course Outcomes :
Upon successful completion of the course the students will be able to
1. Construct orthographic drawing and isometric drawing of a given object
2. Evaluate Projections of various One Dimensional, Two dimensional, Three dimensional objects
3. Develop the lateral surfaces of various solids, their section and intersection**.**
4. Practice the use of software tools used for Two dimensional drawings.

Unit I: Theory of Orthographic Projections:	**(3 Hrs.)**
Introduction, Quadrant system, Theory of orthographic projection, Projection method and principal planes, First and Third angle projections,	
Unit II: Theory of Isometric Projections:	**(2 Hrs.)**
Theory of isometric projection, Method for drawing isometric views, Different problems on isometric projections.	
Unit III: Lines:	**(2 Hrs.)**
Projection of points, Projection of lines, True lengths and inclinations, apparent lengths and inclinations, various positions of lines in different quadrants, Traces of lines, projection of line on auxiliary plane.	
Unit IV: Planes and Solids:	**(4 Hrs.)**
Projection planes: (Polygonal Lamina, Circular Lamina), Projection of Perpendicular planes and oblique planes. Auxiliary views (Auxiliary planes) Projection of Solids :(Inclined to One Plane Only) - Polyhedra (Regular and Irregular Polyhedra), Solids of Revolution	
Unit V: Section of Solids and Development of Surfaces:	**(2 Hrs.)**
Types of Section planes, Sectional top view, True shape. Development of different solids using Radial line and parallel line methods.	
Unit VI: Intersection of Surfaces of solids:	**(2 Hrs.)**
Intersection between similar solids, Intersection between dissimilar solids, Lines and Curves of Intersection.	
Total Lecture	**15 Hours**

Textbooks:	
1.	D.M. Kulkarni, A. P. Rastogi and A. K. Sarkar , Engineering Graphics with AutoCAD PHI learning Pvt. Ltd., Revised Edition(2014),
2.	N. D. Bhatt ,Engineering Drawing Charotar Publishing House Pvt. Ltd, 53 rd Edition 2017

Reference Books:	
1.	D. A. Jolhe Engineering Drawing , Tata McGraw Hill Publications , 2008,
2.	K. L. Narayana & P. Kannaiah , Engineering Drawing SciTech Publication , 2010
3.	R. K. Dhawan Engineering Drawing S. Chand Publication Multicolor revised edition 2015

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	Intranet on address 172.16.1.10. data/CCC/software / AutoCAD Software Setup.

MOOCs Links and additional reading, learning, video material	
1.	https://youtube.com/playlist?list=PLLy_2iUCG87Bw9XPfEF3r3EW5UlAOv8iz
2.	Eng https://nptel.ac.in/courses/112105294

I SEMESTER

23ME1102 : Lab. Engineering Graphics

Course Outcomes :
Upon successful completion of the course the students will be able to
1. Construct orthographic drawing and isometric drawing of a given object
2. Evaluate Projections of various One Dimensional, Two dimensional, Three dimensional objects
3. Develop the lateral surfaces of various solids, their section and intersection**.**
4. Practice the use of software tools used for Two dimensional drawings.

Practical's to be performed from the list as below

SN	**Experiments based on**	**No.of Practical's**
1	Introduction of AutoCAD Basic Commands	02
2	Orthographic Projection	03
3	Isometric Projection	03
4	Projection of Straight Line	03
5	Projection of Planar Surface	03
6	Projection of Solid	03
7	Section and Development of Solid	04
8	Intersection of Surfaces	03
9	Drawing Sheet 1: Convention for various lines, Dimensioning and Orthographic Projection	02
10	Drawing Sheet 2: Projection of line, planar surface or solid. (Any one)	02
	Total Practical's	**28 Hours**

Nagar Yuwak Shikshan Sanstha's

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B. Tech SoE and Syllabus 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Electrical Engineering)

B.Tech in Electrical Engineering

SoE No. 23EL-101

I SEMESTER

23EL1101 : Basic Electrical and Electronics Engineering

Course Outcomes:

1. Understand the fundamental concepts of Analog Electronic and Electrical Circuits
2. Apply the concepts of Electrical and Electronic Circuits to obtain the desired parameter
3. Analyze analog Electrical Circuits for given application.
4. Analyze analog Electronic Circuits for given application

Unit I: Circuit Elements and Energy Sources	**(7 Hrs.)**
Circuit Elements, Series and Parallel Combination of Resistances, Inductance and Capacitances, Energy Sources, Source Transformation, Sources with Periodic Waveforms, A.C. in Inductance and Capacitance, Star-Delta Connection. **(Contemporary Issues related to Topic)**	
Unit II: Analysis of Network	**(7 Hrs.)**
Kirchhof's Laws, Current Division, Voltage Division, Nodal and Mesh Analysis of Electric Circuits, Thevenin's Theorem **(Contemporary Issues related to Topic)**	
Unit III: Generator and Motors	**(7 Hrs.)**
Introduction to Generator, Construction, working principle, Types of Generators, Introduction to DC Motor,Working Principle of DC Motor, Types of Motors. **(Contemporary Issues related to Topic)**	
Unit IV: Diode and Transistor	**(6 Hrs.)**
Introduction to Semiconductor, P-N junction diodes, Biasing & Characteristics of diodes. Diode Circuits - Half wave rectifier, full wave rectifier, bridge rectifier. Introduction to BJT- NPN and PNP, Modes of operation,. **(Contemporary Issues related to Topic)**	
Unit V: Operational Amplifier and Its Application	**(7 Hrs.)**
Introduction to Op-Amp, Inverting and Non-Inverting Amplifier, Linear Applications of OP-AMP like adder, Subtractor, integrator, differentiator and non-linear application using Comparator. **(Contemporary Issues related to Topic)**	
Unit VI: Electronics Measurement	**(6 Hrs.)**
Introduction to Measurement System, Generalized block diagram of Measurement System, Static & dynamic characteristics of measurement system, Types of errors & their sources, Statistical analysis. **(ContemporaryIssues related to Topic)**	
Total Lecture	**40 Hours**

			July,2023	1.00	Applicable for AY 2023-24 Onwards
Chairperson	Dean (Acad. Matters)	Dean OBE	Date of Release	Version	

Textbooks:	
1.	Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford Higher Education, First Edition2005
2.	Electronics Devices and circuits, Millman Jacob, McGraw Hill Education, Fourth Edition (2015)
3.	Circuit Theory (Analysis and Synthesis) , by A. Chakrabarti, Dhanpat Rai & Co., Reprint Edition 2014

Reference Books:	
1.	OP-AMP and Linear Integrated Circuit, by Ramakant A. Gayakwad, Prentice Hall India Learnin Private Limited, Published in 2002
2.	Electrical & Electronic measurement & Instrument, A. K. Sawhney, Dhanpat Rai & Co.,18th edition 2008

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042

MOOCs Links and additional reading, learning, video material	
1.	https://onlinecourses.nptel.ac.in/noc22_ee113/preview

I SEMESTER

23ME1107 : Lab. FAB Shop

Course Outcomes :

Upon successful completion of the course the students will be able to:

1. Interpret the general safety/precautions on shop floor; identify and use the different materials, machines and measuring and cutting tools.
2. Practice on manufacturing of components using workshop trades including fitting, plumbing, carpentry, smithy/foundry and welding, etc.
3. Demonstrate practical knowledge of the dimensional accuracies and tolerances applicable for different manufacturing processes.
4. Produce simple/small devices of their interest in project/product development or research purpose.

Sr.No	Experiments based on	CO	Level
1	Study and demonstration of safety norms, unfair practices, meaning of different signs/symbols and use of fire extinguishers	I	L-II
2	Study and demonstration of different materials, devices/machines, cutting and measuring devices used in fitting, plumbing, carpentry, smithy/foundry, welding and machining shop.	I	L-II
3	Create simple job/part/pattern in fitting, plumbing, carpentry, smithy/foundry and welding shop.	II	L-III
4	Elaborate the created job/part/pattern with proper justification of its dimensional accuracies and tolerances.	III	L-III
5	Case study: To prepare simple/small models (Group Activity)	IV	L-III
6	**Demonstration of Advance Machining Facility:** (With manufacturing of sample job on any one machine)	I	L-II
	a) Lathe, Drilling, Milling, Shaper, Press etc **OR**		
	b) CNC Trainer Lathe/Milling Machines **OR**		
	c) CNC Router **OR**		
	d) EDM		

Text books	
1	Workshop Technology - Part I,Chapman W.A.JFifth edition CBS Publishers
2	Elements of Workshop Technology, (Vol-I), S.K.Hajra Choudhary,A.K.Hajra Choudhary,Nirjhar Roy, Media Promoters & Publishers Pvt Ltd
3	Workshop Technology (Volume-II) Hajra Choudhary 2nd Edition (2012) The McGraw-Hill Companies
4	Manufacturing Technology (Metal Cutting & Machine Tools) P N Rao 2nd Edition (2009) The McGraw-Hill Companies
5	A Course in Workshop Technology , Vol-I, B S Raghwanshi, Dhanpat Rai & Company
6	A Text Book on Workshop Technology by R S Khurmi & J K Gupta, S K Chand & Co
7	Workshop Manual by P Kannaiah & K L Narayana, SCITECH Publications

Reference Books	
1	Manufacturing Engineering & Technology S Kalpakjian & SR Schmid 1st Edition (2009) Pearson Education Canada
2	Technology of machine Tools Krar & Oswald 1st Edition (1984) Gregg Division, McGraw-Hill
3	Manufacturing Processes M Begman 1st Edition (1974) Ballinger Pub. Co
4	Manufacturing Science Ghosh & Malik 2nd Edition (2010) East West

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042

MOOCs Links and additional reading, learning, and video material	
1	https://nptel.ac.in/courses/112/103/112103280/
2	https://nptel.ac.in/courses/106/106/106106179/
3	https://nptel.ac.in/courses/127/105/127105007/

I SEMESTER

23ME1105 : Material Science & Metallurgy

Course Outcomes :

Upon successful completion of the course the students will be able to

1. Distinguish between ferrous and Non-ferrous materials. Illustrate crystal structures for various materials and Differentiate or Distinguish between ferrous and Non-ferrous materials.
2. Interpret Iron-Iron carbide equilibrium diagram and analyse microstructure, general properties of commercial steels and Cast Iron.
3. Discuss the various heat treatment processes for steels.
4. Demonstrate the basics of powder Metallurgy for powder metallurgical components.

Unit I:	**(7 Hrs.)**
Introduction to materials, classification of materials. Properties and applications of materials. Crystalline nature of metals, specially microscopic and macroscopic examinations of metals. Alloys and solid solutions, types and their formations, modified Gibbs's phase rule, Lever rule for phase mixtures and their application in system.	
Unit II:	**(6 Hrs.)**
Study of equilibrium diagrams and invariant reactions. Iron-Iron carbide equilibrium diagram, critical temperatures. Microstructure of slowly cooled steels. Estimation of carbon from microstructures; structure property relationship. Welding Metallurgy and solidification.	
Unit III:	**(6 Hrs.)**
Classification and application of plain carbon steels. Examples of alloy steel such as Hadfield Manganese Steel, ball Bearing Steels, etc. Effect of alloying elements. Tool Steels – Classification, composition, application and commercial heat treatment practice for HSS, Secondary hardening. Stainless Steels - Classification, composition, application and general heat treatment practice for Stainless Steels.	
Unit IV:	**(7 Hrs.)**
Heat treatment and its importance. Annealing, Normalizing, Hardening, Quench Cracks, Hardenability test. TTT diagram and its construction and related Heat Treatment Processes such as Austempering, Martempering, Patenting etc. Retention of Austenite, Effects and elimination of retained austenite, Tempering. Case / Surface hardening treatments such as Carburising, Nitriding, Cyaniding, Carbonitriding, Flame and Induction hardening.	

Unit V:	**(7 Hrs.)**
Cast Iron – Classification, White cast Iron, Gray Cast Iron, Nodular Cast Iron, Malleable Cast Iron, Chilled and alloy Cast Iron. (Production route, Composition, Microstructure and applications) Effects of various parameters on structure and properties of Cast Iron, Alloy cast Iron such as Ni-resist, Ni-hard. Non-Ferrous Alloys – Study of non-ferrous alloys such as brasses (Cu-Zn diagram), Bronzes (Cu-Sn diagram), Aluminum Alloys (e.g. Al-Si & Al-Cu diagram), Bearing materials.	
Unit VI:	**(6 Hrs.)**
Powder Metallurgy: Powder manufacture and Conditioning, Production of Sintered Structural Components, Self lubricating bearing, Cemented Carbides, Ceramics, Sintered Carbide cutting tools.	
Total Lecture	**39 Hours**

Textbooks:	
1	Dr. V.D. Kodgire, Material Science and Metallurgy, Edition, 1st Jan 2011, Everest Publication House
2	Dr. B K Agrawal, Introduction to Engineering Metallurgy, 21st revised edition, 2007, Tata Mc. Graw Hill Education Pvt. Ltd., New Delhi.

Reference Books:	
1	Sidney H. Avner, Introduction to Physical Metallurgy, 29st revised edition, 2009, Mc. Graw Hill Publication, New Delhi, 1964.
2	Yu Lakhtin, Engineering Physical Metallurgy and Heat Treatment, 21st revised edition, 1988, Mir publishers, Moscow, Russia
3	E C Rollason, Metallurgy for Engineers, 4th Revised edition 1987, E. Arnold.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	https://drive.google.com/file/d/1zKi0psulXBNLQux7CZnrFIjxfJ3NWoRb/view?usp=share_link
2	https://drive.google.com/file/d/1uVUHGG8-2vWahUnuBEE6rjAFeLZtJNnI/view?usp=share_link

MOOCs Links and additional reading, learning, video material	
1	https://www.youtube.com/watch?v=vkraap0k6FE
2	https://www.youtube.com/watch?v=cJm-jeb_c9U
3	https://www.youtube.com/watch?v=2IHhIEfzoOo

I SEMESTER

23ME1106 : Lab. Material Science & Metallurgy

Course Outcomes :

Upon successful completion of the course the students will be able to

1. Distinguish between ferrous and Non-ferrous materials. Illustrate crystal structures for various materials and Differentiate or Distinguish between ferrous and Non-ferrous materials.
2. Interpret Iron-Iron carbide equilibrium diagram and analyse microstructure, general properties of commercial steels and Cast Iron.
3. Discuss the various heat treatment processes for steels.
4. Demonstrate the basics of powder Metallurgy for powder metallurgical components.

Minimum Five Practical's to be performed from the list as below

SN	**Experiments based on**
1	Study of Metallurgical Microscope.
2	Preparation of Specimen for metallographic examinations.
3	Study and drawing of microstructures of Steels.
4	Study and drawing of microstructures of Cast Iron
5	Study and drawing of microstructures of Non Ferrous Metals.
6	Study of the effect of annealing and normalizing on properties of steels.
7	Determination of hardenability of steels by Jominy End Quench test.
8	Measurement of hardness of ferrous and non-ferrous materials with the help of Brinell hardness tester.
9	Measurement of hardness of ferrous and non-ferrous materials with the help of Rockwell hardness tester.
10	Study the heat treatment of high speed steels.
11	Study of mechanisms of quenching.
12.	Study of Pack carburizing of steel samples.
13.	Study of effect of alloying elements on properties of steel.

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech SoE and Syllabus 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Civil Engineering)

B.Tech in FYC

SoE No. 23FY-101

I SEMESTER

23GE1117-Get Set Go

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Students will understand the importance of building trust in communication and learn how to use the 3Vs of communication (Visual, Vocal, Verbal) to energize their interactions.
2. The course will focus on leadership principles and styles, emphasizing how effective communication can motivate others and gain willing cooperation. Students will participate in activities like skits and team presentations to demonstrate their leadership skills.
3. The course will equip students with team management and organization skills, enabling them to lead and participate in team-building activities effectively.

Unit:1	Build a foundation for success	6 Hours
Explain the Importance of Process of improvement, stating your Name with Impact, Recall and Use Names, Name Remembering Formula o LIRA o PACE – Individual Activity o BRAMMS o Chaining Method, Introduce "My Vision" Communication Fundamentals for Building Trust- Be a good listener, use conversation links, show genuine interest Hi-Five of Success ♣ Build on Memory Skills and Enhance Relationships ♣ PEG words ♣ Explain Permanent PEG Memory System, energize our Communications – Explain 3Vs of communication – Visual-Vocal-Verbal Activity – Practice Conversations, Pause-Part-Punch, Group Activity		
Unit:2	**Increase Self Confidence**	**6 Hours**
Use our experiences to communicate more confidently • Communicate with clarity and conciseness • Discover how past experiences influence behaviour ,Motivate Others and Enhance Relationships- • Learning Objectives • Explain Gain Willing Cooperation Principles • Group Presentation • Explain Demonstration of Leadership Principles • Explain "Evidence" critical in establishing credibility Individual Activity – Sharing of defining moment, Skit to demonstrate Leadership Principles, Stranded on Island .		
Unit:3	**Fundamentals of Communication**	**6 Hours**
Fundamentals of Communication (Earn the right – Excite -Eagerness) ♣ Elevator Pitch ♣ Develop more Flexibility, ♣ Recap and Summarize Activities - – Individual Presentation, Flexibility Drills, Individual Presentations – My Vision Assignment		
Unit:4	**Team Management and Organization skills**	**5 Hours**
Team Management and Organization skills, Leadership Styles, Effective Communication Activity- Team Presentation, Team building activities.		
EVALUATION	**1 Hour**	**EVALUATION**
WRITTEN TEST		
Total Lecture Hours		**24 Hours**

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Reference Books	
1	Soft Skills - Enhancing Employability: Connecting Campus with Corporate. - M S Rao
2	Soft Skills Training: A Workbook to Develop Skills for Employment - Frederick H Wentz
3	Soft Skills: Know Yourself and Know the World - Alex

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Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2023

2nd Semester

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

SoE No. 23ME-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER (GROUP-B)															
1	1	BS	GE	23GE1102	Differential Equations, Matrices and Statistics	T	3	0	0	3	3	30	20	50	3
2	1	BS	GE	23GE1108	Engineering Physics	T	3	0	0	3	3	30	20	50	3
3	1	BS	GE	23GE1109	**Lab:** Engineering Physics	P	0	0	2	2	1		60	40	
4	1	BES	ME	23ME1101	Engineering Graphics	T	1	0	0	1	1	30	20	50	3
5	1	BES	ME	23ME1102	**Lab :** Engineering Graphics	P	0	0	4	4	2		60	40	
6	1	BES	EL	23EL1101	Basic Electrical and Electronics Engineering	T	3	0	0	3	3	30	20	50	3
7	1	BES	ME	23ME1107	**Lab :** FAB Shop	P	0	0	2	2	1		60	40	
8	1	PC	ME	23ME1105	Material Science & Metallurgy	T	3	0	0	3	3	30	20	50	3
9	1	PC	ME	23ME1106	**Lab :** Material Science & Metallurgy	P	0	0	2	2	1		60	40	
10	1	VSEC	GE	23GE1117	Get Set Go	…	…	…	…	…	2		60	40	
11	1	CC2	GE		**Liberal Learning Course (LLC2)**	…	…	…	…	…	2		60	40	
					TOTAL FIRST SEM		**13**	**0**	**10**	**23**	**22**				
MANDATORY LEARNING COURSES															
1	1	HS		GE2131	Universal Human Values (UHV)	**A**	2	0	0	2	0				
SECOND SEMESTER (GROUP-B)															
1	2	BS	GE	23GE1201	Calculus and Vector	T	3	0	0	3	3	30	20	50	3
2	2	BS	GE	23GE1204	Applied Chemistry	T	3	0	0	3	3	30	20	50	3
3	2	BS	GE	23GE1205	**Lab:** Applied Chemistry	P	0	0	2	2	1		60	40	
4	2	HS/AEC1	GE	23GE1212	Professional Communication	T	2	0	0	2	2	30	20	50	2
5	2	HS/IKS	GE	23GE1215	Indian Knowledge System	T	2	0	0	2	2	30	20	50	2
6	2	BES	CV	23CV1201	Engineering Mechanics	T	3	0	0	3	3	30	20	50	3
7	2	BES	CV	23CV1202	**Lab:** Engineering Mechanics	P	0	0	2	2	1		60	40	
8	2	BES	IT	23IT1203	Programming for Problem Solving	T	2	0	0	2	2	30	20	50	2
9	2	BES	IT	23IT1204	**Lab:** Programming for Problem Solving	P	0	0	2	2	1		60	40	
10	2	VSEC	GE	23GE1218	Functional English	…	…	…	…	…	2		60	40	
11	2	CC1	GE	23GE1216	**Liberal Learning Course (LLC1)**	…	…	…	…	…	2		60	40	
					TOTAL SECOND SEM		**15**	**0**	**6**	**21**	**22**				

Liberal Learning Course

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	2	CC2	GE	23LLC1201	Music (Vocal)
2	2	CC2	GE	23LLC1202	Music (Instrumental)
3	2	CC2	GE	23LLC1203	Indian Classical Dance
4	2	CC2	GE	23LLC1204	Other forms of Dances
5	2	CC2	GE	23LLC1205	Painting
6	2	CC2	GE	23LLC1206	Theatre and acting
7	2	CC2	GE	23LLC1207	Photography
8	2	CC2	GE	23LLC1208	Yoga
9	2	CC2	GE	23LLC1209	Chess
10	2	CC2	GE	23LLC1210	Athletics
11	2	CC2	GE	23LLC1211	Basket Ball
12	2	CC2	GE	23LLC1212	Judo
13	2	CC2	GE	23LLC1213	Elements of Japanese Language
14	2	CC2	GE	23LLC1214	Elements of German Language
15	2	CC2	GE	23LLC1215	Elements of French Language
16	2	CC2	GE	23LLC1216	Elements of Spanish Language
17	2	CC2	GE	23LLC1217	Basics of Vedic Maths
18	2	CC2	GE	23LLC1218	Skilling in Microsoft Visio and Inkscape

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

SoE No. 23ME-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	

Liberal Learning Course

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	1	CC1	GE	23LLC1101	Music (Vocal)
2	1	CC1	GE	23LLC1102	Music (Instrumental)
3	1	CC1	GE	23LLC1103	Indian Classical Dance
4	1	CC1	GE	23LLC1104	Other forms of Dances
5	1	CC1	GE	23LLC1105	Painting
6	1	CC1	GE	23LLC1106	Theatre and acting
7	1	CC1	GE	23LLC1107	Photography
8	1	CC1	GE	23LLC1108	Yoga
9	1	CC1	GE	23LLC1109	Chess
10	1	CC1	GE	23LLC1110	Athletics
11	1	CC1	GE	23LLC1111	Basket Ball
12	1	CC1	GE	23LLC1112	Judo
13	1	CC1	GE	23LLC1113	Elements of Japanese Language
14	1	CC1	GE	23LLC1114	Elements of German Language
15	1	CC1	GE	23LLC1115	Elements of French Language
16	1	CC1	GE	23LLC1116	Elements of Spanish Language
17	1	CC1	GE	23LLC1117	Basics of Vedic Maths
18	1	CC1	GE	23LLC1118	Skilling in Microsoft Visio and Inkscape

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

Chairperson	Dean (Acad. Matters)	July, 2023	1.00	Applicable for AY 2023-24 Onwards
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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech SoE and Syllabus 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mathematics & Humanities)

B.Tech First Year

SoE No. 23FY-101

II SEMESTER

23GE1201: Calculus and Vector

Course Outcomes :
The students will be able to 1. Apply the knowledge of differentiation to solve the Engineering problems. 2. Determine the derivatives of functions of several variables and develop the relations among the derivatives of variables. 3. Apply the knowledge of Beta and Gamma functions to find area, volume and mass. 4. Discuss Calculus of Scalar and vector point function and use appropriate theorems to evaluate integrals of functions of single and multiple variables.

Unit I: Differential Calculus	**(6 Hrs.)**
Successive differentiation, n^{th} derivative of rational function, Trigonometrical transformations, n^{th} derivative of the product of two functions (Leibnitz's theorem), Taylor's theorem, Use of Maclaurin's theorem for one variable, standard expansions, Examples on Taylor's Theorem. **(Contemporary Issues related to Topic)**	
Unit II: Partial Differentiation	**(7 Hrs.)**
Functions of several variables, First and higher order derivatives, Homogeneous functions, Euler's theorem on homogeneous function, Chain rule and total differential coefficient of composite functions. Jacobians. **(Contemporary Issues related to Topic)**	
Unit III: Integral Calculus	**(6 Hrs.)**
Improper integrals: Gamma and Beta functions, applications of integral calculus in computing area, length, volumes, and surface of solids of revolutions. **(Contemporary Issues related to Topic)**	
Unit IV: Multiple integrals	**(6 Hrs.)**
Double integral, change of order of integral, change of variables, triple integrals and its applications. **(Contemporary Issues related to Topic)**	
Unit V: Vector Calculus	**(7 Hrs.)**
Vector fields, Vector differentiation, Gradient, Divergence and Curl, Directional derivatives with physical interpretation, Solenoidal and irrotational motions. **(Contemporary Issues related to Topic)**	
Unit VI: Vector Integration & Applications	**(7 Hrs.)**
Vector integration: Line, surface and volume integrals, Statement of Stoke's theorem, Gauss divergence theorem and Green's theorem (without proof), Simple applications of these theorems. **(Contemporary Issues related to Topic)**	
Total Lecture	**39 Hours**

			July,2023	1.00	Applicable for AY 2023-24 Onwards
Chairperson	Dean (Acad. Matters)	Dean OBE	Date of Release	Version	

Textbooks:	
1.	Erwin Kreyzig, Advance Engineering Mathematics, 10th Edition, John Wiley and Sons, INC.
2.	H.K. Dass, Engineering Mathematics, 11th revised edition, S. Chand, Delhi.
3.	H.K. Dass, Advanced Engineering Mathematics, 8th revised edition, S. Chand, Delhi.
4.	Dr. B.S. Grewal, Higher Engineering Mathematics, 42th edition, Khanna Publishers.
5.	P.N.Wartikar and J.N.Wartikar, Applied Mathematics, 4th Edition, Vidyarthi GrihaPrakashan.

Reference Books:	
1.	G B Thomas and R L Finney, Calculus and Analytical Geometry, 9th edition, Addison-Wesley, 1999.
2.	Michael Spivak and Tom Apostol, Calculus, VolI & Vol II 2nd edition, Wiley.
3.	N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, 10th edition, Laxmi Prakashan.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Applied%20Sciences%20&%20Humanities/Mathematics%20and%20Humanities/

MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/111/106/111106146/
2.	https://nitkkr.ac.in/docs/5-Multiple%20Integrals%20and%20their%20Applications.pdf

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B. Tech SoE and Syllabus 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Applied Chemistry)

B.Tech First Year

SoE No. 23FY-101

I/II SEMESTER

23GE1104/23GE1204: Applied Chemistry

Course Outcomes:

Upon successful completion of the course the students will be able to:

1. **Build** the knowledge of qualitative and quantitative aspects of water for industrial and domestic applications. (L3)
2. **Apply** fundamental principles of electrochemistry to understand corrosion, energy storage devices and their industrial applications. (L3)
3. **Develop** insight into engineering materials for industrial applications. (L3)
4. **Utilize** knowledge of advanced engineering materials for technological applications. (L3).

Unit I: Water Chemistry	**(8 Hrs.)**
Introduction, Potable water quality parameters. Hardness, Types of hardness. Sterilization. Desalination of water by R.O. Softening of water by Zeolite process and Ion Exchange Process (principle, advantages, and limitations). Numerical based on Hardness and Zeolite process. Boiler trouble (Scale and sludge). Contemporary issues related to the topic	
Unit II: Electrochemistry	**(8 Hrs.)**
Introduction, Redox reactions, EMF of a cell, standard electrode potential, Nernst equation, numerical and applications to chemical cells. Conductance in electrolytic solutions, specific and molar conductivity, variations of conductivity with concentration, Electrolysis, laws of electrolysis and numerical. Industrial applications: Electroplating, Electrolytic refining. **Corrosion:** Definition, Causes, theories of corrosion- dry, wet and differential aeration. Contemporary issues related to the topic	
Unit III: Energy storage devices	**(7 Hrs.)**
Battery: Introduction, Characteristics, and General applications Lithium-ion battery, Glass battery, H_2-O_2 Fuel cell. Differences between Battery and Fuel cell. Recycling and safe disposal of batteries. **Supercapacitors:** Definition, Types, Characteristics,and Application. **H_2 as a green fuel:** Introduction, Production, Storage, and Utilization.Contemporary issues related to the topic	
Unit IV: Fuels	**(8 Hrs.)**
Introduction, Calorific value, HCV & LCV. Determination of calorific value of fuels by Bomb & Boy's calorimeter. Dulong's formula Numerical. Significance of Proximate and Ultimate analysis. Knocking in Internal combustion petrol and diesel engines, Octane and Cetane number, Knocking and its relationship with structure of fuels. Catalytic cracking & advantages. Contemporary issues related to the topic	
Unit V: Engineering Materials	**(7 Hrs.)**
Cement: Introduction, Manufacturing of Portland cement. Role of microscopic constituents. Properties-setting and hardening, heat of hydration and soundness. Types of cement-Rapid hardening cement, Low heat cement, High alumina cement. Ready-mix concrete.	

			July,2025	1.00	Applicable for AY 2025-26 Onwards
Chairperson	Dean (Acad. Matters)	Dean OBE	Date of Release	Version	

Lubricants: Introduction, Classification, Mechanism of Lubrication. Properties & Significance of liquid lubricants–Viscosity and viscosity index, Flash and fire point, Cloud and pour point, Aniline point, acid value, saponification number. Numerical on V.I. Contemporary issues related to the topic.	
Unit VI: Advanced Materials	**(7 Hrs.)**
Nanomaterials: Definition, Carbon Nanotubes and types. Applications of Nanomaterials in Electronics, Environment and Medicine. **Liquid Crystal Polymers:** Introduction**,** General properties and applications. **Polymers in electronic industries**: Introduction**,** Piezo, pyroelectric, Ferroelectric polymers. **Smart materials:** Introduction**,** Properties and applications of Chromoactive, Photoactive and Magneto rheological materials. **Spectroscopic techniques:** Introduction and applications. Contemporary issues related to the topic	
Total Lecture	**45 Hours**

Textbooks:	
1.	S S. Dara , A Text book of Engineering Chemistry , S.Chand & Co New Delhi. Eleventh Edition.
2.	P.C. Jain and Monica Jain , Engineering Chemistry , Dhanpat Rai & sons New Delhi , Sixteenth Edition.
3.	P. W. Atkins, Physical Chemistry ,Oxford Publications, Eighth edition .

Reference Books:	
1.	Eskel Nordell , Water treatment for industrial and other use ,Rein hold Publishing Corporation, New York.
2.	Lloyd A.Munro, Chemistry in Engineering, Prentice-hall, Inc Nj, 2nd Edition.
3.	Robert B Leighou Mc Graw, Chemistry of Engineering Materials, Hill Book Company, Inc New York.
4.	B.K.Sharma Krishna, Engineering Chemistry, Prakashan media private LTD. 1st Edition, 2014.
5.	R.V.Gadag, A.Nityananda Shetty, Engineering Chemistry ,I K International Publishing House New Delhi , First Edition.
6	Fred. Billmeyer Jr., A textbook of polymer science, Wiley India ,Third Edition.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/SERIES%20WISE%20BOOKS/CHEMISTRY/

MOOCs Links and additional reading, learning, video material	
1.	https://www.youtube.com/watch?v=XTt3gXB0a84
2.	https://www.youtube.com/watch?v=iihYXx79QiE
3.	https://www.youtube.com/watch?v=JfJ7MlP9Dco
4.	https://www.youtube.com/watch?v=L2VSOccUrSk
5.	https://www.youtube.com/watch?v=p5pk4Um6lsk
6.	https://youtu.be/-R7s17hD104
7.	https://youtu.be/Bmj85Ihfv7w

I/II SEMESTER
23GE1105/23GE1205: Applied Chemistry Lab

Course Objectives (PR)

1) Develop analytical ability.
2) Integrate chemistry fundamentals with practical applications.

Course Outcomes

Upon successful completion of the course the students will be able to

1. **Apply** the knowledge of quantitative and qualitative chemical analysis to perform record and analyze the results. (L3)
2. **Experiment** with instrumental and analytical techniques in Chemistry to solve engineering problems related to sustainability. (L3)
3. **Write** effective reports and communicate through oral presentations. (L3)
4. **Review a**nd apply laboratory safety protocols and procedures to acquire the ability for independent and lifelong learning. (L3)

Total 9 experiments are to be performed
(4 each from Lab I and Lab II and one demonstration experiment)

SN	Experiments based on
	List of Experiments-Lab- I
1	Estimation of Nickel.
2	Estimation of Fe^{2+} ions by redox titration
3	Determination of copper by iodometric titration
4	Determination of Cation exchange capacity of an ion exchange resin
5	To determine the strength of a given potassium dichromate solution with N/20 sodium thiosulphate solution
6	Determination of COD of water sample.
	List of Experiments-Lab- II
1	Determination of viscosity of lubricating oil by Redwood Viscometer I or II
2	Determination of molecular weight of a polymer.
3	Proximate analysis of coal

4	Determination of electrochemical equivalence of copper using Faradays Law
5	Determination of strength of the given acid conductometrically.
6	To verify Beer-Lambert law for $KMnO_4$ calorimetrically and determine the concentration of the given solution of $KMnO_4$.
	List of Demonstration Experiments
1	Synthesis of urea formaldehyde.
	Advanced Topics (CBS)
1.	To Determine optimum alum dosage for water or wastewater treatment by turbidity measurement using nephelometer and residual chlorine testing using chloroscope.
2.	Comparative study of effects of different drying techniques on the quality of fruits and vegetables.

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(Department of Mathematics & Humanities)

B.Tech First Year

SoE No. 23FY-101

II SEMESTER

23GE1212 : Professional Communication

Course Outcomes :
Upon successful completion of the course the students will be able to: 1.Apply different modes for effective communication 2.Produce competently the Phonology of English language 3.Apply nuances of LSRW skills 4.Practice Communication through different channels

Unit I: Basics of Communication	**(6 Hrs.)**
Process of Communication, Levels of Communication, Flow of Communication, Networks of Communication, Classification of Barriers (Intrapersonal, Interpersonal, Organizational).	
Unit II: English Phonetics	**(7 Hrs.)**
Speech Mechanism, Organs of speech, Consonant and Vowels sounds symbols, word stress rules	
Unit III: Presentation & Interview Skills	**(6 Hrs.)**
Presentation-Nuances of presentation- Kinesics, Proxemics, Chronemics, Vocalics, Modes of Presentation, Interview-Purpose , expectations of employer and preparation for Interview, Types, Types of Questions &Answering Techniques, Telephonic Interviews – preparation and guidelines	
Unit IV: Technical Reports, Memo & E-Mail Etiquettes	**(7 Hrs.)**
Report -Types, Characteristics, prewriting aspects of report and preparing writing of reports Memo- Objectives, Types, Structure and Layout Email-Etiquettes, acronyms.	
Total Lecture	**26 Hours**

Textbooks:	
1.	Meenakshi Raman & Sangeeta Sharma, Technical Communication, Raman & Sharma, Oxford University Press Orford University Press
2.	T. Balasubramaniam, Textbook of English Phonetics for Indian Students, Macmillan India Ltd
3.	

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Reference Books:	
1.	Dale Carnegie ,How to Develop Self – Confidence & Influence People by Public Speaking
2.	Asha Kaul, Communication Skills
3.	Allen Peas ,Body Language
4.	Gerson's Gerson, Technical Communication

MOOCs Links and additional reading, learning, video material	
1.	https://dl.uswr.ac.ir/bitstream/Hannan/141245/1/9781138219120.pdf
2.	https://www.pdfdrive.com/word-power-made-easy-the-complete-handbook-for-building-a-superiorvocabulary-e157841139.html
3.	https://www.pdfdrive.com/improve-your-communication-skills-present-with-confidence-write-with-stylelearn-skills-of-persuasion-e156963640.html
4.	https://www.pdfdrive.com/21-days-of-effective-communication-everyday-habits-and-exercises-to-improveyour-communication-skills-and-social-intelligence-e158273760.html

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II SEMESTER

23GE1215 : Indian Knowledge System

Course Outcomes:
Upon successful completion of the course the students will be able to
1. Apply primary requirements pertaining towards awareness of Indian Knowledge System.
2. Analyze various Indian society, culture and literature to enhance their traditions.
3. Evaluate structure of Indian art.
4. Understand Indian heritage and architectural skills.

Unit:1	**Introduction to Indian Civilization**	**6 Hours**
Development of Human Civilization with specific reference: Stone age: Tool Technology and Cultural Development, Indus Valley civilization, Vedic Civilization. **(Contemporary Issues related to Topic)**		
Unit:2	**Indian Society, Culture and Literature**	**6 Hours**
Society and its types, Culture and its Characteristics, Foundational Literature. **(Contemporary Issues related to Topic)**		
Unit:3	**Tradition of Indian Art and Painting**	**7 Hours**
Indian Traditional Painting, Art style folk, mural with Gandhara and Mathura school of art. **(Contemporary Issues related to Topic)**		
Unit:4	**Indic Traditions of Architecture, Design and Planning**	**7 Hours**
Monumental studies of architectural skill: Rock Cut Caves, Stupa and Temple Architecture, The Ancient cities of Indus Saraswati region. Town Planning and drainage system. **(Contemporary Issues related to Topic)**		
	Total Lecture Hours	**26 Hours**

Textbooks	
1	Reader's Digest: Vanished Civilizations, THE READER'S DIGEST ASSOCIATION LIMITED, LONDON,NEWYORK.
2	Qaiser Zoha Alam ; Language and Literature Divers Indian Experience
3	Bal Ram Singh (Author), Nath Girish (Author) ; Science and Technology in Ancient Indian Texts
4	NCERT Books

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Reference Books	
1	B S Harishankar; Art and Archaeology of India: Stone Age to the Present, 2003.
2	Gupte R S and Mahajan B D; Ajanta, Ellora and Aurangabad, 1962.
3	Dharampal, Some Aspects of Earlier Indian Society and Polity and Their Relevance Today, New Quest Publications, Pune, 1987.
4	Michel Lorblanchet, "Rock Art In The Old World" IGNCA series, in India
5	Percy Brown, "Indian Architecture" D. B. Taraporevala sons & co. Pvt. Ltd. Bombay(1959).

PPT's/Research papers	
1	https://www.researchgate.net/publication/360889208_STONE_AGE_TOOL_TECHNOLOGY_and_CULTURAL_DEVELOPMENT
2	https://scholar.google.com/citations?view_op=view_citation&hl=en&user=iT1KSV8AAAAJ&sortby=pubdate&citation_for_view=iT1KSV8AAAAJ:UeHWp8X0CEIC

MOOCs Links and additional reading, learning, video material	
1	https://prepp.in/news/e-492-indian-architecture-art-and-culture-notes
2	https://www.artzolo.com/blog/most-famous-indian-painting-styles
3	https://www.researchgate.net/publication/360889332_Stone_Age_Tool_Technology_Cultural_Development
4	https://testbook.com/ias-preparation/ancient-history-16-mahajanapadas

II SEMESTER

23CV1201 : Engineering Mechanics

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Describe the fundamental concepts of statics and dynamics. 2. Apply the basic concepts of applied mechanics for solution of problems on planar force system. 3. Determine the properties of surface like centroid, moment of inertia, etc. for planar surfaces and mass moment of inertia for rigid body. 4. Analyze pin jointed truss frame structure and beam structure analytically and graphically. 5. Evaluate the dynamic variables of kinetics of particles and simple lifting machine

Unit I: Resultant of planar force System	**(7 Hrs.)**
Fundamental concepts, system of forces, laws of mechanics, principle of transmissibility of force, Moment of force, Principle of moment, Couple, Resultant of a planar force system, Equivalent force couple system. **(Contemporary Issues related to Topic)**	
Unit II: Equilibrium of planar force System	**(6 Hrs.)**
Free body diagrams, Conditions of equilibrium, types of supports, types of beams, types of loads on beam, Equilibrium of a planar force system **(Contemporary Issues related to Topic)**	
Unit III: Friction and Trusses	**(7 Hrs.)**
Friction: Coulomb's laws of dry friction, plane friction, belt friction. Trusses: Types of trusses, assumptions in analysis of truss, Analysis of truss by method of joint. **(Contemporary Issues related to Topic)**	
Unit IV: Properties of Surfaces	**(6 Hrs.)**
Centroid: Introduction, First Moment of Area, Centroid of composite areas. Moment of Inertia: Introduction, Second Moment of Area, Polar moment of Inertia, Radius of Gyration, Transfer formula for moment of Inertia, Product of Inertia, Moment of Inertia, and product of inertia for composite areas, Principal Moments of Inertia. **(Contemporary Issues related to Topic)**	
Unit V: Virtual Work Method and Kinetics of Particle	**(7 Hrs.)**
Virtual Work Method: Introduction, Principle of virtual work, Application to beam and frame. Kinetics of Particle: Introduction, Newton's law of motion for a Particle, D' Alembert's principle, Translation of particle and connected system. **(Contemporary Issues related to Topic)**	
Unit VI: Work Energy and Impulse Momentum Method	**(6 Hrs.)**
Work Energy Method: Introduction, Work energy equation for translation, Work energy applied to particle motion and connected system. Impulse Momentum Method: Introduction, Linear Impulse momentum, Conservation of linear momentum, coefficient of restitution, elastic impact, Impulse momentum in plane motion. **(Contemporary Issues related to Topic)**	
Total Lecture	**39 Hours**

Textbooks:	
1.	Nelson A., Engineering Mechanics (Statics and Dynamics), ed 2009, Tata Mc. Grew Hill Education Pvt. Ltd., New Delhi, 2009.
2.	Dubey N.H., Engineering Mechanics (Statics and Dynamics) first edition 2013, Tata Mc. Graw Hill Education Pvt. Ltd., New Delhi, 2013.
3.	Singer F.L, Engineering Mechanics (Statics and Dynamics), Harper and Rowe publication, New Delhi, 1994.
Reference Books:	
1.	Timoshenko S, Young D.H and Rao J.V, Engineering Mechanics, Mc. Graw Hill Publication, New Delhi, 2007.
2.	Bhattacharyya B., Engineering Mechanics, Oxford University Press, New Delhi, 2008.
3.	Hibbeler R.C, Engineering Mechanics (Statics and Dynamics), Pearson Publication, Singapore, 2000.
4.	Shames I.H. and Rao J.V., Engineering Mechanics (Statics and Dynamics), First Edition, Pearson Publication, New Delhi, 2003.
5.	Beer F.P. and Johnston E.R; Vector Mechanics for Engineers, 9th edition Tata Mc. Graw Hill Publication, New Delhi. 2007.
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/78.%20Engineering-Mechanics-Statics-and-Dinamics-E-W-Nelson-C-L-Best-W-G-McLean-1st-Ed-1997-Schaum-Outline-McGraw-Hill%20(1).pdf
2	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/79.%20Engineering%20Mechanics.%20Statics-%20MERIAM%20%20AND%20KRAIGE.pdf
3	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/81.%20Engineering%20Mechanics%201.pdf
MOOCs Links and additional reading, learning, video material	
1.	https://www.youtube.com/watch?v=nGfVTNfNwnk
2.	https://www.youtube.com/watch?v=6nguX-cEsvw
3.	https://nptel.ac.in/courses/112103108

II SEMESTER

23CV1202 : Lab. Engineering Mechanics

Course Outcomes
Upon successful completion of the course the students will be able to
1. Describe the fundamental concepts of statics and dynamics.
2. Apply the basic concepts of applied mechanics for solution of problems on planar force system.
3. Determine the properties of surface like centroid, moment of inertia, etc. for planar surfaces and mass moment of inertia for rigid body.
4. Analyze pin jointed truss frame structure and beam structure analytically and graphically.
5. Evaluate the dynamic variables of kinetics of particles and simple lifting machine

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	To find determine the support reactions of a Simply Supported Beam experimentally and analytically.
2	To determine the forces in the members of a Jib Crane Apparatus experimentally and graphically.
3	To determine the coefficient of friction between two surfaces of different material on Plane Friction Apparatus.
4	To determine the coefficient of friction of Coil Friction Apparatus.
5	To determine the forces in members of a Shear Leg Apparatus experimentally and manually.
6	To determine the mass moment of inertia of a fly wheel using Fly Wheel Apparatus
7	To determine efficiency and law of machine of Differential Axel & Wheel machine.
8	To determine efficiency and Law of machine of Single Purchase Crab machine.
9	To determine efficiency and Law of machine of Double Purchase Crab machine.
10	To verify law of polygonal of forces using Law of Polygon Apparatus.
11	To find support reactions of a simply supported beam using graphical method and hand calculation.
12.	To find the forces in the member of truss using graphical method and hand calculation.
13.	To find (1) Principle moment of inertia and (2) Moment of inertia and product of inertia about any inclined axis for a composite figure using Mohr's circle and hand calculation,

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(Department of Information Technology)

B.Tech in Information Technology

SoE No. 23IT-101

II SEMESTER

23IT1203 : Programming for Problem Solving

Course Outcomes :
1) Understand the basics of computer system operations and algorithms, flowcharts.
2) Apply the basics of C programming for problem solving.
3) Apply and analyze the different dimensional arrays for problem solving.
4) Understand the basics of string, structure, and union and apply them to problem solving.

Unit I: Computer System Basics:	**(3 Hrs.)**
Basics of programming and problem solving. Introduction to algorithms and flowcharts, Types of programming errors, basic input/output statements and functions (scanf, printf, getch, putch, gets, puts), Introduction to library functions,	
Unit II: Basic of C Programming	**(6 Hrs.)**
Basic building blocks of C: Character set, variables, identifiers & keywords, Data types, Operators: arithmetic, logical and relational operators, , bitwise operators, precedence of operators, Expressions, sizeof() operator, constants, typedef statement, writing straight line programs. Decision control statements: if, if - else and nested if-else statements, else-if ladder statement, switch-case control statement.	
Unit III: Loop Structures:	**(5 Hrs.)**
While, do while and for loops, break and continue statement, "goto" statement, real life programming examples based on these loop structures, real life programming examples.	
Unit IV: Modular Programming:	**(6 Hrs.)**
Concept of functions, user defined functions, function prototypes, formal parameters, actual parameters, return types, call by value , call by reference, C programs using functions, Recursive functions, comparing recursion against iteration, C programs using recursive functions, real life programming examples	
Unit V: Arrays:	**(6 Hrs.)**
One dimensional array, array manipulation, insertion, deletion of an element, searching techniques- Linear and binary search, sorting technique – Bubble sort. Two-dimensional arrays: matrix representation, programs for basic matrix operations such as addition, multiplication and transpose, Array as function arguments. real life programming examples	
Unit VI: String, Structure and Union:	**(4 Hrs.)**
Strings: string representation and string handling functions, Introduction to pointer, structure and union. real life programming examples	
Total Lecture	**30 Hours**

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Text books	
1	The C Programming Language, J.B.W.Kernighan & D.M.Ritchie, Prentice Hall
2	Mastering C, K.R.Venugopal & S.R. Prasad, TMH, 2007.
3	Programming in ANSI C, E. Balaguruswamy, Mc Graw Hill Education

Reference Books	
1	Problem Solving And Program Design In C, Jeri. R. Hanly, Elliot B. Koffman, Pearson Education.
2	Programming with C, Byron Gottfried, Schaum;s Outline Series
3	How to solve it by computers, R. G. Dromey, Prentice Hall India

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1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/106104128
2	https://nptel.ac.in/courses/106104128
3	https://www.youtube.com/watch?v=rQoqCP7LX60&list=PLxgZQoSe9cg1drBnejUaDD9GEJBGQ5hMt

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(Department of Information Technology)

B.Tech in Information Technology

SoE No. 23IT-101

II SEMESTER

23IT1204 : Lab. Programming for Problem Solving

Course Outcomes: Students will be able to
1) Understand the basics of computer system operations and algorithms, flowcharts. 2) Apply the basics of C programming for problem solving. 3) Apply and analyze the different dimensional arrays for problem solving. 4) Understand the basics of string, structure, and union and apply them to problem solving.

Unit I: Computer System Basics:	**(3 Hrs.)**
Basics of programming and problem solving. Introduction to algorithms and flowcharts, Types of programming errors, basic input/output statements and functions (scanf, printf, getch, putch, gets, puts), Introduction to library functions,	
Unit II: Basic of C Programming	**(6 Hrs.)**
Basic building blocks of C: Character set, variables, identifiers & keywords, Data types, Operators: arithmetic, logical and relational operators, , bitwise operators, precedence of operators, Expressions, sizeof() operator, constants, typedef statement, writing straight line programs. Decision control statements: if, if - else and nested if-else statements, else-if ladder statement, switch-case control statement.	
Unit III: Loop Structures:	**(5 Hrs.)**
While, do while and for loops, break and continue statement, "goto" statement, real life programming examples based on these loop structures, real life programming examples.	
Unit IV: Modular Programming:	**(6 Hrs.)**
Concept of functions, user defined functions, function prototypes, formal parameters, actual parameters, return types, call by value , call by reference, C programs using functions, Recursive functions, comparing recursion against iteration, C programs using recursive functions, real life programming examples	
Unit V: Arrays:	**(6 Hrs.)**
One dimensional array, array manipulation, insertion, deletion of an element, searching techniques- Linear and binary search, sorting technique – Bubble sort. Two-dimensional arrays: matrix representation, programs for basic matrix operations such as addition, multiplication and transpose, Array as function arguments. real life programming examples	
Unit VI: String, Structure and Union:	**(4 Hrs.)**
Strings: string representation and string handling functions, Introduction to pointer, structure and union. real life programming examples	
Total Lecture	30 Hours

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2	Mastering C, K.R.Venugopal & S.R. Prasad, TMH, 2007.
3	Programming in ANSI C, E. Balaguruswamy, Mc Graw Hill Education

Reference Books	
1	Problem Solving And Program Design In C, Jeri. R. Hanly, Elliot B. Koffman, Pearson Education.
2	Programming with C, Byron Gottfried, Schaum;s Outline Series
3	How to solve it by computers, R. G. Dromey, Prentice Hall India

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1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/106104128
2	https://nptel.ac.in/courses/106104128
3	https://www.youtube.com/watch?v=rQoqCP7LX60&list=PLxgZQoSe9cg1drBnejUaDD9GEJBGQ5hMt

List of Practical

SN	Unit	Name Of The Practical	Remark	CO'S Mapped	PO'S Mapped
1(A)		Introduction to Linux Operating system & it's different commands.	**Manual**	**CO 1**	**PO1**
1(B)		Introduction to Vi editor, Compilation and Execution of a program in Linux.	**Manual**	**CO 1**	**PO1**
2	**II**	Practical based on Arithmetic and Conditional operators.	**Operators**	**CO 1**	**PO1**
3	**II**	Practical based on Conditional and Unconditional Statements.	**Conditional Statements**	**CO 1**	**PO1**
4	**III**	Practical based on Entry Controlled Looping Statements.	**For / While Loop**	**CO 2**	**PO 1, PO 2**
5	**III**	Practical based on Exit Controlled Looping Statement	**Do while Loop**	**CO 2**	**PO 1, PO 2**
6	**IV**	Practical based on Functions and Recursion.	**Functions / Recursion**	**CO 3**	**PO2, PO3**
7	**V**	Practical based on 1-D Array.	**1D Array**	**CO 3**	**PO2, PO3**
8	**V**	Practical based on 2-D Array.	**2D Array**	**CO 3**	**PO2, PO3**
9	**VI**	Practical based on Strings.	**Strings & Pointers**	**CO 3**	**PO2, PO3**
10	**VI**	Practical based on Structures.	**Structures**	**CO 4**	**PO1, PO2, PO3**

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(Department of Mathematics & Humanities)

SoE No. 23FY-101

B.Tech First Year

II SEMESTER

23GE1218 : Functional English

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Understand the concept of FE (Functional English) and its application in various real-life scenarios. 2. Develop basic interactive communication skills, including greetings, asking for information, stating opinions, and providing feedback. 3. Acquire knowledge of social networking, texting, instant messaging, blogs, and discussion boards, along with the ethical considerations associated with online communication. 4. Successfully complete quizzes and assignments assessing knowledge in the covered topics of FE, social media, tenses, and effective communication.

Unit:1	Introduction to Functional English	6 Hours
What is FE? And Areas of application. Basic Interactive sentences - Greetings & Replies, Asking for information, Telling people what you do, Asking somebody's opinion, Giving your opinion, Saying someone is correct, Saying that someone is wrong, Apologizing, Praising someone's work, Saying goodbye. Introduction & Basics of Common Expressions – Offer, Request, Gratitude, Apology. Modal Verbs - Words used often: Can- could, Will – would, Shall – should, Ought to-Must, May-might. Practice exercises, Practice Conversations, Script Activity		
Unit:2	**Internet & Social Media Communication**	**6 Hours**
Introduction & Basics to Social Networking, Texting & Instant messaging, Blogs & Discussion Board- discussion with examples, Ethics of social media & communication Topic: Introduction to Creative Ads Why Ads, What's in it for me? Characteristics of ads. Assignment Quiz on the above Topics, Exercises for Evaluation		
Unit:3	**TENSES**	**6 Hours**
Introduction & Basics, Simple Tense (Past, Present, Future), Continuous Tense (Past, Present, Future) – discussion with examples. Introduction & Basics, Perfect Tense (Past, Present, Future), Perfect Continuous Tense (Past, Present, Future) – discussion with examples Introduction to Movie Magic, Learn English with films, Film Vocabulary, Describing a film, Types of Films Assessment – Letter and Email Writing, Tenses – Quiz		
Unit:4	**Written Communication**	**5 Hours**
Introduction & Basics of Writing, five methods of communication, Mind your grammar, Commonly confusing words Letters – Format, Parts of a business letter, When does communication fail?, Things to remember, Positive language not negative language, Active voice not passive voice Effective emailing -How to make an effective e-mail, Few common e-mail habits that cause problems, Parts of an e-mail, Some other important aspects.		

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Assignment Presentation on Mad Ads, Quiz on Tenses and social media-Internet Communication
Topic: Activity Extempore

EVALUATION			**1 Hour**
WRITTEN TEST	**TA=60**	**ESE=40**	**TOTAL=100**
Total Lecture Hours			**24 Hours**

Reference Books	
1	How to win friends & influence people – Dale Carnegie
2.	Functional English for Communication - Ujjwala Kakarla
3	Functional English for Technical Students – Dr Prathibha Mahato & Dr Dora Thompson

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(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2023

3rd Semester

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

Nagar Yuwak Shikshan Sanstha's

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(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mechanical Engineering)

B. Tech. in Mechnical Engineering

SoE No.
23 ME-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
THIRD SEMESTER															
1	3	HSSM-1	GE	23GE1301	Fundamentals of Management & Economics	T	2	0	0	2	2	30	20	50	3
2	3	VEC-II	ME	23ME1301	Computer Aided Design	T	2	0	0	2	2	30	20	50	3
3	3	CEP	ME	23ME1302	**Community Engagement Project**	P	0	0	2	4	2		60	40	
4	3	PC	ME	23ME1303	Manufacturing Processes	T	3	0	0	3	3	30	20	50	3
5	3	PC	ME	23ME1304	**LAB:** Manufacturing Processes	P	0	0	2	2	1		60	40	
6	3	PC	ME	23ME1305	Mechanics of Materials	T	3	1	0	4	4	30	20	50	3
7	3	PC	ME	23ME1306	**LAB:-** Mechanics of Materials	P	0	0	2	2	1		60	40	
8	3	PC	ME	23ME1307	Kinematics of Machineries	T	3	0	0	3	3	30	20	50	3
9	3	OE - I	OE		**Open Elective -I**	T	2	0	0	2	2	30	20	50	3
10	3	MDM - I	ME		**MD Minor Course-I**	T	2	0	0	2	2	30	20	50	3
						TOTAL	**17**	**1**	**6**	**26**	**22**				
List of Mandatory Learning Course (MLC)															
1	3	HS	T&P	MLC2123	**YCAP3 :** YCCE Communication Aptitude Preparation	**A**	3	0	0	3	**0**				

Open Elective - I

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	3	OE1	GE	23OE1301	OE-I : Combinatorics
2	3	OE1	GE	23OE1302	OE-I : Fuzzy Set Theory, Arithmetic And Logic
3	3	OE1	GE	23OE1303	OE-I : Green Chemistry & Sustainability
4	3	OE1	GE	23OE1304	OE-I : Hydrogen Fuel
5	3	OE1	GE	23OE1305	OE-I : Electronic Materials And Applications
6	3	OE1	GE	23OE1306	OE-I : Laser Technology And Applications
7	3	OE1	MGT	23OE1307	OE-I : Finance And Cost Management
8	3	OE1	MGT	23OE1308	OE-I : Operation Research Techniques
9	3	OE1	MGT	23OE1309	OE-I : Project Evaluation & Management
10	3	OE1	MGT	23OE1310	OE-I : Total Quality Management
11	3	OE1	MGT	23OE1311	OE-I : Value Engineering
12	3	OE1	MGT	23OE1312	OE-I : Maintenance Management
13	3	OE1	MGT	23OE1313	OE-I : Industrial Safety
14	3	OE1	MGT	23OE1314	OE-I : Industry 4.0
15	3	OE1	MGT	23OE1315	OE-I : Operation Management
16	3	OE1	MGT	23OE1316	OE-I : Material Management
17	3	OE1	MGT	23OE1317	OE-I : Hospitality Management
18	3	OE1	MGT	23OE1318	OE-I : Human Resource Management & Organizational Behaviour
19	3	OE1	MGT	23OE1319	OE-I : Agri-Business Management
20	3	OE1	MGT	23OE1320	OE-I : Rural Marketing
21	3	OE1	MGT	23OE1321	OE-I : Marketing Management
22	3	OE1	MGT	23OE1322	OE-I : Health Care Management
23	3	OE1	MGT	23OE1323	OE-I : Designated approved online NPTEL/KKSU Course
24	3	OE1	MGT	23OE1324	OE-I : Indian Archeology
25	3	OE1	MGT	23OE1325	OE-I : Social & Positive Psychology
26	3	OE1	MGT	23OE1326	OE-I : Seismology & Earthquake

		July, 2023	**1.00**	**Applicable for AY 2023-24 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

III SEMESTER
23GE1301: Fundamentals of Management & Economics

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Develop the Managerial Perspective and perform the various functions of management for optimum utilization of Engineering Resources
2. Identify and Analyze the role of Financial Accountancy and Marketing Management in the Organization
3. Develop perspective about economy based on logical reasoning and estimate the economic outcomes.
4. Interprets comparative advantage of resources.

Unit I:	**7 Hrs.**
Principles of Management: Evolution of Management Thought: Scientific and Administrative Theory of Management, Definition and Concept of Management, Functions of Management: Planning, Organizing, Directing, Staffing and Controlling, Motivational Theories, Concept of Leadership.	
Unit II:	**8 Hrs.**
Marketing and Financial Management: Marketing and Financial Management –Marketing Theories and Concept-Marketing Mix, Market Segmentation, Targeting and Positioning and Functions Financial Management and Accountancy- Accountancy Rules and Capital, Preparation of Books of Account- Journal posting of Transaction into ledger and preparation of trial Balance, Introduction of Trading Account, Profit and loss account and balance sheet.	
Unit III:	**7 Hrs.**
Introduction to Microeconomics: Nature and Scope of Microeconomics, Demand Analysis: Meaning and determinants of demand, law of demand, Elasticity of Demand - types and degrees, Utility analysis, Law of diminishing marginal utility, supply- law of supply, Law of Variable proportions and Return to Scale, Classification of market structure.	
Unit IV:	**8 Hrs.**
Introduction to Macroeconomics: Nature and Scope of Macroeconomics, Concept of GDP, GNP, NDP, NNP, Measurement of GDP; Economic Growth and development, Money – definition, types and function of money, Inflation – meaning, types, causes and measure to control, concept of deflation, functions of central and commercial bank , Sources of public revenue - direct and indirect taxes.	
	Total Lecture **30 Hours**

Textbooks:	
1	Principle of Management, 9th edition , Harold Koontz Ramchandra, Tata McGrow hills
2	Marketing Management: Planning, Implementation and Control, 3rd Edition, Ramaswamy V.S. and Namakumari S, Macmillian
3	Fundamentals of Accounting Gupta R.L. & Radhaswamy ;
4	Modern Economics, 13th Edition, H. L. Ahuja, S. Chand Publisher, 2009
5	Modern Economic Theory, 3rd edition, K. K. Devett, S. Chand Publisher,2007
6	Principle of Economics, 7th edition, Mankiw N. Gregory, Thomson, 2013

Reference Books:	
1	Foundations of Financial Markets and Institutions, 3rd Edition, Fabozzi, Pretice Hall
2	Fundamentals of Financial Instruments , 2nd Edition, Parameshwaran, Wiley India
3	Marketing Management , 3rd Edition , RajanSaxena, Tata McGraw Hill
4	Advance Economic Theory, 17th Edition, H. L. Ahuja, S. Chand Publisher, 2009
5	International Trade, 12th edition, M. L. Zingan, Vindra Publication, 2007
6	Macro Economics, 11th edition, M. L. Zingan, Vindra Publication, 2007
7	Monitory Economics:,1st Edition, M. L. Sheth, Himayalaya Publisher, 1995

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042

MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc22_mg104/preview
2	https://archive.nptel.ac.in/courses/110/101/110101131/
3	https://onlinecourses.nptel.ac.in/noc23_mg122/preview
4	https://onlinecourses.nptel.ac.in/noc21_hs52/preview
5	https://onlinecourses.nptel.ac.in/noc22_hs67/preview

III SEMESTER
23ME1301 : Computer Aided Design

Course Outcomes :
Upon successful completion of the course, the students will be able to;
1. Describe the fundamental concepts of CAD tools. 2. Apply the basic concepts of 2D and 3D transformation for solving engineering problems. 3. Analyze the importance of computer graphics for plotting curves. 4. Evaluate the use of different data exchange formats as per the applications.

Unit I:	**6 Hrs.**
CAD Tools: Definition of CAD Tools, Introduction to use of computer in Product Life Cycle, Software for mechanical engineering CAD/CAM/CAE	
Unit II:	**7Hrs.**
Two dimensional geometric and co-ordinate transformations like scaling, translation, rotation reflection, shear. Concept of homogeneous representation and concatenated transformations, Inverse transformations.	
Unit III:	**7Hrs.**
Three dimensional geometric and co-ordinate transformations, Orthographic and Perspective projection, Types of mathematical representation of curves, wire frame models, wire frame entities.	
Unit IV:	**8 Hrs.**
Geometric modeling techniques, Wireframe modeling, Surface Modeling and Solid Modeling, B-Rep, CSG and Hybrid modellers Evaluation of data-exchange formats, IGES data representations and structure, STEP architecture and applications	
Total Lecture	**28 Hours**

Textbooks:	
1.	CAD/CAM, theory & practice: Ibrahim Zeid
2.	Procedural elements for computer graphics: D Rogers
3.	Computer Graphics: D Hearn &M.P.Baker

Reference Books:	
1.	Computer Graphics: S Harrington.
2.	Mikell. P. Groover "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India, 2008.
3.	Radhakrishnan P, Subramanyan S. and Raju V., "CAD/CAM/CIM", 2nd Edition, New Age International (P) Ltd, New Delhi,2000
MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/112103019/
2.	https://nptel.ac.in/syllabus/112106075/

III SEMESTER
23ME1302 : LAB - Industrial Case Study

III SEMESTER
23ME1303 : Manufacturing Processes

Course Outcomes :
Upon successful completion of the course the students will be able to 1. The student will be able to illustrate the moulding process and compare various casting processes. 2. The student will be able to analyse various Forming processes and become familiar with the working of dies. 3. The student will be able to evaluate different welding processes. 4. The student will be able to describe unconventional machining processes.

Unit I:	**7 Hrs.**
Casting Process: Introduction, Pattern making: Types, materials used, Pattern making allowances, color codes. Core making: - Types, core material & its properties. Molding: Types of sand molds, molding sand composition, molding sand properties, molding machines. Gating design – Elements of gating systems, pouring time, riser design (Analytical treatment). Real time estimation of pouring time for casting.	
Unit II:	**7 Hrs.**
Foundry mechanism: Special casting processes such as investment Casting, Centrifugal Casting, Shell Molding, CO Molding, Slush Casting, Die Casting, Cleaning, inspection &casting defects. Identification of various defects and possible causes with remedies through the fish bone diagram.	
Unit III:	**7 Hrs.**
Forming Processes: Mechanics of forming processes (including analytical treatment), Determination of forging forces, equipment (Hammer/Press) capacity required. Rolling, Forging, Extrusion & Wire Drawing. Melting furnaces – Types, Electric furnace, Induction furnace, Cupola-construction & operation.Prerequisite for commencing furnace operation for Cupola.	
Unit IV:	**8 Hrs.**
Sheet Metal Working: Sheet Metal Working, Terminology, Types of Operation, Classification of Dies. Intro to Design Parameters and Types of Presses. Optimum utilization of metal strip in SMW	
Unit V:	**8 Hrs.**
Joining processes: Introduction to Welding, Soldering, Brazing Processes. Types of Welding, Arc Welding & Gas Welding Processes, Defects & Inspection of Welding Joints, Electrodes, Weldability of Metals, Welding equipments of Fixtures. Advance Welding Methods: Introduction to TIG, MIG, spot welding, Welding Design (Analytical Treatment)- Heat Input , Heat Flow , Cooling Rate Calculations . Identification of various defects & possible causes with remedies through fish bone dig.	
Unit VI:	**8 Hrs.**

Jigs & fixture: Introduction, locating & clamping - principle of location, principle of pin location, locating devices, radial or angular location, V - location, bush location. Drilling Jigs: - Types of drilling jigs - Template jig, plate type jig, open type jig, swinging leaf jig, Box type jig, channel type jig . Jig feet. Milling Fixtures: - Essential features of a milling fixtures, milling machine vice, Indexing jig & fixtures, Automatic clamping Devices		
	Total Lecture	**45 Hours**

Textbooks:	
1.	P.n.Rao, Manufacturing TechnologyForming & Welding)), ed 2009, Tata Mc. Grew Hill Education Pvt. Ltd., New Delhi, 2009.
2.	Ghosh and Malik ,Manufacturing Science,East West Second edition,2010.
3.	Hajra Choudhary, Workshop Technology (Volume-I), The McGraw-Hill Companies2nd ED-2010

Reference Books:	
1.	S Kalpakjian &Schmid ,Manufacturing Engineering & Technology, Pearson education Canada. 2 ed 2010
2.	W Chapman, Workshop Technology: Vol. I –III, St. Martin's Press, 5 ed 2019.
3.	M Begman,ManufacturingProcesses, Ballinger Pub. Co

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/SUPPORTED%20FILE/SUPPORTED%20file/SERIES20WISE%20BOOKS/MECHANICAL%20ENGINEERING

MOOCs Links and additional reading, learning, video material	
1.	https://archive.nptel.ac.in/courses/112/107/112107083/
2.	https://www.youtube.com/watch?v=Xf08dgnlwXg
3.	https://nptel.ac.in/courses/112107089

III SEMESTER
23ME1304 : Lab Manufacturing processes

Course Outcomes
Upon successful completion of the course the students will be able to 1. The student will be able to illustrate the molding process and compare various casting processes. 2. The student will be able to Analyze various Forming processes and become familiar with the working of dies. 3. The student will be able to evaluate different welding processes. 4. The student will be able to Describe unconventional machining processes

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Preamble about Foundry practices used in industries.
2	Study of various moulding processes along with preparation of moulding sand.
3	Preparation of wooden pattern in pattern making shop along with study of different types of wooden pattern.
4	To determine grain fineness number of given moulding sand.
5	Demonstration of mould making along with study of foundry tools.
6	Preparation of mould cavity along-with steps involved in mould making.
7	Study of various types of melting furnaces and cupola in detail.
8	Preparation of job on punching press and design of blanking and piercing die.
9	Performance on various welding machines such as MIG, TIG along-with study of different welding processes.
10	Preparation of casting job along-with study of different casting processes.
11	Report/Case Study of foundry visit.
12	A Visit: A visit to a foundry shop for more understanding of the casting practices

III SEMESTER
23ME1305 : Mechanics of Materials

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Apply the basic concepts of stress, strain and their variations under different types of loading to calculate Stresses. 2. Construct bending moment, shear force diagram for statically determinate beams and determine stress distribution. 3. Compute slope and deflection in statically determinate beam and calculate strain energy under varying load conditions. 4. Evaluate the torsional shear stress in shaft and examine the buckling failure in columns

Unit I:	**8 Hrs.**
Concept of simple stresses and strains : Introduction, Stress, strain, types of stresses, stress - strain diagram for brittle & ductile material, elastic limit, Hooks law, modulus of elasticity, modulus of rigidity, factor of safety, analysis of tapered rod, analysis of composite section, thermal stress and strain, thermal stresses with heat flow in cylinders and plates. Longitudinal strain & stress, lateral stresses and strains, Poisson's ratio, volumetric stresses and strain with uni-axial, bi-axial & tri-axial loading, bulk modulus, relation between Young's modulus and modulus of rigidity, Poisson's ratio and bulk modulus. Contemporary issues	
Unit II:	**7 Hrs.**
Shear force and bending moments in Beam: Types of beam (cantilever beam, simply supported beam, overhung beam etc.), Types of loads (Concentrated and UDL), shear force and bending moment diagrams for different types of beams subjected to different types of loads, sign conventions for bending moment and shear force, shear force and bending moment diagrams for beams subjected to couple, Relation between load, shear force and bending moment. Contemporary issues	
Unit III:	**8 Hrs.**
Stresses in beams: Pure bending, theory of simple bending with assumptions & expressions for bending stress, derivation of bending equation, bending stresses in symmetrical sections, section modulus for various shapes of beam sections.**Shear stresses in beams**: - Concept, derivation of shear stress distribution formula, shear stress distribution diagram for common symmetrical sections, maximum and average shear stress Contemporary issues.	
Unit IV:	**7Hrs.**
Deflection of beams: Derivation of differential equation of elastic curve, Deflection & slope of cantilever, simply supported, overhung beams subjected to concentrated loads, UDL, Relation between slope, deflection & radius curvature McCauley's method, area moment method to determine deflection of beam.**Strain energy and impact**: Concept of strain energy, derivation and use of expressions for	

deformation of axially loaded members under gradual sudden and impact loads. Strain energy stored in bending & torsion. Castingliano's theorem. Contemporary issues	
Unit V:	**8 Hrs.**
Torsion of circular shafts, Column & Struts: Derivation of torsion equation. Torsional shear stress induced in the shaft, when it is subjected to torque. Torque transmitted by solid & hollow circular shaft. Derivation of maximum, minimum principal stresses and maximum shear stress induced in shaft when it is subjected to bending moment, torque & axial load.	
Unit VI:	**7 Hrs.**
Combined Stresses: Definition of principal planes & principal stresses, analytical method of determining stresses on oblique section when member is subjected to direct stresses in one plane in mutually perpendicular two planes, when member is subjected to shear stress and direct stresses in two mutually perpendicular planes, Mohr's circle for representation of stresses. Derivation of maximum and minimum principal stresses & maximum shear stresses when the member is subjected to different types of stresses simultaneously (i.e. combined stress) Contemporary issues	
Total Lecture	**45 Hours**

Textbooks:	
1.	Strength of Materials, Ramamrutham S., 16th Edition (2010) , Dhanpat Rai Publishing
2.	Strength of Materials Beer and Johnston 4th Edition (2009) McGraw-Hill
3.	Popov E. P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 2007.

Reference Books:	
1.	Strength of Materials Timoshenko and Young Seventh Edition1984 , CSB Publisher
2.	Applied Strength of Materials, Sixth Edition SI Units Version, Robert L. Mott, Joseph A. Untener, CRC Press, 2017
3.	Subramanian R., "Strength of materials", 2nd Edition (2010) Oxford University Press, New Delhi,
4.	Shames I.H. "Introduction to Solid Mechanics", PHI Publication, 3rd Edition, 2002
5.	William A.Nash, "Theory and Problems of Strength of materials, Schaum's Outline series", Tata McGraw-Hill, New Delhi, 2007.

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1	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/78.%20Engineering-Mechanics-Statics-and-Dinamics-E-W-Nelson-C-L-Best-W-G-McLean-1st-Ed-1997-Schaum-Outline-McGraw-Hill%20(1).pdf
2	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/79.%20Engineering%20Mechanics.%20Statics-%20MERIAM%20%20AND%20KRAIGE.pdf
	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/81.%20Engineering%20Mechanics%201.pdf

MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/112107146
2.	https://nptel.ac.in/courses/112106141
3.	https://archive.nptel.ac.in/courses/105/105/105105108/

III SEMESTER
23ME1306 : Lab Mechanics of Materials

Course Outcomes

Upon successful completion of the course the students will be able to

1. Apply the basic concepts of stress, strain and their variations under different types of loading to calculate Stresses.
2. Construct bending moment, shear force diagram for statically determinate beams and determine stress distribution.
3. Compute slope and deflection in statically determinate beam and calculate strain energy under varying load conditions.
4. Evaluate the torsional shear stress in shaft and examine the buckling failure in columns

Minimum Eight Practical's to be performed from the list as below

SN	**Experiments based on**
1	Demonstration of UTM
2	Tension test on a mild steel rod
3	Compression test on Aluminium specimen
4	Hardness test on metals with Rockwell Hardness tester
5	Flexure test on Wooden beam
6	Spring stiffness test
7	Torsion test on mild steel rod
8	Impact Test
9	Demonstration of Fatigue Test

III SEMESTER
23ME1307 : Kinematics of Machineries

Course Outcomes :

Upon successful completion of the course the students will be able to

1. Apply the basic concepts of stress, strain and their variations under different types of loading to calculate Stresses.
2. Construct bending moment, shear force diagram for statically determinate beams and determine stress distribution.
3. Compute slope and deflection in statically determinate beam and calculate strain energy under varying load conditions.
4. Evaluate the torsional shear stress in shaft and examine the buckling failure in columns

Unit I:	**8 Hrs.**
Simple mechanisms: Lower and higher pairs, degrees of freedom, various types of mechanisms, their inversions and applications, universal joints, introduction to spatial linkages	
Unit II:	**7 Hrs.**
Quantitative kinematics analysis of mechanism: Quantitative kinematics analysis of mechanism: - Displacement, Velocity and Acceleration analysis of planer mechanism by graphical method as well as analytical method [complex number method/matrix method], Instantaneous center method, Kennedy's theorem	
Unit III:	**8 Hrs.**
Cam and follower : Concepts of cam mechanism, comparison of cam mechanism with linkages. Types of cams and followers and applications. Synthesis of cam for different types of follower motion like constant velocity, parabolic, SHM, cycloid etc. Analysis of follower motion for cams with specified contours like eccentric cam, tangent cam and circular arc cam with concave and convex curvature. Pressure angle in cam, parameters affecting cam performance	
Unit IV:	**7 Hrs.**
Gears : Concept of motion transmission by toothed wheels, comparison with cams and linkages, various tooth profiles, their advantages and limitations, gear tooth terminologies, concept of conjugate action, law of conjugate action, kinematics of in volute gear tooth pairs during the contact duration, highlighting locus of the point of contact, arc of contact, numbers of pairs of teeth in contact, path of approach and path of recess, interference, undercutting for in volute profile teeth	
Unit V:	**8 Hrs.**
Gear Trains : Kinematics of helical, bevel, spiral, worm gears, rack and pinion gears, kinematics analysis, and torque analysis of simple epicyclical and double epicyclical gear trains	
Unit VI:	**7 Hrs.**
Static force analysis: Static force analysis: Free body diagram, condition of equilibrium. Analysis of all links of given linkage, cam, gear mechanism and their combinations without friction	
	Total Lecture **45 Hours**

Textbooks:	
1.	Theory of mechanism and machines Tata Mc. Graw Hill Education Pvt. Ltd., New Delhi, 2014
2.	Theory of mechanism and machines Khurmi and Gupta,S chand publication
3.	Mechanisms and machines J.S.Rao ,R.V.Dukkupati new age international limited.
4.	Theory of machines V.P.Singh, Dhanpat Rai & Co.

Reference Books:	
1.	Theory of machines Thomas beven, Pearson Education.
2.	Theory of machines Sandor & Erdman, Tata Mc. Graw Hill Education Pvt. Ltd

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2	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/79.%20Engineering%20Mechanics.%20Statics-%20MERIAM%20%20AND%20KRAIGE.pdf
3.	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/81.%20Engineering%20Mechanics%201.pdf

MOOCs Links and additional reading, learning, video material	
1.	https://www.youtube.com/watch?v=EVqBzOGQlkI
2.	https://onlinecourses.nptel.ac.in/noc24_me44/preview
3.	https://www.youtube.com/watch?v=kXXfz6acsyU

III SEMESTER

Multidisciplinary Minor Courses

Track 1

Courses	Sem	MDMT1ME101 : Computer-Aided Design
MDM-I	3	(MDM1ME101) Engineering Materials
MDM-II	4	(MDM2ME102) Basics of Mechanism
MDM-III	5	(MDM3ME103) Basics of Machine Design
MDM-IV	6	(MDM4ME104) Computer Aided Design
MDM-V	7	(MDM5ME105) Product Design and Development
MDM-VI	8	(MDM6ME106) INDUSTRY 5.0

Track 2

Courses	Sem	MDMT2ME201 : Robotics and Computer Integrated Manufacturing
MDM-I	3	(MDM1ME201) Introduction to Robotics
MDM-II	4	(MDM2ME202) Industrial Robotics
MDM-III	5	(MDM3ME203) Computer Integrated Manufacturing
MDM-IV	6	(MDM4ME204) Subtractive Manufacturing
MDM-V	7	(MDM5ME205) Additive Manufacturing
MDM-VI	8	(MDM6ME206) Supply Chain Management

III SEMESTER
Track 1 - Computer Aided Design
MDM1ME101 : Engineering Materials

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Distinguish between ferrous and Non-ferrous materials. Illustrate crystal structures for various materials and Differentiate or Distinguish between ferrous and Non-ferrous materials. 2. Discuss the various applications of steel and cast iron. 3. Discuss the various super alloys. 4. Demonstrate the basics of powder Metallurgy for powder metallurgical components.

Unit I:	**8 Hrs.**
Introduction to Materials: Introduction to materials, classification of materials. Properties and applications of materials. Crystalline nature of metals, specially microscopic and macroscopic examinations of metals. Alloys and solid solutions, types and their formations. **Contemporary Issues related to Topic**	
Unit II:	**8 Hrs.**
Steel and Cast Iron: Classification and application of plain carbon steels. Composition and application of Tool Steels & Stainless Steels. Cast Iron – Classification, White cast Iron, Gray Cast Iron, Nodular Cast Iron, Malleable Cast Iron. **Contemporary Issues related to Topic**	
Unit III:	**7 Hrs.**
Super alloys: Introduction, Classification, Applications and properties of Ni, Fe, Co based super alloys and their thermo-mechanicaltreatments. **Contemporary Issues related to Topic**	
Unit IV:	**7 Hrs.**
Powder Metallurgy: Powder manufacture and Conditioning, Production of Sintered Structural Components **Contemporary Issues related to Topic**	
Total Lecture	**30 Hours**

Textbooks:	
1.	Dr. V.D. Kodgire, Material Science and Metallurgy, Edition, 1st Jan 2011, Everest Publication House
2.	Dr. B K Agrawal, Introduction to Engineering Metallurgy, 21st revised edition, 2007, Tata Mc. Graw Hill EducationPvt. Ltd., New Delhi.

Reference Books:	
1.	Sidney H. Avner, Introduction to Physical Metallurgy, 29st revised edition, 2009, Mc. Graw Hill Publication, NewDelhi, 1964
2.	Yu Lakhtin, Engineering Physical Metallurgy and Heat Treatment, 21st revised edition, 1988, Mir publishers,Moscow, Russia
3.	E C Rollason, Metallurgy for Engineers, 4 th Revised edition 1987, E. Arnold

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1	
2	

MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/112101098
2.	https://nptel.ac.in/courses/112101099

III SEMESTER
Track 2- Robotics and Computer Integrated Manufacturing
MDM1ME201 : Introduction to Robotics

Course Outcomes :
Upon successful completion of the course the students will be able to: 1. Describe the components and working principles of robots. 2. Program robots using different programming languages. 3. Demonstrate proficiency in using computer vision techniques for robot applications. 4. Identify and analyze real-world applications of robotics with ethical and societal implications.

Unit I:	**8 Hrs.**
Fundamentals of Robotics: Introduction to Robotics: Definition, history, and applications, Components of a Robot: Sensors, actuators, controllers, and effectors, Basics of Robot Kinematics, Basics of Robot Dynamics. **Contemporary Issues related to Topic**	
Unit II:	**8 Hrs.**
Robot Programming: Introduction to Robot Programming: Programming languages used in robotics, Robot Operating System (ROS): Basics of ROS, nodes, topics, messages, Motion Planning: Path planning algorithms, obstacle avoidance, Robot Simulation: Introduction to simulation environments like Gazebo/MATLAB Robotics Toolbox/Robot Analyzer. **Contemporary Issues related to Topic**	
Unit III:	**7 Hrs.**
Robot Perception: Introduction to Robot Perception: Sensors used in robotics - vision, proximity, touch, etc., Computer Vision: Image processing techniques, object detection, and recognition, Sensor Fusion: Integration of data from multiple sensors for better perception, Localization and Mapping: SLAM (Simultaneous Localization and Mapping) algorithms. **Contemporary Issues related to Topic**	
Unit IV:	**7 Hrs.**
Applications and Future Trends: Industrial Robotics: Applications in manufacturing, assembly, and automation, Service Robotics: Applications in healthcare, agriculture, and domestic tasks, Research Trends in Robotics: Emerging technologies like soft robotics, swarm robotics, and bio-inspired robotics, Ethical and Societal Implications of Robotics: Discussions on job displacement, privacy concerns, and ethical considerations. **Contemporary Issues related to Topic**	
Total Lecture	**30 Hours**

Textbooks:	
1.	Robot Engineering An Intergrated approach 2004 Klafter R.D., Chmielewski T.A. and Negin M Springer
2.	Industrial Robotics: Technology, Programming and Applications, 2012 Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and Ashish Dutta 2nd Edition, Tata McGraw Hill, 2012.
	Automation in Production system 2002 Mikell P. Groover Prentice-Hall of India Pvt. Ltd., New Delhi, 2002
3.	Bruno S and Sciavicco L, Robotics: Modelling, Planning and Control, Springer (2009)
4.	Robot Engineering An Intergrated approach 2004 Klafter R.D., Chmielewski T.A. and Negin M Springer

Reference Books:	
1.	Robotics control, sensing, vision, and intelligence
2.	Robotics Technology and Flexible Automation
3.	Introduction to Robotics Mechanics and Control
4.	Industrial Robotics, By Ganesh S. Hegde • 2006, Laxmi Publications, June 2006

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	
2	

MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/112101098
2.	https://nptel.ac.in/courses/112101099

III SEMESTER

Open Elective -I : Basket

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	3	OE1	GE	23OE1301	OE-I : Combinatorics
2	3	OE1	GE	23OE1302	OE-I : Fuzzy Set Theory, Arithmetic And Logic
3	3	OE1	GE	23OE1303	OE-I : Green Chem. & Sustainability
4	3	OE1	GE	23OE1304	OE-I : Hydrogen Fuel
5	3	OE1	GE	23OE1305	OE-I : Electronic Materials And Applications
6	3	OE1	GE	23OE1306	OE-I : Laser Technology And Applications
7	3	OE1	MGT	23OE1307	OE-I : Finance And Cost Management
8	3	OE1	MGT	23OE1308	OE-I : Operation Research Techniques
9	3	OE1	MGT	23OE1309	OE-I : Project Evaluation & Management
10	3	OE1	MGT	23OE1310	OE-I : Total Quality Management
11	3	OE1	MGT	23OE1311	OE-I : Value Engineering
12	3	OE1	MGT	23OE1312	OE-I : Maintenance Management
13	3	OE1	MGT	23OE1313	OE-I : Industrial Safety
14	3	OE1	MGT	23OE1314	OE-I : Industry 4.0
15	3	OE1	MGT	23OE1315	OE-I : Operation Management
16	3	OE1	MGT	23OE1316	OE-I : Material Management
17	3	OE1	MGT	23OE1317	OE-I : Hospitality Management
18	3	OE1	MGT	23OE1318	OE-I : Human Resource Management & Organizational Behaviour
19	3	OE1	MGT	23OE1319	OE-I : Agri-Business Management
20	3	OE1	MGT	23OE1320	OE-I : Rural Marketing
21	3	OE1	MGT	23OE1321	OE-I : Marketing Management
22	3	OE1	MGT	23OE1322	OE-I : Health Care Management

Link for Open Electives syllabus: https://ycce.edu/syllabus/

III SEMESTER
Mandatory Learning Course (Audit Course)
MLC2123 : YCAP3

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2023

4th Semester

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mechanical Engineering)

B. Tech. in Mechnical Engineering

SoE No.
23 ME-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
FOURTH SEMESTER															
1	4	BS	GE	23GE1402	Integral Transform	T	3	0	0	3	3	30	20	50	3
2	4	HSSM-2	GE	23GE1401	Entrepreneurship Development	T	2	0	0	2	2	30	20	50	3
3	4	**AEC-2**	GE	23GE1405 23GE1406	Marathi Language / Hindi Language	T	2	0	0	2	2	30	20	50	3
4	4	VEC - I	CV	23CV1411	Environmental Sustainability, Pollution and Management	T	2	0	0	2	2	30	20	50	3
5	4	PC	ME	23ME1401	Machining Processes	T	3	0	0	3	3	30	20	50	3
6	4	PC	ME	23ME1402	**Lab -** Machining Processes	P	0	0	2	2	1		60	40	
7	4	PC	ME	23ME1403	**Lab -** Computer Aided Design	P	0	0	2	2	1		60	40	
8	4	VSEC - III	ME	23ME1404	**Lab -** Machine Drawing	P	0	0	4	4	2		60	40	
9	4	OE - II	OE		**Open Elective -II**	T	2	0	0	2	2	30	20	50	3
10	4	MDM - II	ME		**MD Minor Course-II**	T	2	0	0	2	2	30	20	50	3
						TOTAL	**16**	**0**	**8**	**24**	**20**				
List of Mandatory Learning Course (MLC)															
1	4	HS	T&P	MLC2124	**YCAP4 :** YCCE Communication Aptitude Preparation	**A**	3	0	0	3	**0**				

Open Elective - II

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	4	OE2	GE	23OE2401	OE-II : Combinatorics
2	4	OE2	GE	23OE2402	OE-II : Fuzzy Set Theory, Arithmetic And Logic
3	4	OE2	GE	23OE2403	OE-II : Green Chem. & Sustainability
4	4	OE2	GE	23OE2404	OE-II : Hydrogen Fuel
5	4	OE2	GE	23OE2405	OE-II : Electronic Materials And Applications
6	4	OE2	GE	23OE2406	OE-II : Laser Technology And Applications
7	4	OE2	MGT	23OE2407	OE-II : Finance And Cost Management
8	4	OE2	MGT	23OE2408	OE-II : Operation Research Techniques
9	4	OE2	MGT	23OE2409	OE-II : Project Evaluation & Management
10	4	OE2	MGT	23OE2410	OE-II : Total Quality Management
11	4	OE2	MGT	23OE2411	OE-II : Value Engineering
12	4	OE2	MGT	23OE2412	OE-II : Maintenance Management
13	4	OE2	MGT	23OE2413	OE-II : Industrial Safety
14	4	OE2	MGT	23OE2414	OE-II : Industry 4.0
15	4	OE2	MGT	23OE2415	OE-II : Operation Management
16	4	OE2	MGT	23OE2416	OE-II : Material Management
17	4	OE2	MGT	23OE2417	OE-II : Hospitality Management
18	4	OE2	MGT	23OE2418	OE-II : Human Resource Management & Organizational Behaviour
19	4	OE2	MGT	23OE2419	OE-II : Agri-Business Management
20	4	OE2	MGT	23OE2420	OE-II : Rural Marketing
21	4	OE2	MGT	23OE2421	OE-II : Marketing Management
22	4	OE2	MGT	23OE2422	OE-II : Health Care Management
23	4	OE2	MGT	23OE2423	OE-II : Designated approved online NPTEL/KKSU Course
24	4	OE2	MGT	23OE2424	OE-II : Indian Archeology
25	4	OE2	MGT	23OE2425	OE-II : Social & Positive Psychology
26	4	OE2	MGT	23OE2426	OE-II : Seismology & Earthquake

		July, 2023	**1.00**	**Applicable for AY 2023-24 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

III /IV SEMESTER
23GE1302/23GE1402 : Integral Transforms

Course Outcomes:
Upon successful completion of the course the students will be able to 1 Apply the knowledge of Laplace and Fourier transforms to solve the continuous problems. 2. Apply the knowledge of Z transforms to solve the discrete mathematical equations. 3. Determine Fourier series expansion of periodic functions, Fourier Transform. 4. Use appropriate methods to solve partial differential equations.

Unit I:	**7 Hrs.**
Laplace Transforms : Definition and examples of Laplace transforms, properties of Laplace transforms, Examples by using properties of Laplace transforms, Unit step function, periodic function.	
Unit II:	**8 Hrs.**
Inverse of Laplace Transform: Definition and examples of Inverse Laplace transforms, Inverse Laplace transform by using properties, Partial fraction method to find Inverse Laplace transforms, convolution theorem, Applications of Laplace transform to solve ordinary differential equations.	
Unit III:	**7 Hrs.**
Z-Transform: Some elementary concepts, Definition of Z-Transform, Examples of Z-Transform, Properties (without proof), Inversion by partial fraction decomposition and residue theorem, Applications of Z-transform to solve difference equations with constant co-efficient.	
Unit IV:	**8 Hrs.**
Fourier Series: Periodic Functions, standard results, Fourier series expansion, Convergence of Fourier Series, Fourier Series for even and odd function, Change of interval, half range Fourier Series, Examples on half range sine and cosine series.	
Unit V:	**8 Hrs.**
Fourier Integral: Fourier Integral of a function formula and examples, Fourier Cosine integral, Fourier Sine integral, Complex Fourier integral, Evaluation of integration using Fourier integral.	

Unit VI:		**7 Hrs.**
Fourier Transforms: Fourier Transform, Fourier sine and cosine transformation and its examples, Properties of Fourier sine and cosine transform and its examples, Application of Fourier sine and cosine transform on Partial differential equation, Parseval's Identity.		
	Total Lecture	**45 Hours**

Textbooks:	
1	Erwin Kreyzig, Advance Engineering Mathematics, 9th Edition, John Wiley and Sons, INC.
2	Dr. B. S. Grewal, Higher Engineering Mathematics, 40th edition, Khanna Publisher.
3	H.K. Dass, Advanced Engineering Mathematics, 8th revised edition, S. Chand, Delhi.

Reference Books:	
1	Chandrika Prasad, Mathematics for Engineers, 19th Edition, John Wiley and Sons, INC.
2	L. A. Pipes and Harville, Applied Mathematics for Engineers, 3rd Edition, McGraw Hill.
3	P.N. and J. N. Wartikar, A text book of Applied MAthematics, 3rd edition, Pune Vidyarthi Griha Prakashan
4	N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, 10th edition, Laxmi Prakashan.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Applied%20Sciences%20&%20Humanities/Mathematics%20and%20Humanities/

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/111106111
2	https://onlinecourses.nptel.ac.in/noc22_ma41/preview
3	https://archive.nptel.ac.in/courses/111/101/111101153/

IV SEMESTER
23GE1401 : Entrepreneurship Development

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Appreciate role of entrepreneurs in society and develop entrepreneurial abilities by providing information about skill sets. 2. Develop an understanding of how and what form of business organization to choose for start up. 3. Stimulate to innovate, develop prototypes or ideas by applying theory into practice. 4. Identify the Support rendered by various Government Agencies.

Unit I:	**7 Hrs.**
Entrepreneur & Entrepreneurship: Meaning of Entrepreneur, Evolution of the concept – Theories and Models, Types of Entrepreneur, Stages in entrepreneurial process- Idea Generation, Screening, Selection and Managing Resources.	
Unit II:	**8 Hrs.**
Legal Compliances for Incorporating Start up: Fundamentals of choosing the Business Organization form for startup, Incorporation of Partnership, LL.P & Co – operative, Incorporation of One Person Company, Pvt. Ltd., Pub. Ltd. and not for profit company, Financing the legal Venture and Legal Compliances.	
Unit III:	**7 Hrs.**
Entrepreneurship and IP Strategy: Intellectual Property : Definition and Concept of Trade Mark, Patent, Copyright, Industrial Design, IP Strategy and Entrepreneurship.	
Unit IV:	**8 Hrs.**
Support to Entrepreneurs: Financing new ventures, Business Incubators – Government Policy for Small Scale Enterprises, Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Subcontracting.	
Total Lecture	**30 Hours**

Student activities:	
1.	Interview at least four entrepreneurs or businessman and identify Traits of successful entrepreneurs.
2.	Analyse case studies of any two successful entrepreneurs.
3.	Download product development and innovative films from internet.
4.	Identify your hobbies and interests and convert them into business idea

Textbooks	
1.	Khanka. S.S., "Entrepreneurial Development" S.Chand & Co. Ltd.,Ram Nagar, New Delhi, 2013.
2.	Donald F Kuratko, "Entrepreneurship – Theory, Process and Practice", 9th Edition, Cengage Learning 2014.
3.	Corporate Law, 33rd ed. 2016, Taxman New Delhi.
4.	Narayanan, V. K., Managing technology and innovation for competitive advantage, first edition, Pearson education, New Delhi, (2006)
5.	Idris, K. (2003), Intellectual property: a power tool for economic growth, second edition, WIPO publication no. 888, Switzerland
6.	Khanka. S.S., "Entrepreneurial Development" S.Chand & Co. Ltd.,Ram Nagar, New Delhi, 2013.
7.	Ramaiya's Guide to the Companies Act, 18th ed. 2014, Lexis Nexis New Delhi.
Reference Books	
1.	Mehta, Monica- The Entrepreneurial Instinct : How everyone has the innate ability to start a successful small business – McGraw – Hill Education, New Delhi 2012, ISBN 978-0-07-179742-9
2	Prasanna Chandra "Protect Preparation, Appraisal, Implementation" Tata McGraw Hill. New Delhi
3	S Anil Kumar "Entrepreneurship Development" New Age International Publishers
4	Nishith Dubey "Entrepreneurship Development" PHI Learning
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.swayam2.ac.in/cec23_mg24/course- entrepreneurship development
2	https://onlinecourses.nptel.ac.in/noc23_mg74/announcements?force=true-entrepreneur
3	https://onlinecourses.nptel.ac.in/noc23_mg126/announcements?force=true- Business fundamentals for entrepreneurship

IV SEMESTER
23GE1405 : Marathi Language

Course Objectives
1. मराठी भाषेच्या समृद्धीची जाणीव करून देणे. 2. विद्यार्थ्यांमध्ये भाषा कौशल्याचा विकास करणे आणि त्यातून रोजगाराच्या संधींचा शोध घेणे.

Course Outcomes
3. भाषेचा जीवन व्यवहारात योग्य पद्धतीने वापर करण्याचा प्रयत्न करणे. 4. संत साहित्याच्या शिकवणुकीमुळे मानवता आणि मानवी व्यवहाराची सांगड घालणे, नैतिक मूल्ये रुजविणे. 5. विद्यार्थ्यांना रोजगाराभिमुख बनविणे.

Unit:1	गद्य विभाग	8 Hours

१.	भारतीय लोकशाहीचे भवितव्य काय?	- डॉ. बाबासाहेब आंबेडकर
२.	काळी आई	- व्यंकटेश माडगूळकर
३.	संत तुकारामांचे अभंग	- निर्मलकुमार फडकुले
४.	माझी शाळा	- प्रकाश खरात
५.	समतेचे वारकरी संत गाडगेबाबा आणि राष्ट्रसंत तुकडोजी महाराज	- अशोक राणा
६.	लोककल्याणकारी राजा :	- शरयू तायवाडे

Unit:2	पद्य विभाग	8 Hours

१.	ज्ञानेश्वरांचे अभंग	- संत ज्ञानेश्वर
२.	वनसुधा	- वामन पंडित
३.	नवा शिपाई	- केशवसुत
४.	मेंढरं	- विठ्ठल वाघ
५.	पोरी	- अनुराधा पाटील
६.	गाव	- हेमंतकुमार कांबळे

Unit:3	व्यावहारिक मराठी	7 Hours

१. म्हणी
२. मुलाखतलेखन - डॉ. वैशाली धनविजय
३. वाक्प्रचार
४. जाहिरातलेखन - डॉ. अजय देशपांडे

Unit:4	रोजगाराभिमुख मराठी व्यावहारिक कौशल्ये	7 Hours

१. प्रत्यक्ष मुलाखत कौशल्य
२. वाचन कौशल्य - (अ) बातमी वाचन (ब) कथा वाचन
३. ऑनलाईन कौशल्य - (अ) ग्राहक सेवा केंद्राशी संवाद, (ब) ऑनलाईन अर्ज करणे

Reference Books

1. पाठ्यपुस्तक **: शब्दसाधना - भाग १**
2. रोजगाराभिमुख मराठी व्यावहारिक कौशल्ये

IV SEMESTER
23GE1406 : Hindi Language

Course Objectives

6. विद्यार्थियों में देशभक्तिपरक एवं पारिवारिक मूल्यों का विकास |
7. विद्यार्थियों पर्यावरण-संरक्षण के प्रति सजग करना |
8. एकांकी, कहानी, निबंध आदि विधाओं के मध्य का अंतर अवगत कराना |
9. हिंदी के प्रयोजनमूलक स्वरूप से परिचित कराना |
10. विद्यार्थियों को आधुनिक प्रौद्योगिकी (तकनीक) का प्रयोग करने में सक्षम बनाना |.

Course Outcomes

1. पौराणिक अथवा ऐतिहासिक घटनाओं को तार्किक आधार पर स्वीकार करेंगे | अपने परिवेश के उचित और अनुचित व्यवहारों के प्रति आकलन शक्ति बढ़ेगी |
2. एकांकी, कहानी, निबंध आदि विधाओं के मध्य का अंतर बताने में सक्षम होंगे |
3. कविता का रसास्वादन करने में समर्थ होंगे |
4. 'अनुवाद' के स्वरूप एवं प्रक्रिया से अवगत होंगे |
5. 'मार्गिक नक़्शे' का दैनिक जीवन में उपयोग करने में सक्षम होंगे |

Unit:1	गद्य विभाग	8 Hours

१. भाईसाहब (कहानी) - प्रेमचंद
२. स्मृति (निबंध) - श्रीराम शर्मा
३. गिल्लू (रेखाचित्र) - महादेवी वर्मा
४. अभाव (कहानी) - विष्णु प्रभाकर
५. महाभारत की साँझ (एकांकी) - भारतभूषण

६. उखड़े खंबे (व्यंग्य)।	- हरिशंकर परसाई

Unit:2	पद्य विभाग	8 Hours

१. कबीर के दोहे - कबीरदास
२. ले चल यहाँ भुलावा देकर - जयशंकर प्रसाद
३. स्नेह-निर्झर बह गया - हैसूर्यकांत त्रिपाठी "निराला"
४. प्रथम रश्मि - सुमित्रानंदन पंत
५. जीवन का झरना - आरसीप्रसाद सिंह
६. कविता के साथ - दामोदर खड़से

Unit:3	अन्य पाठ्य सामग्री	7 Hours

१. मुहावरे और लोकोक्तियाँ: पाठ्यपुस्तक में मुहावरे और लोकोक्तियाँ का अर्थ एवं वाक्य प्रयोग

२. विज्ञापन कला : अर्थ, परिभाषा, प्रकार, शीर्षक का महत्त्व, विज्ञापन के प्रयोजन, सत्य, लक्ष्य, विज्ञापन की भाषा, अच्छे विज्ञापन के गुण इत्यादि ।

Unit:4	कौशल्य आधारित घटक	7 Hours

१. वाचन कौशल्य (समाचार-वाचन, कहानी-वाचन)
२. सोशल मीडिया के शिष्टाचार
३. ऑनलाइन आवेदन, ग्राहक-सेवा केंद्र से संवाद

Reference Books

3. पाठ्यपुस्तक : **"पलाश"**

III/IV SEMESTER
23CV1311/23CV1411
Environmental Sustainability, Pollution and Management

Course Outcomes :
Upon successful completion of the course, the students will be able to
The student will be able to 1. Gain insights into the efforts to safeguard the Earth's environment and resources. 2. Develop a critical understanding of the contemporary environmental issues of concern 3. Have an overview of pollution, climate change and national and global efforts to address adaptation and mitigation to changing environment through environmental management. 4. Learn about the major international treaties and our country's stand on and responses to the major international agreements.

Unit:1	**Environment and Sustainable Development**	**8 Hours**
The man-environment interaction; Overview of natural resources: renewable, and non-renewable energy resources; Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs; Environmental issues: Global change, Climate Change and Mitigation.		
Unit:2	**Environmental Pollution and Health**	**7 Hours**
Understanding pollution: Production processes and generation of wastes, Air pollution, Water pollution, Soil pollution and solid waste, Noise pollution, Thermal and Radioactive pollution. Impact on biotic and abiotic things.		
Unit:3	**Environmental Management**	**8 Hours**
Environmental management system: ISO 14001, Concept of Circular Economy, Life cycle analysis; Cost-benefit analysis, Environmental audit and impact assessment; Waste Management and sustainability; Ecolabeling /Eco mark scheme		
Unit:4	**Environmental Treaties and Legislation**	**7 Hours**
Introduction to environmental laws and regulation, An overview of instruments of international cooperation, Major International Environmental Agreements, Major Indian Environmental Legislations, Major International organizations, and initiatives		
	Total Lecture	**30 Hours**

Text books	
1	Chiras, D. D and Reganold, J. P. (2010). Natural Resource Conservation: Management for a Sustainable Future.10th edition, Upper Saddle River, N. J. Benjamin/Cummins/Pearson
2	Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press
3	Krishnamurthy, K.V. (2003) Textbook of Biodiversity, Science Publishers, Plymouth, UK
4	Jackson, A. R., & Jackson, J. M. (2000). Environmental Science: The Natural Environment and Human Impact. Pearson Education
5	Pittock, Barrie (2009) Climate Change: The Science, Impacts and Solutions. 2nd Edition. Routledge.
6	Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press
7	Kanchi Kohli and Manju Menon (2021) Development of Environment Laws in India, Cambridge University Press

Reference Books	
1	Headrick, Daniel R. (2020) Humans versus Nature- A Global Environmental History, Oxford University Press
2	Gilbert M. Masters and W. P. (2008). An Introduction to Environmental Engineering and Science, Ela Publisher (Pearson)
3	William P. Cunningham and Mary A. (2015). Cunningham Environmental Science: A global concern, Publisher (Mc-Graw Hill, USA)
4	Varghese, Anita, Oommen, Meera Anna, Paul, Mridula Mary, Nath, Snehlata (Editors) (2022) Conservation through Sustainable Use: Lessons from India. Routledge.
5	Central Pollution Control Board Web page for various pollution standards. https://cpcb.nic.in/ standards
6	Barnett, J. & S. O'Neill (2010). Maladaptation. Global Environmental Change—Human and Policy Dimensions 20: 211–213
7	Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press
8	Ministry of Environment, Forest and Climate Change (2019) A Handbook on International Environment Conventions & Programmes. https://moef.gov.in/wp- content/uploads/2020/02/ convention-V-16-CURVE-web.pdf
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	
MOOCs Links and additional reading, learning, video material	
1	

IV SEMESTER
23ME1401 : Machining Processes

Course Outcomes :

Upon successful completion of the course the students will be able to

1. Demonstrate and design the tool geometry of SPCT, mechanism of chip formation and principle of orthogonal/oblique cutting.
2. Analyze the cutting tool geometry of MPCT, mechanism of chip formation, mechanism used and working principle with applications.
3. Identify basic parts and operations of machine tools including lathe, shaper, planer.
4. Categorize basic parts and operations of machine tools including boring, milling, and grinding machines.
5. Select a machining operation and corresponding machine tool for a specific application in real-time.

Unit I:	**8 Hrs.**
Mechanics of Machining and Machinability: Introduction to machining, geometry of SPCT. Mechanism of chip formation, Orthogonal and Oblique cutting, Use of chip breaker in machining, Merchant Circle. (Application of force analysis Analytical treatment expected), thermal aspects of machining, Cutting Fluids, Machinability, Estimation of Tool life, Tool materials.	
Unit II:	**7 Hrs.**
Lathe: Kinematic systems and operations of lathes, attachments for various operations, machine specifications, basis for selection of cutting speed, feed and depth of cut, time estimation for turning operations such as facing, step turning, taper turning, threading, knurling. Capstan and Turret Lathe and special purpose Machines: Construction, Operation and selection of Machining Parameters, Machining Centers, Tool Heads and indexers	
Unit III:	**8 Hrs.**
Shaper: Introduction, type, specification, description of machines, hydraulic drives in shapers, cutting parameters, attachments for shaper, work holding devices, shaper operations. Planer: Introduction, specifications, description, type of planner, Mechanism for planner: Driving mechanism, feeding mechanism, planner cutting tools, cutting parameters Slotter: Introduction, specifications, description, type of drives for slotter, types of slotting	
Unit IV:	**7 Hrs.**
Milling: Kinematic systems and operations of milling machines, attachments for Milling. Cutting parameters, Types of milling cutters, Tool geometry & their specifications. Indexing- simple, compound and differential. Screw threads and Gear Manufacturing Methods. Applications of milling in gear production process.	

Unit V:	**8 Hrs.**
Grinding operations: Grinding operations, grinding wheel, specifications & selection, cylindrical &centre less grinding operation, surface grinding, tool & cutter grinding, time estimation for grinding operations. Super finishing process: Honing, Lapping, super finishing, polishing, buffing, metal spraying, galvanizing and electroplating. Process parameters and attainable grades of surface finish, surface roughness measurement. Applications of these process in product development	
Unit VI:	**7 Hrs.**
Drilling: Reaming: Broaching: Unconventional Machining and Joining Processes: Characteristics, Operation, applications, Limitation and selection of process parameters of the following processes, Abrasive Jet Machining, Ultrasonic Machining, Water Jet Machining, EDM, and ECM. Plasma Arc welding, Electron Beam, and Electron Laser Beam welding.Real time applications of unconventional processes.	
Total Lecture	**45 Hours**

Textbooks:	
1.	Workshop Technology - Part I,Chapman W.A.JFifth edition CBS Publishers
2.	Manufacturing Technology (Metal Cutting & Machine Tools) P N Rao 2nd Edition (2009) The McGraw-Hill Companies
3.	Manufacturing Science Ghosh & Malik 2nd Edition (2010) East West
4.	Workshop Technology (Volume-II) Hajra Choudhary 2nd Edition (2012) The McGraw-Hill Companies

Reference Books:	
1.	Manufacturing Engineering & Technology S Kalpakjian & SR Schmid 1st Edition (2009) Pearson Education Canada
2.	Technology of machine Tools Krar & Oswald 1st Edition (1984) Gregg Division, McGraw-Hill
3.	Manufacturing Processes M Begman 1st Edition (1974) Ballinger Pub. Co

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2.	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042

MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/112/103/112103280/
2.	https://nptel.ac.in/courses/106/106/106106179/
3.	https://nptel.ac.in/courses/127/105/127105007/

IV SEMESTER
23ME1402 : Lab Machining Processes

Course Outcomes
Upon successful completion of the course the students will be able to 1. Demonstrate and design the tool geometry of SPCT, mechanism of chip formation and principle of orthogonal/oblique cutting. 2. Analyze the cutting tool geometry of MPCT, mechanism of chip formation, mechanism used and working principle with applications 3. Identify basic parts and operations of machine tools including lathe, shaper, planer 4. Categorize basic parts and operations of machine tools including boring, milling and grinding machines. 5. Select a machining operation and corresponding machine tool for a specific application in real-time.

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1.	Demonstration of Single point cutting tool their Nomenclature , geometry, materials and applications.
2.	Demonstration of Multi point cutting tool their Nomenclature , geometry, materials and applications.
3.	Demonstration of working of Lathe machine and study of its mechanisms.
4.	Demonstration of working of Shaper machine and study of its mechanism.
5.	Demonstration of working of Milling machine and study of its mechanism.
6.	Demonstration of working of Drilling machine and study of its mechanism..
7.	Practical on Lathe for turning, facing, step turning, taper turning, and l threading.
8.	Practical on Shaper with exposure to auto feed.
9.	Practical on Milling machine for slot cutting.
10.	Practical on Drilling machines for drilling.
11.	Demonstration of Boring operations.
12.	Study of Grinding machines and Super finishing processes.
13.	Introduction to NC, CNC machines.

IV SEMESTER
23ME1403 : Lab Computer Aided Design

Course Outcomes

Upon successful completion of the course, the students will be able to;

Apply the knowledge of CAD software for product development in an Industry

1. Apply the knowledge of CAD software for product development in an Industry
2. Create CAD assemblies for real time product.
3. Prepared drafting drawing which required for manufacturing.
4. Simulate the CAD model or CAD assembly.
5. Analyse different CAD models for 3D printing applications.

SN	**Experiments to be performed**
1.	Creation of three dimensional CAD models using CAD software.
2.	Basic surface modeling using CAD software.
3.	Advanced model creation using surface modeling.
4.	Assembly of CAD models using CAD software.
5.	Kinematics of CAD assembly using CAD software.
6.	Drafting of CAD models using CAD software.
7.	Drafting of CAD assemblies using CAD software.
8.	CAD Model preparation for 3D Printing.
9.	3D Printing of CAD models using 3D printer.
10.	Advanced rendering features for CAD model.

IV SEMESTER
23ME1404 : Lab Machine Drawing

Course Outcomes
Upon successful completion of the course, the students will be able to; 1. **Understand** and **Apply** the detailed drawing of a given object. 2. **Interpre**t and **Prepare** the drawing. 3. **Construct** details and assembly of different mechanical systems. 4. **Create** an assembly drawing into a detailed drawing using modeling software

SN	Experiments to be performed
Drawing Sheets	
1	**Representation** of different types of lines, Name Block, Dimensioning, Machining Symbols, Heat Treatment, Allowances, Convention Representation of Engineering Part (CO1)
2	**Welding symboland Riveting: -** Shapes of rivet heads. (Diagonal pitch, Margin, Back pitches, etc.) Types of riveting lap and butt joint, zigzag, and chain structure. All types of welding symbols are common representations of welding.(CO2)
3	**Type of Bolt and Nut: -**Hexagonal bolt and nut with washer, SQ headed bolt, Eye bolt, Eye foundation bolt, Bent foundation, and Lewis and Rag foundation bolt. Locking of bolt (All 5 types) T-headed bolt Hook bolt, Flanged nut Cap nut Dome nut Capstan nut Ring nut Wing nut, and Stud.(CO2)
4	**Type of Coupling, Key, and Joint** Saddle Keys, Sunk Keys, Gib Headed keys, parallel and feather (All Four types) round Keys, Woodruff key, Spline Shafts, Cotter joints, Knuckle joints, Coupling (flange, protective, muff, Oldham,universal) (CO2)
Assembly Drawings Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportion. Note: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.	
5	**Steam Engine parts –** Stuffing boxes, Crossheads, Eccentrics, pistons, Valvesand Pumps.(CO3,4)
6	**Bearings -**Bushed journal bearing,Foot-step bearing, and Plummer block.(CO3,4)
7	**Machine tool parts –**Lathe Tail-stock, Square Tool Post, Machine Vices.(CO3,4)
8	**Other machine parts –**Screws jacks, Square Tool post, and Petrol engine connecting rod.(CO3,4)
9	Simple designs of a steam stop valve, spring-loaded safety valve and feed check valve.(CO3,4)
10.	**Cotter and pin joints and coupling.**(CO3,4)
11.	**Production Drawing:** Name Plates, Part List and Revisions.(CO4)

Textbooks:	
1.	K L Narayana, P Kannaiah and K Venkata Reddy, Machine Drawing, 3rd edition, New Age Publications, 2006.
2.	N D Bhatt, Engineering Drawing, Charotar Publications, 2000.

Reference Books:	
1.	N Sidheswar, P Kannaiah and V V S Sastry, Machine Drawing, Tata McGraw Hill, 1980.
2.	K L Narayana, P Kannaiah and K Venkata Reddy, Production Drawing, 2nd edition, New Age Publications, 2009.
3.	P S Gill, A Textbook of Machine Drawing, S.K. Kataria & Sons Publishers, 2013.
4.	R K Dhawan, Machine drawing, S. Chand Publications, 1998.
5.	Basudev Bhattacharyya, Machine Drawing, Oxford University Press, 2011.
6.	G Pohit, G Ghosh, Machine Drawing with Auto CAD, Pearson Education India, 2004.
7.	Ajeet Singh, Machine Drawing, Tata McGraw Hill, 2012.
8.	Gopalkrishna K. R, Machine Drawing, Subhas Publications, Bangalore, 1985.
9.	Naryana K.L., Kannaiah R., Venkata Reddy K "Production Drawing ", New Age Int.Pub, 1st

YCCE e-library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/78.%20Engineering-Mechanics-Statics-and-Dinamics-E-W-Nelson-C-L-Best-W-G-McLean-1st-Ed-1997-Schaum-Outline-McGraw-Hill%20(1).pdf
2	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/79.%20Engineering%20Mechanics.%20Statics-%20MERIAM%20%20AND%20KRAIGE.pdf
3	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/81.%20Engineering%20Mechanics%201.pdf

MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/112103019/
2.	https://nptel.ac.in/syllabus/112106075/

IV SEMESTER
Multidisciplinary Minor Courses

Track 1

Courses	Sem	MDMT1ME101 : Computer-Aided Design
MDM-I	3	(MDM1ME101) Engineering Materials
MDM-II	4	(MDM2ME102) Basics of Mechanism
MDM-III	5	(MDM3ME103) Basics of Machine Design
MDM-IV	6	(MDM4ME104) Computer Aided Design
MDM-V	7	(MDM5ME105) Product Design and Development
MDM-VI	8	(MDM6ME106) INDUSTRY 5.0

Track 2

Courses	Sem	MDMT2ME201 : Robotics and Computer Integrated Manufacturing
MDM-I	3	(MDM1ME201) Introduction to Robotics
MDM-II	4	(MDM2ME202) Industrial Robotics
MDM-III	5	(MDM3ME203) Computer Integrated Manufacturing
MDM-IV	6	(MDM4ME204) Subtractive Manufacturing
MDM-V	7	(MDM5ME205) Additive Manufacturing
MDM-VI	8	(MDM6ME206) Supply Chain Management

IV SEMESTER
Track 1 - Computer Aided Design
MDM2ME102 : Basics of Mechanisms

Course Outcomes :
Upon successful completion of the course the students will be able to 1. **Understand** the various kinematic concepts in different mechanisms.(L3) 2. **Explain** the working Principles of various Mechanism. (L3) 3. **Demonstrate** the various working principles of plants.(L3) 4. **Construct** the various model using CAD software. (L4)

Unit I:	**7 Hrs.**
Basic Concept of Mechanism: link, kinematics pairs, kinematics chain, mechanism, machine, simple & compound chain, Degree of freedom, estimation of degree of freedom, inversion of four-bar-chain. (CO-1)	
Unit II:	**8 Hrs.**
Working Principles of Mechanism: Seesaw mechanism, Reciprocating Mechanism,Brake Mechanism, Clutch mechanism, Gear mechanism. (CO-2)	
Unit III:	**8 Hrs.**
Mechanisms of: Working of EV vehicles, Thermal power plants, solar power plants, Hydro power plant, wind power and Nuclear power plant. Refrigeration and Air conditioning. (CO-3)	
Unit IV:	**7 Hrs.**
Concept of modelling and analysis: Generation of model using CAD software,Analysis and synthesis of Various Mechanisms. (CO-4)	
	Total Lecture **30 Hours**

Textbooks:	
1.	Theory of mechanisms & machines, Shigley J. E, 4TH Edition 2014,Tata McGraw-Hill
2.	Theory of Machine, Rattan S.S, 4th Edition 2015, Tata McGraw-Hill

Reference Books:	
1.	Non-Conventional Energy Resources, Khan B.H., 3rd Edition, Tata McGraw-Hill.
2.	Electric and Hybrid Vehicles, DENTON T., 2ED (PB 2020), Institute of motor Industry

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	
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MOOCs Links and additional reading, learning, video material	
1.	
2.	
3.	

IV SEMESTER
Track 2- Robotics and Computer Integrated Manufacturing
MDM2ME202: Industrial Robotics

Course Outcomes :

Upon successful completion of the course the students will be able to

1. Apply the knowledge of robot motion analysis for product development in an Industry
2. Design robot programs for various manufacturing operations
3. Analyze Robotics based automation and its different roles in industry
4. Analyze the working methodology of robotics and automation, motion and control, machine vision and programming, application of robots in industry.

Unit I:	**7 Hrs.**
Introduction: Overview of Industrial Robotics: Definition, history, and evolution, Types of Industrial Robots: Manipulators, articulated robots, SCARA robots, etc., Robot Components and Architecture: End effectors, actuators, controllers, and sensors, Applications of Industrial Robots: Manufacturing, assembly, welding, painting, etc. **Contemporary Issues related to Topic**	
Unit II:	**8 Hrs.**
Robot Motion Analysis and Control and Robot End-Effectors: Introduction to Manipulator Kinematics, Homogeneous Transformations and Robot Kinematics, Manipulator Path Control, Robot Dynamics, Configuration of a Robot Controller, Control System Analysis, Robot Activation and Feedback Components, Types of End Effectors, Mechanical Grippers, Other Types of Grippers, Considerations in Gripper Selection and Design, End Effector Integration: Mounting, calibration, and programming of end effectors. **Contemporary Issues related to Topic**	
Unit III:	**8 Hrs.**
Sensors in Robotics and Machine Vision: Transducers and Sensors, Sensors in Robotics, Tactile Sensors, Proximity and Range Sensors, Miscellaneous Sensors and Sensor-Based Systems, Uses of Sensors in Robotics, Introduction to Machine Vision, The Sensing and Digitizing Function in Machine Vision, Image Processing and Analysis, Training and Vision System, Applications in Manufacturing industry. **Contemporary Issues related to Topic**	
Unit IV:	**7 Hrs.**
Robot Programming and Languages: Robot Programming Languages: Teach pendant programming, offline programming, and programming interfaces, Robot Control Systems: Open-loop vs. closed-loop control, PID control, trajectory planning, Robot Safety: Safety standards, risk assessment, and safety features in industrial robots, Simulation and Offline Programming: Introduction to simulation software for robot programming and validation. Al and Robotics. **Contemporary Issues related to Topic**	
	Total Lecture **30 Hours**

Textbooks:	
1.	Robot Engineering An Intergrated approach 2004 Klafter R.D., Chmielewski T.A. and Negin M Springer
2.	Industrial Robotics: Technology, Programming and Applications, 2012 Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and Ashish Dutta 2nd Edition, Tata McGraw Hill, 2012.
3.	Automation in Production system 2002 Mikell P. Groover Prentice-Hall of India Pvt. Ltd., New Delhi, 2002
4.	Bruno S and Sciavicco L, Robotics: Modelling, Planning and Control, Springer (2009)

Reference Books:	
1.	Robotics control, sensing, vision, and intelligence 2004 Fu K.S., Gonzalez R.C., and Lee C.S.G. Tata McGraw-Hill Education
2.	Robotics Technology and Flexible Automation 2001 Deb S.R Tata McGraw-Hill Education
3.	Introduction to Robotics Mechanics and Control 2008 Craig J.J Pearson Education India
4.	Industrial Robotics, By Ganesh S. Hegde · 2006, Laxmi Publications, June 2006

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	
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MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/112101098
2.	https://nptel.ac.in/courses/112101099

IV SEMESTER
Open Elective -II : Basket

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	4	OE2	GE	23OE2401	OE-II : Combinatorics
2	4	OE2	GE	23OE2402	OE-II : Fuzzy Set Theory, Arithmetic And Logic
3	4	OE2	GE	23OE2403	OE-II : Green Chem. & Sustainability
4	4	OE2	GE	23OE2404	OE-II : Hydrogen Fuel
5	4	OE2	GE	23OE2405	OE-II : Electronic Materials And Applications
6	4	OE2	GE	23OE2406	OE-II : Laser Technology And Applications
7	4	OE2	MGT	23OE2407	OE-II : Finance And Cost Management
8	4	OE2	MGT	23OE2408	OE-II : Operation Research Techniques
9	4	OE2	MGT	23OE2409	OE-II : Project Evaluation & Management
10	4	OE2	MGT	23OE2410	OE-II : Total Quality Management
11	4	OE2	MGT	23OE2411	OE-II : Value Engineering
12	4	OE2	MGT	23OE2412	OE-II : Maintenance Management
13	4	OE2	MGT	23OE2413	OE-II : Industrial Safety
14	4	OE2	MGT	23OE2414	OE-II : Industry 4.0
15	4	OE2	MGT	23OE2415	OE-II : Operation Management
16	4	OE2	MGT	23OE2416	OE-II : Material Management
17	4	OE2	MGT	23OE2417	OE-II : Hospitality Management
18	4	OE2	MGT	23OE2418	OE-II : Human Resource Management & Organizational Behaviour
19	4	OE2	MGT	23OE2419	OE-II : Agri-Business Management
20	4	OE2	MGT	23OE2420	OE-II : Rural Marketing
21	4	OE2	MGT	23OE2421	OE-II : Marketing Management
22	4	OE2	MGT	23OE2422	OE-II : Health Care Management

Link for Open Electives syllabus: https://ycce.edu/syllabus/

IV SEMESTER
Mandatory Learning Course (Audit Course)
MLC2124 : YCAP4

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2023

5th Semester

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mechanical Engineering)

B. Tech. in Mechnical Engineering

SoE No. 23 ME-101

SN	Sem	Type	BoS/Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIFTH SEMESTER															
1	5	PC	ME	23ME1501	Engineering Thermodynamics	T	3	0	0	3	3	30	20	50	3
2	5	PC	ME	23ME1502	Measurement, Metrology & Quality Control	T	3	0	0	3	3	30	20	50	3
3	5	PC	ME	23ME1503	**Lab :** Measurement, Metrology & Quality Control	P	0	0	2	2	1		60	40	
4	5	PC	ME	23ME1504	Fluid Mechanics	T	3	1	0	4	4	30	20	50	3
5	5	PC	ME	23ME1505	**Lab :** Fluid Mechanics	P	0	0	2	2	1		60	40	
6	5	PC	ME	23ME1506	Operation Research Technique	T	3	0	0	3	3	30	20	50	3
7	5	PE	ME		**Professional Elective - I**	T	3	0	0	3	3	30	20	50	3
8	5	PE	ME		**Lab : Professional Elective - I**	P	0	0	2	2	1		60	40	
9	5	**OE-3**	OE		**Open Elective -III**	T	3	0	0	3	3	30	20	50	3
10	5	MDM	ME		**MD Minor Course-III**	T	3	0	0	3	3	30	20	50	3
11	5	STR	ME	23ME1507	Internship and Indsutrial Visit	P	0	0	1	1	1		60	40	
					TOTAL		**21**	**1**	**7**	**29**	**26**				
List of Mandatory Learning Course (MLC)															
1	5	HS	T&P	MLC2125	**YCAP5 :** YCCE Communication Aptitude Preparation	**A**	3	0	0	3	**0**				
Professional Elective - I															
1	5	PE-I	ME	23ME1521	**PE-I :** Finite Element Methods										
2	5	PE-I	ME	23ME1522	**PE-I : Lab :** Finite Element Methods										
3	5	PE-I	ME	23ME1523	**PE-I :** Industrial Fluid Power										
4	5	PE-I	ME	23ME1524	**PE-I : Lab :** Industrial Fluid Power										
5	5	PE-I	ME	23ME1525	**PE-I :** Electric and Hybrid Vehicle										
6	5	PE-I	ME	23ME1526	**PE-I : Lab :** Electric and Hybrid Vehicle										
7	5	PE-I	ME	23ME1527	**PE-I :** Advance Welding Techniques										
8	5	PE-I	ME	23ME1528	**PE-I : Lab :** Advance Welding Techniques										
9	5	PE-I	ME	23ME1529	**PE-I :** CNC & Robotics										
10	5	PE-I	ME	23ME1530	**PE-I : Lab :** CNC & Robotics										
11	5	PE-I	ME	23ME1531	**PE-I :** Mechatronics										
12	5	PE-I	ME	23ME1532	**PE-I : Lab :** Mechatronics										
13	5	PE-I	ME	23ME1533	**PE-I :** Computer Aided Manufacturing										
14	5	PE-I	ME	23ME1534	**PE-I : Lab :** Computer Aided Manufacturing										
15	5	PE-I	ME	23ME1535	**PE-I :** Two Wheeler technology										
16	5	PE-I	ME	23ME1536	**PE-I : Lab :** Two Wheeler technology										

Open Elective - III

SN	Sem	Type	BoS/Deptt	Sub. Code	Subject	FACULTY
1	5	OE3	CSE	23OE3501	OE-III : Social Reformers in Modern Maharashtra	ARTS
2	5	OE3	CSE	23OE3502	OE-III : Independent India 1948-2010	ARTS
3	5	OE3	CT	23OE3503	OE-III : Introduction To Cognitive Psychology	ARTS
4	5	OE3	CT	23OE3504	OE-III : Introduction To Engineering Psychology	ARTS
5	5	OE3	CT	23OE3505	OE-III : Introduction To Behavioural Psychology	ARTS
6	5	OE3	CT	23OE3506	OE-III : Introduction To Emotional Psychology	ARTS
7	5	OE3	EL	23OE3507	OE-III : Elements of Public Administration	ARTS
8	5	OE3	ETC	23OE3508	OE-III : Ancient Indian History	ARTS
9	5	OE3	IT	23OE3509	OE-III : Consciousness Studies	ARTS
10	5	OE3	IT	23OE3510	OE-III : Psychology for Professionals	ARTS
11	5	OE3	IT	23OE3511	OE-III : Introduction to Sociology and Human Behavior	ARTS
12	5	OE3	GE	23OE3512	OE-III : Economics of Money and Banking	ARTS
13	5	OE3	GE	23OE3513	OE-III : Economics of Capital Market	ARTS
14	5	OE3	GE	23OE3514	OE-III : Digital Humanities	ARTS
15	5	OE3	GE	23OE3515	OE-III : Introduction to Political Science	ARTS
16	5	OE3	CT	23OE3516	OE-III : Bhagwat Geeta - An Engineer's Interpretation	ARTS - IKS
17	5	OE3	CT	23OE3517	OE-III : Artha shastra by Kautiliya	ARTS - IKS
18	5	OE3	CSD	23OE3518	OE-III : Glimpses of Ancient science and Technology	ARTS - IKS
19	5	OE3	CV	23OE3519	OE-III : Indian taxation system	COMMERCE
20	5	OE3	CV	23OE3520	OE-III : Elements of share trading	COMMERCE
21	5	OE3	EE	23OE3521	OE-III : Introduction to Fintech	COMMERCE
22	5	OE3	EE	23OE3522	OE-III : Financial Analytics	COMMERCE
23	5	OE3	ETC	23OE3523	OE-III : Fundamentals of Investments	COMMERCE
24	5	OE3	EE	23OE3524	OE-III : Lifestyle Diseases	HEALTHCARE & MEDICINE
25	5	OE3	EE	23OE3525	OE-III : Holistic Nutrition	HOME SCIENCE
26	5	OE3	EL	23OE3526	OE-III : Community Organization & Development	HOME SCIENCE
27	5	OE3	CSE	23OE3527	OE-III : Human Rights & International Laws	LAW
28	5	OE3	CSE	23OE3528	OE-III : Cyber Crime Administration	LAW
29	5	OE3	MATHS	23OE3529	OE-III : Finite Differences & Numerical Methods	SCIENCE
30	5	OE3	MATHS	23OE3530	OE-III : Business Statistics	SCIENCE
31	5	OE3	PHY	23OE3531	OE-III : Crystalline Solids: Properties and Applications.	SCIENCE
32	5	OE3	PHY	23OE3532	OE-III : Nanotechnology: Fundamental to Applications	SCIENCE
33	5	OE3	CHE	23OE3533	OE-III : Chemistry in daily life	SCIENCE
34	5	OE3	CHE	23OE3534	OE-III : Battery Systems and Management	SCIENCE
35	5	OE3	NPTEL	23OE3535	OE-III : Designated approved online NPTEL Course	NPTEL

Chairperson	Dean (Acad. Matters)	July, 2023	1.00	Applicable for AY 2023-24 Onwards
		Date of Release	Version	

V SEMESTER

23ME1501: Engineering Thermodynamics

Course Outcomes :

Upon successful completion of the course the students will be able to

1. Apply the laws of thermodynamics to various thermodynamic processes/systems for energy interaction.
2. Estimate the entropy interaction in various thermodynamic processes/ systems.
3. Evaluate various thermodynamic parameters with phase change using phase change diagrams, relations, and steam tables.
4. Analyze the performance of various Thermodynamic cycles.

Unit I:	**8 Hrs.**

Introduction to Thermodynamics:

Basic concepts of Thermodynamics, Continuum, and macroscopic approach; thermodynamic system, Concept of energy and various forms of energy; internal energy, enthalpy; specific heats; thermodynamic properties and equilibrium; state of a system, state postulate, state diagrams, paths / processes, and cycles on state diagrams. The Ideal Gas equation of State. The concepts of heat and work interactions. Evaluation of different modes of work. Zeroth Law of Thermodynamics, concept of temperature.

Unit II:	**7 Hrs.**

The First Law of Thermodynamics applied to the various processes in Closed Systems, Various Steady flow systems, Steady-Flow Engineering Devices and Unsteady Flow process such as: charging and discharging of gas cylinder.

Unit III:	**8 Hrs.**

Second Law of Thermodynamics:

Limitations of the Zeroth and First law of thermodynamics, concepts of Thermal energy reservoirs, heat engines and heat pumps/refrigerators, Kelvin-Planck and Clausius statements and their equivalence; reversible and irreversible processes. Carnot cycle and Carnot principles/theorems; thermodynamic temperature scale.

Unit IV:	**7 Hrs.**

Entropy:

Clausius inequality and concept of entropy; microscopic interpretation of entropy, the principle of increase of entropy, T-s diagrams, Change in entropy for processes in Closed and Steady flow systems.

Introduction to the concept of Availability

Unit V:	**8 Hrs.**

Properties of Pure Substances (Steam):

Thermodynamic properties of pure substances in solid, liquid and vapor phases; P-v-T behavior of simple compressible substances, phase rule, thermodynamic property tables (Steam Tables) and

charts.

Calculations of work and heat interactions in non-flow and steady flow processes. Determination of dryness fraction using various calorimeters

Unit VI:	**7 Hrs.**

Thermodynamic Cycles

Vapor Power Cycles: Carnot vapor cycle, Rankine cycle: ideal and the reheat, the analysis of vapor power cycle. Concept of Mixture of Gases and Properties of Mixtures.

Air-standard cycles: air standard assumptions, basic considerations, and the analysis of power cycles: Otto cycle, Diesel engine cycle, and Brayton cycle.

Refrigeration Cycle: Introduction to Vapor-compression Refrigeration Cycle

	Total Lecture	**45 Hours**

Textbooks:	
1.	Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi.
2.	Thermodynamics – An Engineering Approach – Yunus Cengel& Boles Tata McGraw Hill, New Delhi.

Reference Books:	
1.	Sonntag, R. E., Borgnakke, C., & Wylen, G. J. V. Fundamentals of thermodynamics: Wiley.
2.	Thermodynamics – J.P.Holman /McGrawHill
3.	Michael J. Moran & Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, John Wiley & Sons,
4.	Reiner Joel., Basic Engineering Thermodynamics, Longman Publications.
5	Engineering Thermodynamics, 2E, by P. Chattopadhyay, OUP India
6	An introduction to Thermodynamics, YVC Rao, New Age publishers, New Delhi.
7	Fundamentals of Engineering Thermodynamics by R.Yadav, Central Publishing House, Allahabad
8	Engineering Thermodynamics by Onkar Singh, New Age International.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2.	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042

MOOCs Links and additional reading, learning, video material	
1.	https://www.my-mooc.com/en/mooc/thermodynamics-iitbombayx-me209-1x-1/
2.	https://www.coursera.org/courses?query=thermodynamics
3.	https://archive.nptel.ac.in/courses/101/104/101104063/
4.	https://onlinecourses.nptel.ac.in/noc20_ae09/preview

V SEMESTER

23ME1502: Measurement Metrology and Quality Control

Course Outcomes :
Upon successful completion of the course the students will be able to
1. Illustrate the basic knowledge of measuring instruments along with various Static & Dynamic characteristics.
2 Describe principles of metrology and Analyze quality of product by metrological instruments.
3 Classify types of fits, Design of limit gauges and tolerance charts.
4 Evaluate quality improvement through statistical tools and acceptance sampling techniques.

Unit I:	**7 Hrs.**
Introduction to Measurement Purpose, Structure, and elements of a general measurement system. Static characteristics of measurement system, types of error, type of input, methods of correction. Dynamic characteristics of measurements system.	
Unit II:	**8 Hrs.**
Measurement instruments: Study of instruments for measurements of linear & angular displacement, speed, temperature and pressure. Application of Stroboscope for speed measurement for industrial purpose.	
Unit III:	**8 Hrs.**
Introduction to Metrology: Interchangeability, Standard of measurements simple gauging instruments for linear and angular measurements, form measurement, Surface finish measurement, Comparators, measurement of straightness and flatness. Measurements of thread, measurements of gear tooth, interferometery, Laser Meteorology, Coordinate measuring machine (CMM). Calibration of Metrological instruments for quality assurance to be used in shop floor	
Unit IV:	**7 Hrs.**
Limits , Fits and Tolerances Tolerance analysis of limit & fits, Design of limit gauges, types of fits, shaft basis system, hole basis system selective assembly, allowances, specification of process planning sheet. Preparation of PPS and Tolerance chart for mechanical component.	
Unit V:	**7 Hrs.**
Quality Control Definition, function, objective characteristics. Quality, Quality of design quality of conformance, process control charts and process capability. Statistical quality control**.** Process capability analysis for process	

control chart.		
Unit VI:		**8 Hrs.**
SQC Acceptance sampling techniques O.C. curves, sampling plans, inspection types and objectives		
	Total Lecture	**45 Hours**

Textbooks:	
1.	Engg Metrology , R K Jain, khanna pub, 21 ed, 2019.
2.	Engg Metrology , I C Gupta , Dhanpat Rai pub, 2019.
3.	SQC, Mahajan , Dhanpat Rai, 2021.

Reference Books:	
1.	Introduction to Statistical Quality Control , Douglas Montgomery , 6ED, John willey and sons , 2008.
2.	Statistical QualityControl , Grant , MC Graw Hill Pub ,7 ed , 2017.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	http://103.152.199.179/YCCE/yccelibrary.html
2.	https://www.knimbus.com/#/

MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/112/104/112104250/ mmm
2.	https://archive.nptel.ac.in/courses/112/104/112104245/
3.	digimat.in/nptel/courses/video/112106179/L01.html
4.	https://www.youtube.com/watch?v=xJGzqilNF4Y&t=4s
5.	https://onlinecourses.nptel.ac.in/noc24_me99/preview
6.	https://archive.nptel.ac.in/courses/110/104/110104080/
7.	https://archive.nptel.ac.in/content/storage2/courses/downloads_new/110104080/

V SEMESTER

23ME1503: Lab - Measurement Metrology and Quality Control

Course Outcomes

Upon successful completion of the course the students will be able to:

1. Calibrate and use different length and pressure measuring instruments like Bourdon tube , Lvdt.
2. Demonstrate the necessary skills for estimation and testing of transducers such as RTD.
3. Describe principles of metrology and use metrological instruments for angular measurement.
4. Apply various techniques for measuring Threads, Gears, Surface Finish and profile of a job.

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1.	Calibration of bourdon tube pressure gauge using dead weight pressure gauge.
2.	Calibration of LVDT.
3.	Measurement of speed by using variable resistance transducer.
4.	Measurement of speed by using photo electric transducer.
5.	Measurement of speed by using Stroboscope.
6.	Find half taper angle by sine bar.
7.	Study of slip gauges.
8.	Find effective dia. With the help of floating carriage machine.
9.	Find various parameters of screw thread using Tool maker's microscope.
10.	Study of flatness of surface using fringes pattern.
11.	Measure surface roughness of a given workpiece using stylus probe.
12.	To study the profile of given work piece using profile projector.
13.	Temperature measurement by using RTD.

V SEMESTER
23ME1504: Fluid Mechanics

Course Outcomes :

Upon successful completion of the course the students will be able to

1. Apply the knowledge of various fluid properties and evaluate hydrostatic forces acting on submerged flat bodies.
2. Apply the knowledge of Kinematics to fluid flow and evaluate Velocity, acceleration and various function of Fluid Flow.
3. Analyze and evaluate real flow problems by applying Bernoulli's equations and momentum equations.
4. Apply the knowledge of fluid flow over bodies to analyze and evaluate the Forces acting on bodies.

Unit I:	**8 Hrs.**
Introduction to Fluid Mechanics: Definition of Fluid, Properties of fluids, Newton's law of viscosity, Pascal's law, Basic equation of fluid static, Pressure variations in compressible & incompressible fluids, Fluid pressure & its measurement (Manometers & Bourdon's pressure gauge)	
Unit II:	**7 Hrs.**
Hydrostatics: Forces on submerged plane surfaces Stability of floating Bodies and Mentacentre Kinematics Of Fluid Flow: Types of flow, Stream line, Path line, Streak line, Stream tube, Continuity equation, Velocity and Acceleration at a point, Circulation and Vorticity, Stream function and Velocity potential.	
Unit III:	**7 Hrs.**
Dynamics Of Fluid Flow: Principal of Momentum equation, Impact of jet on stationary and moving Flat and curved vanes. Dimensional Analysis & Dynamic Similitude	
Unit IV:	**8 Hrs.**
Reynolds transport theorem, conservation of mass, linear and angular momentum for inertial and accelerating control volumes, conservation of energy, Navier-Stokes equations, Derivation of Bernoulli's equation for incompressible flow & its applications for various ideal and practical systems, Flow Measurement Devices	
Unit V:	**8 Hrs.**
Viscous Flow: Newton's law of viscosity and its applications, Introduction to laminar and turbulent flow through pipes, Reynolds number and its significance, Boundary layer concept, Drag and Lift on immersed bodies	
Unit VI:	**7 Hrs.**
Flow Through Pipes: Equations for pipe flow, Friction charts and their uses, Losses in pipes and fittings, Hydraulic gradient lines and total energy lines, Pipes in series and parallel. Siphon, Water hammer phenomenon. Power Transmission Through Pipeline: Condition for maximum power transmission through a given pipeline (single pipe), Relationship of nozzle diameter to pipe diameter for maximum power transmission.	
Total Lecture	**45 Hours**

Textbooks:	
1.	Engineering Fluid Mechanics, K. L. Kumar, S. Chand & Company Ltd.
2.	Basic Fluid Mechanics, C.P. Kothandaraman & R. Rudramoorthy , New Age Publication
3.	Fluid Mechanics & Fluid Power Engineering , D. S. Kumar, S. K. Kataria Publication

Reference Books:	
1.	Fluid Mechanics: Fundamentals and Applications, Yunus A. Cengel and John M. Cimbala, McGraw-Hill.
2.	Fluid Mechanics, J.F.Douglas, J.M.Gasiorek & J.A. Swaffield, ELBS Publication
3.	Fluid Mechanics, A.K.Mohanty, Prentice Hall Publication

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2.	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042

MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/112104118
2.	https://nptel.ac.in/courses/105103192

V SEMESTER
23ME1505: Lab - Fluid Mechanics

Course Outcomes
Upon successful completion of the course the students will be able to 1. Demonstrate and design the tool geometry of SPCT, mechanism of chip formation and principle of orthogonal/oblique cutting. 2. Analyze the cutting tool geometry of MPCT, mechanism of chip formation, mechanism used and working principle with applications 3. Identify basic parts and operations of machine tools including lathe, shaper, planer 4. Categorize basic parts and operations of machine tools including boring, milling and grinding machines. 5. Select a machining operation and corresponding machine tool for a specific application in real-time.

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Demonstration of Single point cutting tool their Nomenclature , geometry, materials and applications.
2	Demonstration of Multi point cutting tool their Nomenclature , geometry, materials and applications.
3	Demonstration of working of Lathe machine and study of its mechanisms.
4	Demonstration of working of Shaper machine and study of its mechanism.
5	Demonstration of working of Milling machine and study of its mechanism.
6	Demonstration of working of Drilling machine and study of its mechanism..
7	Practical on Lathe for turning, facing, step turning, taper turning, and l threading.
8	Practical on Shaper with exposure to auto feed.
9	Practical on Milling machine for slot cutting.
10	Practical on Drilling machines for drilling.
11.	Demonstration of Boring operations.
12.	Study of Grinding machines and Super finishing processes.
13.	Introduction to NC, CNC machines.

V SEMESTER

23ME1506: Operations Research Technique

Course Outcomes :

Upon successful completion of the course the students will be able to

1. **Solve** real-world optimization problems using linear programming techniques.
2. **Apply** Assignment and Transportation techniques to develop cost-effective solutions .
3. **Evaluate** and optimize system performance using replacement policies, Simulation techniques and queuing models.
4. **Analyze** and manage projects effectively using PERT and CPM to identify critical paths and optimize scheduling for timely project completion.
5. **Assess** inventory techniques to maintain adequate inventory level, improve customer services, minimize cost and enhance overall operational efficiency.

Unit I:	**8 Hrs.**
Linear Programming: Introduction to Linear Programming Problems: Formulation of LPP, Geometry of LPP and Graphical Solution of LPP, Simplex Method, Big M- Method, and Two Phase Method. Solving Linear Problems in Excel	
Unit II:	**8 Hrs.**
Allocation Model: Transportation Problem and Assignment Problem. (Maximization, minimization and degeneracy problem	
Unit III:	**7 Hrs.**
Replacement Models: Replacement of Models that deteriorate with time, Concept of equivalence, Interest Rate and Present worth. Replacement of items that fails suddenly considering Individual and Group replacement policy	
Unit IV:	**8 Hrs.**
Project Management: Network Scheduling by CPM & PERT, Cost considerations in PERT and CPM	
Unit V:	**7 Hrs.**
Queuing Theory: Queuing Systems, Kendelalls for representing queuing models, Classification of queuing models (No derivations expected), The First Model Monto carlo Simulation.	
Unit VI:	**7 Hrs.**
Inventory model: Introduction, classification, Types of inventories, EOQ, Deterministic model with shortage and no shortage problems, Models with price breaks	
Total Lecture	**45 Hours**

Textbooks:	
1.	Introduction to operation research, computer oriented algorithmic approach Gillet B.E Nelson 1985, Tata Mc. Hill.
2.	Operation research by P.K. Gupta and D.S. Hira, S Chand publication 2015.
3.	Operation research theory and application by J.K.Sharma , Macmillan 2012.

Reference Books:	
1.	Operation research by S.D.Sharma , Kedar nath ram nath, Meerut 2014.
2.	Operation research theory and application, J.K.Sharma , Macmillan 2012.
3.	Optimization theory and application, S.S.Rao , Wesley Eastern 1991.
4.	Operation research Tata Hamdy, Prentice hall of india 2012.
5	Operation research by H.A.Taha , Macmillan 2016.
6	Operation research by S.D.Sharma , Kedar nath ram nath, Meerut 2014.

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1.	https://youtu.be/Q31jKiEXxdc
2.	https://www.youtube.com/watch?v=4U3B5lr-MqM
3.	https://www.youtube.com/watch?v=qxls3cYg8to
4.	https://www.youtube.com/watch?v=xGkpXk-AnWU
5.	https://youtu.be/BUGIhEecipE?si=l13V7mlIUvQl-aNv

MOOCs Links and additional reading, learning, video material	
1	https://www.youtube.com/watch?v=C7HeGfl8U9I&pp=ygUdT1BFUkFUSU9OIFJFU0VBUkNIIFRFQ0hOSVFVRVM%3D
2	https://nptel.ac.in/courses/110106062
3	https://www.youtube.com/watch?v=8M0tQKZzdDY&list=PL23dd-8zssJDLv4Zc6975_FKKd4MXwsTC
4	https://www.youtube.com/watch?v=MAPpIpmiILk&pp=ygUdT1BFUkFUSU9OIFJFU0VBUkNIIFRFQ0hOSVFVRVM%3D

V SEMESTER

23ME1507: Internships, Seminar and Research

V SEMESTER
23ME1521: PE1- Finite Element Methods

Course Outcomes :

Upon successful completion of the course the students will be able to:

1. Demonstrate the concepts of stress, strain, and material deformation, covering their equations and boundary conditions
2. Apply the fundamental principles of Finite Element Method (FEM).
3. Analyse one-dimensional and two-dimensional engineering problems using FEM,
4. Evaluate the performance and solutions of machine elements using commercial FEM software.

Unit I:	**8 Hrs.**

Stress and Strain

Fundamentals of stress & strain, stress & strain components, stress strain relationship, Elastic constants, plane stress, plane strain., differential equation of equilibrium, compatibility equations, boundary conditions, Saint Venant's principle **(CO-1)**

Unit II:	**7 Hrs.**

Fundamental concepts of FEM -' Historical background, Scope of FEM in Engineering. Applications, Principle of minimum potential energy (PMPE). FEM analysis procedure. Mathematical understanding required for FEM, Matrix algebra & operations. Methods for solution of simultaneous equations like Gauss elimination. Matrix decomposition method. Concept of Discretization of body into elements. Types of elements (2-D & 3-D elements), displacement models, convergence requirements, and shape function. Programming for above matrices **(CO-2)**

Unit III:	**8 Hrs.**

FEM of 1-D Element

One dimensional problems by Finite element modeling and analysis: Finite element modeling & analysis using Bar & Beam element -stiffness matrix, assembly, boundary conditions, load vector, temperature effects., Numerical on elements connected in parallel, Numerical on self-weight, numerical on Torque, numerical on Thermal stress **(CO-3)**

Unit IV:	**7 Hrs.**

FEM of 2-D Element

Two dimensional problems using Truss, Constant Strain Triangle & Linear Strain Triangle. FEM modeling and analysis of Truss elements, CST & LST elements, elemental stiffness matrix, assembly, boundary conditions, load vector. Stress calculation. Temperature effect. Axi-symmetric solids subjected to axi-symmetric loading -axi-symmetric formulation using CST ring, element, stiffness matrix, boundary conditions, load vector, calculation of stresses. Programming for simple 2-D problems using CST and LST elements.
(CO-3)

Unit V:	**8 Hrs.**
Introduction to Isoperimetric & Higher order elements. Introduction to Numerical Integration. Introduction to dynamic analysis, formulation of mass matrix for one-dimensional bar element, free vibration analysis using one-dimensional bar element. Torsion of prismatic bars using triangular elements. Programming for these elements. **(CO-3)**	
Unit VI:	**7 Hrs.**
Application of commercial software for simple machine elements and interpretation of results. **(CO-4)**	
Total Lecture	**45 Hours**

Textbooks:	
1.	T.R. Chandrupatla & Belegundu, "Introduction to Finite Elements in Engineering", Prentice Hall, Upper Saddle River, New Jersey 07458
2.	J.N. Reddy, "An Introduction to the Finite Element Method", McGraw-Hill, 16 January 2005

Reference Books:	
1.	J.N. Reddy, "An Introduction to the Finite Element Method", McGraw-Hill Education
2.	O.C. Zienkiewicz, R.L. Taylor, and J.Z. Zhu, "The Finite Element Method: Its Basis and Fundamentals", Butterworth-Heinemann

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MOOCs Links and additional reading, learning, video material	
1.	http:/www.freestudy.co.uk
2.	www.nptel.com
3.	www.authorstream.com

V SEMESTER
23ME1522: PE1-Lab - Finite Element Methods

Course Outcomes
Upon successful completion of the course the students will be able to:
1Explain stress, strain, and deformation in materials with key equations and boundary conditions. 6. Apply the fundamental principles of Finite Element Method (FEM). 7. Analyze one-dimensional and two-dimensional engineering problems using FEM, 8. Evaluate the performance and solutions of machine elements using commercial FEM software.

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	To study about Finite Element Methods .
2	To determine stress and strain in 1-D bar element using ANSYS APDL
3	To determine stress and strain in Composite element using ANSYS APDL
4	To determine stress and strain in Composite element using Twisting Moment by ANSYS APDL
5	To determine stress and strain in Composite element using Thermal Forces by ANSYS APDL
6	To determine stress and strain in Composite element using Thermal Forces by ANSYS APDL
7	To determine principle stress and strain in CST element 2D Truss Element by ANSYS APDL
8	To determine stress and strain in CST element
9	Tutorial of 2D truss analysis in Mechanical APDL (Ansys).
10	To determine displacement and coordinates of a point within the CSt element

V SEMESTER
23ME1523: PE-I : Industrial Fluid Power

Course Outcomes :

Upon successful completion of the course the students will be able to

1. **Apply** fluid power laws and principles to analyze simple fluid power systems, select appropriate fluids, and implement contamination control strategies.
2. **Justify** the selection of components for fluid power systems based on their functional characteristics, performance, and application requirements, ensuring safety and efficiency in industrial environments.
3. **Design** fluid power systems and circuit diagrams using standard symbols to meet specified requirements, emphasizing efficiency and safety in industrial applications.
4. **Implement** safety measures, maintenance practices, and troubleshooting techniques for the efficient operation of fluid power systems, incorporating ethical and professional considerations.

Unit I:	**8 Hrs.**

Fluid power systems: Components, advantages, applications in the field of M/c tools, material handling, hydraulic presses, mobile & stationary machines, clamping & indexing devices etc. Transmission of power at static & dynamic states. Pascal's law and its application to hydraulics, Bernoulli's principle, continuity equation, analysis of simple hydraulic jack.
Hydraulic fluid, types, petroleum based, synthetic & water based. Properties of fluids. Selection of fluids, additives, effect of temperature & pressure on hydraulic fluids, SAE grades and ISO viscosity numbers.
Filters, strainers, types and sources of contamination of fluid & its control, effects, ISO contaminant code.
JIC **symbols**/ISO Symbols for hydraulic & pneumatic circuits.
Hydraulic Reservoirs and Power Pack: functions and its elements, standard designs.

Unit II:	**7 Hrs.**

Pumps: Types, classification, principle of working & constructional details of pumps used in Hydraulic system such as vane pump, gear pumps, radial & axial plunger pumps, power and efficiency calculations, characteristic Curves, selection of pumps for hydraulic power transmission.
Accumulators & Intensifiers: Types & functions of accumulators & intensifiers, applications, selection & design procedure.

Unit III:	**8 Hrs.**

Control Of Fluid Power: The need for pressure control, directional control and flow control valves, methods of actuation of valves.
Pressure Control Valves: Principle of pressure control valves, types, constructional features, direct operated, pilot operated, relief valves, pressure reducing valve, sequence valve.
Flow Control Valves: Principle of operation, types, constructional features, pressure compensated, temperature Compensated flow control valves, meter in & meter out flow control circuits, bleed off circuits.
Direction Control Valves: constructional features, types, Check valves, types of D.C. valves:- Two way two position, four way three position, four way two position valves, open center, close center,

tandem center valves, method of actuation of valves, manually operated, solenoid operated, pilot operated etc

Unit IV:	**7 Hrs.**

Actuators: Classification, constructional features and working, Linear & Rotary actuators.

Hydraulic motors: Types, vane, gear piston, radial piston. Theoretical torque, power & flow rate hydraulic motor performance.

Hydraulic Cylinders: Types of cylinder & mountings, cushioning, calculations of force, velocity and power from a cylinder. Design consideration for cylinders.

Unit V:	**8 Hrs.**

Design and analysis of Hydraulic Circuit such as:

1) Control of single and Double-acting hydraulic cylinder,
2) regenerative circuit,
3) pump unloading circuit,
4) double pump hydraulic system,
5) counterbalance valve application,
6) hydraulic cylinder sequencing circuits,
7) Cylinder synchronizing circuit using different methods,
8) hydraulic circuit for force multiplication.
9) speed control of hydraulic cylinder metering in, metering out and bleed off circuits.
10) Pilot pressure operated circuits.
11) Hydraulic circuit examples with accumulator /intensifier.
12) circuit to lift and hold heavy load,
13) Pressure control for cylinders,
14) Flow divider circuits

Safety precautions, maintenance and troubleshooting of Hydraulic Circuits.

Unit VI:	**7 Hrs.**

Pneumatics:
Introduction to pneumatic power sources, Characteristics of compressed air, air compressors used and Components of pneumatic system.
Air preparation units, filters, regulators & lubricators, and silencers. compressed air distribution system in a plant.
Actuators, linear, single & double acting, rotary actuators, air motors,
Valves: Pressure Regulating Valves, Directional Control Valves, Flow Control Valves.
methods of actuation, use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, Signal
Processing Elements: Use of Logic gates - OR and AND gates in pneumatic applications. Practical examples involving the use of logic gates. Pneumatic circuits for industrial applications & automation.

	Total Lecture	**45 Hours**

Textbooks:	
1.	1. Anthony Esposito, Fluid Power with Applications, Pearson; 6th edition (2002)
2.	2. James L Johnson, Introduction to Fluid Power, Cengage Learning; (2001)

Reference Books:	
1.	1. Vickers, Vickers manuals on Industrial Hydraulics, Vickers Publication
2.	2. Franklin D. Yeaple, Fluid Power Design Handbook, McGraw-Hill Book Company
3.	3. S. R. Majumdar, Pneumatic Systems: Principles and Maintenance, McGraw-Hill Education 2002
4.	4. Jagadeesha T. & Thammaiah Gowda, Fluid Power: Generation, Transmission and Control, Wiley (1 January 2013)
5	5. Dudley A. Pease and John J. Pippenger, Basic Fluid Power, Prentice-Hall 1987.
6	6. James R. Daines, Martha J. Daines, Fluid Power: Hydraulics and Pneumatics, Goodheart-Willcox Company, Incorporated, 2018

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	https://fada.birzeit.edu/bitstream/20.500.11889/6869/1/Abu_Hanieh_Fluid_Power_Control_ed2_Reduced.pdf
2.	https://razak.utm.my/shamsul/wp-content/uploads/sites/189/2015/12/Fluid-Power.pdf
3.	https://www.teachengineering.org/content/pur_/lessons/pur_fluidpower_less1/pur_fluidpower_lesson01_trainingmanualfluidpower.pdf

MOOCs Links and additional reading, learning, video material	
1.	https://archive.nptel.ac.in/courses/112/106/112106175/
2.	https://archive.nptel.ac.in/courses/112/106/112106300/
3.	https://onlinecourses.nptel.ac.in/noc24_me69/preview
4.	https://archive.nptel.ac.in/courses/112/105/112105047/

V SEMESTER
23ME1524: PE-I : Lab-Industrial Fluid Power

Course Outcomes

Upon successful completion of the course the students will be able to

1. **Apply** Knowledge of Fluid Power Principles
2. **Design** and Implementation of Fluid Power Circuits
3. **Perform** System Maintenance and Troubleshooting
4. **Demonstrate** Discipline, Safety, and Collaborative Communication Skills

Minimum Eight Practical's to be performed from the list as below

SN	**Experiments based on**
	Experiments on Hydraulics Circuits:
1	Extend-Retract and Stop system of a linear actuator.
2	Regenerative circuit.
3	Speed Control circuits: meter-in, meter-out and bleed off.
4	Sequencing circuit
5	Use of solenoid operated DCV.
6	Traverse and Feed circuit.
	Experiments on Pneumatic Circuits:
7	Study of Compressor, FRL unit and 5/3 DCV.
8	Reciprocating motion of a single and a double acting actuator.
9	Speed control circuits.
10	Automatic to & fro motion of a pneumatic linear actuator.
11	Sequencing circuit.
12	Logical circuits.
	Other practical work:
13	Design **report** of a hydraulic or pneumatic system using **manufacturer's catalogue**.
14	Study of accumulators and intensifiers.
15	**Industrial visit** to study automation by means of hydraulic and pneumatics such as LPG bottling plant etc
16	Study of **compressed air generation and distribution** systems.
17	Study of **simple hydraulic systems** used in practice such as copy turning attachment, hydraulic clamps, jack, dumper, forklift etc.
18	Other circuits possible on the trainer kit, relevant to the syllabus
19	Demonstration of the Hydraulic or Pneumatic System

V SEMESTER

23ME1525: PE1-Electric and Hybrid Vehicle

Course Outcomes :

Upon successful completion of the course the students will be able to:

1. Student will be able to explain the working of electric vehicles and recent trends. (PO-1,PO-10,PO-12) (PSO-1, PSO-2)
2. Student will be able to analyze different power converter topology used for electric vehicle application. (PO-1,PO-10,PO-12) (PSO-1, PSO-2)
3. Student will be able to develop the electric propulsion unit and its control for application of electric vehicles. (PO-1,PO-3,PO-6,PO-10,PO-12) (PSO-1, PSO-2)
4. Student will be able to Design converters for battery charging and explain transformer less topology. (PO-1,PO-3,PO-6,PO-10,PO-12) (PSO-1, PSO-2)

Unit I:	**8 Hrs.**
Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains.	
Unit II:	**7 Hrs.**
Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Hydrogen fuel cell- Connecting cell in series-water management in the PEM fuel cell- Thermal Management of the PEM fuel cell, Super capacitors.	
Unit III:	**8 Hrs.**
EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives	
Unit IV:	**7 Hrs.**
Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, and design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, and energy storage design.	
Unit V:	**8 Hrs.**
Charging methods for battery, Termination methods, charging from grid, The Z-converter, Isolated bidirectional DC-DC converter, Design of Z- converter for battery charging, High-frequency transformer based isolated charger topology, Transformer less topology.	
Unit VI:	**7 Hrs.**
Lighting, Horn, Side indicator, wiper, and other electrical systems, Automobile air-conditioning, Panel Board instruments. Tyre rotation & balancing, Collision avoidance system and vehicle to vehicle communication, Airbags system, EBD, ABS and other safety features, cruise control. Navigation system and control.	
	Total Lecture **45 Hours**

Textbooks:	
1.	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design M. Ehsani, Y. Gao, S. Gay and Ali Emadi CRC Press 2005

Reference Books:	
1.	Electric and Hybrid Vehicles: Design Fundamentals Iqbal Husain CRC Press 2003
2.	Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles Sheldon S. Williamson Springer 2013
3.	Modern Electric Vehicle Technology C.C. Chan and K.T. Chau Oxford University 2001

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	https://onlinelibrary.wiley.com/doi/book/10.1002/0470090707?SeriesKey=10.1002/9781118536186
2.	https://onlinelibrary.wiley.com/doi/book/10.1002/9781118752555

MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/108106170

V SEMESTER

23ME1526: PE1-Lab - Electric and Hybrid Vehicle

Course Outcomes

Upon successful completion of the course the students will be able to:

1. Student will be able to explain the working of electric vehicles and recent trends. (PO-1,PO-10,PO-12) (PSO-1, PSO-2)
2. Student will be able to analyze different power converter topology used for electric vehicle application. (PO-1,PO-10,PO-12) (PSO-1, PSO-2)
3. Student will be able to develop the electric propulsion unit and its control for application of electric vehicles. (PO-1,PO-3,PO-6,PO-10,PO-12) (PSO-1, PSO-2)
4. Student will be able to Design converters for battery charging and explain transformer less topology. (PO-1,PO-3,PO-6,PO-10,PO-12) (PSO-1, PSO-2)

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Study of different systems of Hybrid and electric vehicles.
2	Study of Speed control of DC motor using IGBT.
3	Demonstration of Wiring layout of Electric Vehicles.
4	Study of Control circuit of an Induction Motor
5	Demonstration of Controllers and Actuators in Electric Vehicles.
6	Demonstration of various components of battery and working of its charging system.
7	Demonstration to understand working principle of Electric horn, Brake light and side indicator.
8	Study of various types of Braking systems.
9	Case study of any Electric/ Hybrid car manufactured/sale in India.
10	Visit to servicing station for electric vehicle maintenance, repairs and report.

V SEMESTER

23ME1527: PE1-Advance Welding Techniques

Course Outcomes :
Upon successful completion of the course the students will be able to
1. Justify the concept of advance welding processes applicable to industry..
2. Examine the parameters needed for welding to increase the durability of product.
3. Differentiate the concept of soldering and brazing and cutting process through welding.
4. Evaluate welding defect through welding testing method.

Unit I:	**8 Hrs.**
High energy Density processes, Mode of metal transfer in welding, Use of Inert Gas, Shielded Metal Arc Welding, Gas Tungsten Arc welding, Gas Metal Arc welding, Electron Beam Welding, Principle Bead Welding geometry, Mediums of beam, Vacuum range..	
Unit II:	**7 Hrs.**
Laser Beam welding, Principle, Keyhole technique, applications, Laser materials, Gaseous Lasers.Resistance Welding Methods, Variations in the process, Effect of current, Pressure and resistance on nugget quality, Expulsion of metal, Mushrooming of electrodes, Materials, Direct spot welding, two sides spot welding, multiple spot welding, Shunt current, Electrode material, Seam welding, Projection welding, Butt welding, Flash butt welding, applications.	
Unit III:	**7 Hrs.**
Solid state welding Processes, Classification, Forge Welding, Friction Welding (Friction Stir Welding), Principle, Variables affecting weld quality, Heat generated, Machines used, Ultrasonic welding, Principle, Diffusion Bonding., Explosive Welding.	
Unit IV:	**8 Hrs.**
Brazing, Soldering, ,Capillary action, wetting action, joint designs for sheet metal brazements, brazing filler wire, Butt Joint design for sheet metal brazements, brazing methods, filler materials in brazing, Soldering, materials solder combinations, soldering fluxes, Oxy-fuel welding with chemical reaction. Welding problems and remedies for ferrous and non-ferrous metals	
Unit V:	**8 Hrs.**
Cutting:- Arc cutting, Flame cutting, Plasma cutting, Gouging, Plasma cutting with different gases, Comparision with Oxyacetylene cutting, Oxyacetylene cutting, colour codes for cylinder.Arc welding processes with consumable and non-consumable electrodes, Submerg arc welding	
Unit VI:	**7 Hrs.**
Welding defects, Weldment testing, Destructive and non-destructive testing, Coupon, Determination of yield strengths, ultimate strength, visual Inspection, Dye Penetrant test, penetrants and developers, Eddy current testing, Ultrasonic testing, Magnetic particle Inspection, Radiography testing advantages and application of each method. Welding Procedure specifications, Welder qualification.	
Total Lecture	**45 Hours**

Textbooks:	
1.	Parmar R.S., Welding engineering and technology, 1st edition, Khanna publications (2004).
2.	Parmar R.S., Welding processes and technology, 3rd edition, Khanna publications (2003).

Reference Books:	
1.	Sindo Kou, Welding metallurgy, 2nd edition, John Wiley & Sons (2003).
2.	Kalpakjian S., and Schmid S.R., Manufacturing Engineering and Technology, 6th edition, Pearson Education (2009).
3.	O'Brien R.L., Welding processes, volume 2, eighth edition, Welding hand book (American Welding Society) (1995).

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2.	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042

MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/112/103/112103280/
2.	https://nptel.ac.in/courses/106/106/106106179/
3.	https://nptel.ac.in/courses/127/105/127105007/

V SEMESTER

23ME1528: PE1-Lab - Advance Welding Techniques

Course Outcomes
Upon successful completion of the course the students will be able to 1. Demonstrate the concept of advance welding processes applicable to industry.. 2. Examine the parameters needed for welding to increase the durability of product. 3. Differentiate the concept of soldering and brazing and cutting process through welding. 4. Analyze the welding defect through welding testing method.

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Study of welding Technology.
2	Study of Welding Electrodes in Welding Processes.
3	Study of Effect of welding Parameters.
4	Demonstration of Oxy-fuel Welding.
5	Demonstration of Shielded Metal Arc Welding.
6	Demonstration of Gas Metal Arc Welding.
7	Demonstration of Gas Tungsten Arc Welding.
8	Study of Cold Metal Transfer (CMT) Arc Welding.
9	Study of Welding Defects.
10	Study of Weldment Testing.

V SEMESTER
23ME1529: CNC and Robotics

Course Outcomes :

Upon successful completion of the course, the students will be able to;

1. **Illustrate** the architecture, components, and functioning of CNC and robot systems.
2. **Develop** basic CNC programs for drilling, turning and milling operations.
3. **Analyze** robot kinematics to determine the position and orientation of manipulators.
4. **Evaluate** the integration of CNC and robotic systems in Computer Integrated Manufacturing (CIM) environments for industrial applications.

Unit I: Introduction	**(7 Hrs.)**

NC, CNC, DNC: Introduction, History and Classification of CNC machines, Components of CNC machine, MCU architecture and functionality, Machine Configurations, Types of controls, CNC controller's architecture and characteristics, Interpolators, CNC hardware and control systems.

Unit II: CNC Manual part programming	**(8 Hrs.)**

Manual part programming for CNC drilling, turning and milling operation on machining center. Computer assisted part programming techniques, Conversational and Graphics based software, Solid based part programming.
Freeform surface machining. Simulation and Verification of CNC programs, Adaptive CNC control techniques. Integration of CNC machines for CIM.

Unit III: CNC Tooling and Fixture	**(7 Hrs.)**

Tooling and Fixture: Qualified, semi qualified and preset tooling, Tooling system for Machining centre and Turning centre, work holding devices of CNC Machines, Automatic tool changer.
APT part programming CAD/CAM, APT Words, APT Programming for drilling, turning and milling operation on CNC machines, Part print analysis and Process planning, Advanced Programming features, Canned cycles.

Unit IV: Robotics (Basics and Kinematics)	**(8 Hrs.)**

Robotics: Introduction, history and development, classification, Basic concepts, Robot joints and configurations, Basic robot motions, Types of drives, Robot application (Assembly, inspection, material handling, processing).
Kinematics: Forward solution, Inverse solution, Transformations: Vector operations, Translational transformations and Rotational transformations Properties of transformation matrices, Homogeneous transformations and Manipulator, Introduction to robot dynamics. Robot Controls, Control system concepts, Analysis, control of joints.

Unit V: Robot Programming and Implementation	**(8 Hrs.)**

End effectors, Classification, Mechanical, Magnetic, Vacuum, and Adhesive, Drive systems, Force analysis and Gripper design, Tools for Robot applications (Assembly, inspection, material handling, processing).
Robot programming, Classification, Methods, Languages, Computer control and Robot Software, Programming

Languages (VAL-II, RAPID, KRL, UR Script) Robot Operating System (ROS): Basics of ROS, nodes, topics, messages, Offline programming tools.

Unit VI: Robot Sensors and Perception	**(7 Hrs.)**

Robot Sensors and Perception: Introduction, need, classification, Internal sensors: encoders, gyroscopes, accelerometers, and External sensors: vision systems, ultrasonic, LiDAR, tactile, Proximity, force/torque sensors, IMU, Sensor Fusion: Integration of data from multiple sensors for better perception, Localization and Mapping: SLAM (Simultaneous Localization and Mapping) algorithms. Integration of Robots with CNC machines for CIM.

	Total Lecture	**45 Hours**

Textbooks:

1.	Automation in Production system	2002	Mikell P. Groover	Prentice-Hall of India Pvt. Ltd., New Delhi, 2002
2.	Industrial Robotics: Technology, Programming and Applications,	2012	Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and Ashish Dutta	2nd Edition, Tata McGraw Hill, 2012.
3.	Robot Engineering An Intergrated approach	2004	Klafter R.D., Chmielewski T.A. and Negin M	Springer
4.	Bruno S and Sciavicco L, Robotics: Modelling, Planning and Control, Springer (2009)			

Reference Books:

1.	CNC Technology and Programming	2003	Krar, S., and Gill	Industrial Press Inc
2.	An Introduction to CNC Machining	1991	Gibbs, D.	Industrial Press
3.	Computer Numerical Control Concepts and Programming	1991	Seames, W.S.	Thomson Learning EMEA, Limited
4.	Computer Numerical Control for Machining	1993	Lynch, M	McGraw-Hill
5.	Computer Control of Manufacturing Systems	2005	Koren Y	Tata McGraw-Hill Education
6.	Robotics control, sensing, vision, and intelligence	2004	Fu K.S., Gonzalez R.C., and Lee C.S.G.	Tata McGraw-Hill Education
7.	Robotics Technology and Flexible Automation	2001	Deb S.R	Tata McGraw-Hill Education
8.	Introduction to Robotics Mechanics and Control	2008	Craig J.J	Pearson Education India

YCCE e-library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

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MOOCs Links and additional reading, learning, video material

1.	https://youtu.be/PN_tGm5Gip4?si=RTcuVPcJgyISG8YS
2.	https://youtu.be/_5r2XR1h1aQ?si=NRSnchXTt53s31qx
3.	https://youtube.com/playlist?list=PLbRMhDVUMngcdUbBySzyzcPiFTYWr4rV_&si=4flE0athMawZVFxx

V SEMESTER
23ME1530:CNC and Robotics Lab

Course Outcomes
Upon successful completion of the course the students will be able to
1. Demonstrate different components, tooling and work holding devices of CNC milling and Lathe machine.
2. Simulate the CNC part program for drilling, milling and turning operations.
3. Perform simple jogging operations on five axis FANUC robot.
4. Execute the Robot program for simple pick and place operation on five axis FANUC robot.

Minimum Ten Practical's to be performed from the list below

SN	Experiments based on
1	Review of research article on CNC and Robot
2	Demonstration of Tooling and work holding device of CNC milling and Lathe
3	Demonstration of CNC control panel
4	Performance, Tool offset and work offset setting of CNC milling and Lathe
5	Performance, Simulation on CNC milling (at least two complex geometries of drilling operation)
6	Performance, Simulation on CNC milling (at least two complex geometries of slotting operation)
7	Performance, Simulation on CNC lathe (at least two complex geometries of turning operations)
8	Performance, jogging operation of five axis FANUC robot
9	Performance, programming for simple pick and place operation on five axis FANUC robot
10	Performance/ Practical on Robo Analyzer

V SEMESTER
23ME1531: PE – I : Mechatronics

Course Outcomes :
Upon successful completion of the course the students will be able to : 1. Explain the basic elements of mechatronics system. 2. Analyze the functioning of sensors, transducers and actuators. 3. Analyze and evaluate the electronic elements such as digital circuits, AD convertors, etc. 4. Explain the basics of PLC

Unit I:	**8 Hrs.**
Computer Integration of Electro-Mechanical System, Virtual Instrumentation and Computer Monitoring and control Basics solid state components .Measurement system, Control system, Microprocessor based controllers & its applications, other applications with mechatronic approach, Building blocks of mechatronic system. Comparison between Traditional and Mechatronics approach **Contemporary Issues related to Topic**	
Unit II:	**7 Hrs.**
Classification, Performance terminologies, Displacement, Position & proximity sensors, Photo detectors, Optical encoders, Pneumatic sensor, Hall effect sensor, Velocity & motion sensors: Incremental encoder, Tachogenerator, Piezo electric sensors, Tactile sensors, Flow & temperature sensors: Ultrasonic sensors, Light sensors, Selection of sensors, Interference & noise in measurement. **Contemporary Issues related to Topic**	
Unit III:	**8 Hrs.**
Pneumatic & hydraulic actuation systems: System configuration, Control System & its elements, Linear actuators, Rotary actuators. Mechanical actuation: System types & its configuration, fixed ratio type, Invariant motion profile type, variator etc. Electrical actuation system types & configurations, Mechanical switches, Solid state switches, Solenoids. **Contemporary Issues related to Topic**	
Unit IV:	**7 Hrs.**
Boolean algebra combinational circuits. (Adders, Subtractors, encoders, decoders, multiplexers, de – multiplexers, memory units: RAM, ROM, EPROM etc.), Sequential circuits (Latches, Flip-flops, Counters, Registers). **Contemporary Issues related to Topic**	
Unit V:	**8 Hrs.**
Amplifiers, Operational amplifiers, Ideal model for operational amplification, Inverting amplifier, Non-inverting amplifier, Summer, Difference amplifier, Instrumentation amplifier, Integrator, Differentiator, Sample & hold circuit, Comparator, Basics of filters, Types of filters, Introduction to A/D and D/A converters. **Contemporary Issues related to Topic**	
Unit VI:	**7 Hrs.**
Introduction to MPU & MCU, Interfacing, Introduction to PLC & basics of PLC programming.General philosophy of Artificial Neural Network simulations, Fuzzy logic for operation and control of mechatronic systems. **Contemporary Issues related to Topic**	
Total Lecture	**45 Hours**

Textbooks:	
1.	W. Bolton, Mechatronics, 4th Edition, Pearson Education (India), 2011.

Reference Books:	
1.	M. Mano, Digital Logic & Computer Design, 4th Edition, Pearson, 2016.
2.	HMT Ltd., Mechatronics, 1st Edition, Tata McGraw Hill Publication, 2002
3.	Necsulescu, Mechatronics, Pearson Education (Singapore), 2002.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	https://archive.nptel.ac.in/courses/112/103/112103174/

MOOCs Links and additional reading, learning, video material	
1.	https://onlinecourses.nptel.ac.in/noc21_me27
2.	https://onlinecourses.nptel.ac.in/noc21_me129/preview

V SEMESTER

23ME1532: Lab: PE – I: Mechatronics

Course Outcomes
Upon successful completion of the course the students will be able to 1. Explain the basic elements of mechatronics system. 2. Analyze the functioning of sensors, transducers and actuators. 3. Analyze and evaluate the electronic elements such as digital circuits, AD convertors, etc. 4. Explain the basics of PLC

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Introduction and development of a mechatronic system through a case study.
2	Performance and Demonstration on of operational amplifier.
3	Performance and Demonstration on of rotary encoders.
4	Speed measurement using magnetic pick up coil sensor on DAQ system.
5	Programmable Logic Controller (PLC),PLC Trainer system S7-1200
6	Development of ladder programming using PLC for road junction traffic light control system.
7	Development of ladder programming using PLC for water level control system
8	Development of ladder programming using PLC for washing machine.
9	Development of ladder programming using PLC for soft drink winding machine
10	Development of ladder programming using PLC for the lift simulation
11.	Development of ladder programming using PLC for the pedestrian traffic light control system.
12.	Development of ladder programming using PLC for any other suitable applications.

V SEMESTER
23ME1533: PE-I Computer Aided Manufacturing

Course Outcomes :
Upon successful completion of the course the students will be able to : 1. Apply the knowledge of computer aided manufacturing for product development in an Industry 2. Conduct computer aided manufacturing using 3D CAD models using CNC machines 3. Design parts using CAD and CNC programs using CAM packages for various product manufacturing 4. Analyse different CNC technologies for application in different manufacturing industry 5. Analyse the working methodology of 3D CAD modelling, CNC programming and control and applications in industry

Unit I:	**8 Hrs.**
Introduction to CAM :Computer Aided Manufacturing: CAM Concepts, Objectives & scope, Nature & Type of manufacturing system, Evolution, Benefits of CAM, Role of management in CAM, Concepts of Computer Integrated Manufacturing, Impact of CIM on personnel, Role of manufacturing engineers, CIM Wheel to understand basic functions. **Contemporary Issues related to Topic**	
Unit II:	**7 Hrs.**
NC/CNC Machine Tools: NC and CNC Technology: Types, Classification, Specification and components, Construction Details, Controllers, Sensors and Actuators, CNC machine hardware, step/servo motors. Axis designation, NC/CNC tooling, tool materials, specifications, types of coatings. Contemporary Issues related to Topic	
Unit III:	**7 Hrs.**
CNC Programming (Basic): Positioning system, Cutter offset compensation, Word address format, Introduction to G and M codes Manual part programming for CNC turning, milling and drilling. Contemporary Issues related to Topic	
Unit IV:	**8Hrs.**
CNC Programming (Advanced): Tooling system for Machining center and Turning center, work holding devices of CNC Machines. APT part programming, CAD/CAM programming, Adaptive CNC control techniques. Integration of CNC machines for CIM. Simulation and Verification of CNC programs in NX-CAM environment.	
Unit V:	**8 Hrs.**
Group Technology and CAPP : Group Technology and CAPP, Introduction, part families, part classification and coding systems: OPITZ, PFA, FFA, Cell design, rank order clustering, composite part concepts, Benefits of group technology, Approaches to Process Planning, Different CAPP system, application and benefits. **Contemporary Issues related to Topic**	

Unit VI:	7 Hrs.
Integrated Production Management System: Introduction, PPC fundamentals, Problems with PPC, MRP-I, MRP-II. Just in Time philosophy: JIT & GT applied to FMS, concepts of Expert System in Manufacturing and Management Information System. Contemporary Issues related to Topic	
Total Lecture	**45 Hours**

Textbooks:	
1.	Computer Aided Manufacturing by Tien Chien Chang, Pearson Education
2.	Robotics Technology and Flexible Automation, by S R Deb, S Deb, McGraw Hill Education Private Limited.
3.	Automation in Production system
4.	Flexible Manufacturing Cells and System -William. W. Luggen Hall, England Cliffs, Newjersy
5.	P. Radhakrishnan, " Computer Numerical Control ", New Central Book Agency, 1992.
6.	Computer Aided Manufacturing- Rao, Tewari, Kundra, McGraw Hill, 1993

Reference Books:				
1.	CNC Technology and Programming	2003	Krar, S., and Gill	Industrial Press Inc
2.	An Introduction to CNC Machining	1991	Gibbs, D.	Industrial Press
3.	Computer Numerical Control Concepts and Programming	1991	Seames, W.S.	Thomson Learning EMEA, Limited
4.	Computer Numerical Control for Machining	1993	Lynch, M	McGraw-Hill
5	Computer Control of Manufacturing Systems	2005	Koren Y	Tata McGraw-Hill Education

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
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MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/112105249
2.	https://nptel.ac.in/courses/107106090
3.	https://archive.nptel.ac.in/courses/112/105/112105249/
4.	https://nptel.ac.in/courses/112101098
5.	https://nptel.ac.in/courses/112101099

V SEMESTER

23ME1534: Lab - 23ME1533: PE-I Computer Aided Manufacturing

Course Outcomes
Upon successful completion of the course the students will be able to 1. Apply the knowledge of additive and subtractive manufacturing for product development in an Industry 2. Conduct additive manufacturing using 3D printing methods and subtractive manufacturing using CNC machines 3. Design 3D printing methods and CNC programs for various product manufacturing 4. Analyse different 3D printing and CNC technologies for application in different industry

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	NX CAM basic NX CAM basic tooling overview including work holding and tool holding devices, MCS, WCS, workpiece assignment procedure.
2	Program creation and simulation for face milling operation.
3	Program creation and simulation for mill planar floor and wall, cavity mill, z-level profile milling operation.
4	Program creation and simulation for hole making and planar and contour text engraving operation.
5	Program creation and simulation for boss milling operation.
6	Program creation and simulation for different turning operation including OD, ID turning, grooving, threading, etc.
7	Creation and simulation of program using Feature-based machining.
8	Postprocessing the operations using different postprocessors for creating a CNC program.
9	Creation of shop documentation for the manufacturing operation.
10	Virtual multi-axis CNC machine simulation for the milling and turning operation.

V SEMESTER
23ME1535: PE-I-Two Wheeler Technology

Course Outcomes :

Upon successful completion of the course the students will be able to

1. Student will be able to Classify & Explain various systems of Engine, its function including fuel supply, cooling and lubrication system in a two wheeler. (PO-1,PO-10,PO-12) (PSO-1, PSO-2)
2. Student will be able to Analyze and explain various power transmission systems from clutch to wheel in a two wheeler. (PO-1,PO-10,PO-12) (PSO-1, PSO-2)
3. Student will be able to Student will be able to Classify and Compare control systems like steering, suspension and brakes in a two wheeler. (PO-1,PO-3,PO-6,PO-10,PO-12) (PSO-1, PSO-2)
4. Student will be able to explain and Recommend the necessary electrical and luxurious systems and safety system in a two wheeler. (PO-1,PO-3,PO-6,PO-10,PO-12) (PSO-1, PSO-2)

Unit I:	**7 Hrs.**

Frames, Body and Transmission system: Type of frames: Single cradle frame, Double cradle frame, Tubular frame (Single Down-tube frame using the engine as a stressed member), Body- Monocoque Construction.

Selection of Transmission system components: Cable Actuated Wet Multi-disc clutch, Centrifugal clutch. Chain drive, Belt drive with variator mechanism, Gear drive.

Working of Gear box: its comparison with four wheelers. Gear ratios in scooter and motorcycle. Working of Constant mesh gear box.

Unit II:	**8 Hrs.**

Engines, Fuel Supply System: Induction and Exhaust system: Marks Induction System, Air filter/ Air Cleaner: construction and function.

Two Stroke Engines - Arrangement of Ports in the cylinder, Decompression Valve arrangement. Four Stroke Engines - Overhead Valve and Overhead cam arrangements. Advantages of Multiple valves.

Fuel supply system: Gravity feed and vacuum operated system. Down draught and horizontal/ Side draught carburettor. Carburettor functions and working under various Engine operating conditions like - Idling, Starting, accelerating, normal running. Advantages of electronic fuel injection system.

Unit III:	**8 Hrs.**

Lubrication System and Emission Control System: Construction and function of Exhaust system: Header pipe, Muffler Types and their application, Tail Pipe arrangement and location.

Lubrication and Emission Control Systems: Lubrication system. Petrol Lubrication with Separate Oil Pump for Two stroke engines. Wet sump Pressurized Lubrication in four stroke engines. Block diagram and working of pollution control measures, Catalytic convertor, Exhaust Gas Recirculation, Positive Crankcase Ventilation.

Unit IV:	**7 Hrs.**

Steering and Suspension System, Brakes, Wheels and Tyres: Handle Bar arrangement, Steering fork, Purpose of providing Caster angle. Use of Dampers/ Double acting type of shock absorbers. Use of Variable Rate coil spring, Coil in coil spring arrangement. Advantages of Mono-shock suspension

system. Advantage of Gas filled shock absorber for rear end suspension.
Drum (Mechanical Expanding Shoe type) and disc Brakes (Fixed Caliper and Floating Caliper types.), Mechanical and Hydraulic brakes. Lever operated and pedal operated brakes. Application and criteria for selection of wheels and tyres, their specification for motorcycles, scooters, sports bike.

Unit V:	**8 Hrs.**

Electrical systems-I: Ignition System: Working of Condenser Discharge Ignition (CDI) system. Microprocessor controlled Ignition system block diagram and working. Benefits of Twin Spark Ignition system
Starting system and Charging System: Kick Start and Button Start arrangements. Components of starting system and their functions: D C motor, Battery, Battery Rating for use in Button start vehicles. Schematic circuit and working of charging system. Schematic diagram showing AC and DC circuits.

Unit VI:	**7 Hrs.**

Electrical systems-II: Lighting System and accessories- Specifications and Application of Head Lamp, Tail and number plate Lamp, Purpose of using LED lights in tail lamp, Turn Signal Lamp, Side Stand Indicator Lamp, High Beam Indicator Lamp, Neutral Indicator Lamp, Speedometer Lamp, Horn, Mobile Charger point, Head lamp and tail lamp Reflectors used in two wheelers.
Dash units: Use of Speedometer (Analog and digital), Trip meter. Use of Engine Speed indicator/ Tachometer., Aerodynamic Aspects.

	Total Lecture	**45 Hours**

Textbooks:	
1.	Singh Kirpal, Automobile Engineering, Volume 1 & 2, Standard publishers and distributers, 14th Edition, 2021

Reference Books:	
1.	Ganesan V, Internal Combustion Engines, 4th Edition, McGraw Hill Education, 2012.
2.	Rajpoot R K, A text book of Automobile Engineering, Laxmi publications (P) Ltd., 1st Edition, 2007.
3.	Panchal Dhruv U., Two and Three wheeler Technology, PHI Learning, 2015.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	https://onlinelibrary.wiley.com/doi/10.1002/9781118536186

MOOCs Links and additional reading, learning, video material	
1.	https://archive.nptel.ac.in/courses/107/106/107106088/

V SEMESTER
23ME1536: PE-I : Lab - Two Wheeler Technology

Course Outcomes

Upon successful completion of the course the students will be able to

1. Student will be able to Classify & Explain various systems of Engine, its function including fuel supply, cooling and lubrication system in a two wheeler. (PO-1,PO-10,PO-12) (PSO-1, PSO-2)
2. Student will be able to Analyze and explain various power transmission systems from clutch to wheel in a two wheeler. (PO-1,PO-10,PO-12) (PSO-1, PSO-2)
3. Student will be able to Student will be able to Classify and Compare control systems like steering, suspension and brakes in a two wheeler. (PO-1,PO-3,PO-6,PO-10,PO-12) (PSO-1, PSO-2)
4. Student will be able to explain and Recommend the necessary electrical and luxurious systems and safety system in a two wheeler. (PO-1,PO-3,PO-6,PO-10,PO-12) (PSO-1, PSO-2)

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Observe and sketch the layout of a two wheeler transmission system.
2	Check the following electrical / electronic components, parameters of a two wheeler. CDI system components, Charging System components, Voltage at battery, specific gravity and high discharge test Use service/ operator's manual for specifications.
3	3Adjust idle speed of a two wheeler engine using the specified procedure. Check the Idling Emission using Exhaust Gas Analyzer and do necessary carburetor adjustments for better performance.
4	Check the Ignition Timing of a two-wheeler and compare it with the Workshop/ Operators Manual Specification. Remove, observe, clean the Spark plug and adjust the gap and refit.
5	5Remove and refit rear wheel of a two wheeler - check the conditions of brake shoes, brake drum, bearings etc. Perform brake adjustment. Replace brake cables, brake shoes/ pads.
6	Visit a Two wheeler Dealer Showroom/ Company showroom to obtain Chassis specification of a Scooter/ Motorcycle or scooterate. Share and Compare the data collected for two vehicles in the same category of vehicles (on the basis of Ground clearance, wheel base, engine power, spare wheel, claimed fuel efficiency, load carrying capacity). Prepare a report to identify the better one in the category.
7	Dismantle and assemble a motorcycle clutch and perform clutch adjustments. Replace clutch cable, if required.
8	Carry out lubrication and greasing of a vehicle. Engine, brake linkage, clutch linkage, fork, axle, chain and levers.
9	Demonstration of various components of battery and working of its charging system.
10	Demonstration to understand working principle of Electric horn, Brake light and side indicator.

V SEMESTER
Mandatory Learning Course (Audit Course)
MLC2125 : YCAP5

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2023

6th Semester

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mechanical Engineering)

B. Tech. in Mechnical Engineering

SoE No.
23 ME-101

SN	Sem	Type	BoS/Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
SIXTH SEMESTER															
1	6	PC	ME	23ME1601	Heat Transfer	T	3	0	0	3	3	30	20	50	3
2	6	PC	ME	23ME1602	**Lab :** Heat Transfer	P	0	0	2	2	1		60	40	
3	6	PC	ME	23ME1603	Dynamics of Machines	T	3	0	0	3	3	30	20	50	3
4	6	PC	ME	23ME1604	**Lab :** Dynamics of Machines	P	0	0	2	2	1		60	40	
5	6	PC	ME	23ME1605	Design of Machine Element	T	3	0	0	3	3	30	20	50	3
9	6	PE	ME		**Professional Elective-II**	T	3	0	0	3	3	30	20	50	3
10	6	PE	ME		**Lab : Professional Elective-II**	P	0	0	2	2	1		60	40	
11	6	PE	ME		**Professional Elective-III**	T	3	0	0	3	3	30	20	50	3
12	6	MDM	ME		**MD Minor Course-IV**	T	3	0	0	3	3	30	20	50	3
6	6	**VSEC-4**	ME	23ME1606	**Lab :** Computer Aided Engineering	P	0	0	2	4	2		60	40	
7	6	STR	ME	23ME1607	Project Phase-I	P	0	0	4	4	2		60	40	
8	6	STR	ME	23ME1608	Design Thinking and Research Methodology	T	2	0	0	2	2	30	20	50	3
					TOTAL		**20**	**0**	**12**	**34**	**27**				

List of Mandatory Learning Course (MLC)															
1	6	HS	T&P	MLC126	**YCAP6 :**	**A**	3	0	0	3	**0**				

Professional Elective - II					
1	6	PE-II	ME	23ME1621	**PE-II :** Vibration
2	6	PE-II	ME	23ME1622	**PE-II : Lab :** Vibration Lab
3	6	PE-II	ME	23ME1623	**PE-II :** Referigeration Air conditioning and Cryogenics
4	6	PE-II	ME	23ME1624	**PE-II : Lab :** Referigeration Air conditioning and Cryogenics
5	6	PE-II	ME	23ME1625	**PE-II :** Vehicle Engineering
6	6	PE-II	ME	23ME1626	**PE-II : Lab :** Vehicle Engineering
7	6	PE-II	ME	23ME1627	**PE-II :** Computer Integrated Manufacturing
8	6	PE-II	ME	23ME1628	**PE-II : Lab :** Computer Integrated Manufacturing
9	6	PE-II	ME	23ME1629	**PE-II :** I.C. Engines
10	6	PE-II	ME	23ME1630	**PE-II : Lab :** I.C. Engines
11	6	PE-II	ME	23ME1631	**PE-II :** Earth Moving Equipments
12	6	PE-II	ME	23ME1632	**PE-II : Lab :** Earth Moving Equipments
13	6	PE-II	ME	23ME1633	**PE-II :** Computational Fluid Dynamics
14	6	PE-II	ME	23ME1634	**PE-II : Lab :** Computational Fluid Dynamics
15	6	PE-II	ME	23ME1635	**PE-II :** Solar Energy and Utilization
16	6	PE-II	ME	23ME1636	**PE-II : Lab :** Solar Energy and Utilization

Professional Elective - III					
1	6	PE-III	ME	23ME1641	**PE-III :** Tool Design
2	6	PE-III	ME	23ME1642	**PE-III :** Reliability Engineering
3	6	PE-III	ME	23ME1643	**PE-III :** Advanced Manufacturing Techniques
4	6	PE-III	ME	23ME1644	**PE-III :** Total Quality Management
5	6	PE-III	ME	23ME1645	**PE-III :** Thermal Engineering Systems
6	6	PE-III	ME	23ME1646	**PE-III :** Optimization Techniques
7	6	PE-III	ME	23ME1647	**PE-III :** Project Evaluation & Management
8	6	PE-III	ME	23ME1648	**PE-III :** Fuel Cell Technology
9	6	PE-III	ME	23ME1649	**PE-III :** Design of Experiments and Taguchi Methods

Chairperson	Dean (Acad. Matters)	July, 2023 Date of Release	1.00 Version	Applicable for AY 2023-24 Onwards

VI SEMESTER
23ME1601: Heat Transfer

Course Outcomes :

Upon successful completion of the course the students will be able to:

1. Analyze the problems of unidirectional steady state heat conduction systems.
2. Apply the empirical correlations in convection processes to estimate the heat transfer coefficient.
3. Design the heat exchangers with LMTD & ϵ-NTU methods.
4. Evaluate the net thermal radiation exchange between surfaces and estimate radiation view factors using tables, graphs and the view factor relationships.

Unit I:	**8 Hrs.**

Introduction: Modes of Heat Transfer, Basic Laws of Heat Transfer and Conservation of Energy requirements. Derivation of general Heat conduction equation in Cartesian, Cylindrical and Spherical Co-ordinates, Thermal conductivity, and Thermal diffusivity. One dimensional steady state conduction equation for the plane wall, Cylinder and Sphere, Thermal resistance of composite structures, Contact resistance, and overall heat transfer coefficient.

Unit II:	**7 Hrs.**

Conduction with uniform internal heat generation: within plane wall, solid Cylinder and solid sphere, Extended Surfaces with uniform cross section area, temperature distribution and their heat transfer rate, Fin efficiency and effectiveness. Introduction to Transient heat transfer: lumped analysis.

Unit III:	**7 Hrs.**

Forced Convection: Physical signification of related non-dimensional parameters, Newton's law of cooling, Concept of velocity and thermal boundary layer, heat transfer coefficient.

Using Empirical co-relation (from heat transfer data book) for heat transfer during external and internal flow in laminar and turbulent regime for UHF and UWT condition, for determination of local and average heat transfer coefficient.

Unit IV:	**7 Hrs.**

Natural Convection:

Grashoff number, Rayleigh number, Hydrodynamic and Thermal Boundary Layer. Using Empirical co-relation (from heat transfer data book) for heat transfer during external flow in laminar and turbulent regime for UHF and UWT condition (over plates & cylinders in Horizonal and vertical position, and over sphere).

Heat transfer with phase change (Theory only): Pool boiling phenomenon, curve and regimes of pool boiling,Film and drop wise condensation, effect of superheated and non-condensable gases on condensation heat transfer.

Unit V:	**8 Hrs.**

Heat Exchanger:

Classification of heat exchangers, overall heat transfer coefficient, fouling factor, temperature distribution

Heat Exchanger Analysis for parallel & Counter flow heat exchangers using LMTD Approach and

Effectiveness -NTU approach.		
Unit VI:		**8 Hrs.**
Radiation **Basic Radiation Concepts:** Fundamentals, Basic ideas, spectrum, basic definitions, radiative properties of opaque surfaces, Spectral and directional variations, emissive power, radiosity, intensity of radiation and solid angle, Band Emission. Black Body Radiation Laws: Planck's law, Stefan Boltzmann law, Wien's Displacement law, Kirchhoff's law, Lambert cosine law, **Radiation Energy Exchange:** Concept of black and gray bodies, Radiation exchange between black surfaces, Radiation exchange between gray surfaces Shape Factor Concepts– Definition, relations, and its properties. Radiation network for radiative exchange. Radiation between parallel plates, concentric Cylinders, and concentric spheres & simple enclosures.		
	Total Lecture	**45 Hours**

Textbooks:	
1.	Introduction to heat transfer, Incropera & Dewitt J. Wiley, John Wiley & Sons, 7th Edition (2022).
2.	Elements of heat transfer, M. N. Ozisik, McGraw-Hill, Edition (2023).

Reference Books:	
1.	Heat Transfer, Holman, J. P., McGraw Hill.
2.	Principles of Heat Transfer, Frank Kreith, Harper and Row Publishers, New York.
3.	Heat transfer, S. P. Sukhatme, Universities press, (India), 7th Edition (2020).
4.	Heat Transfer, Yunus A Cengel, McGraw-Hill, Edition (2022).
5	Fundamentals of Heat & Mass transfer, M. Thirumaleshwar, Pearson, 4th Edition (2020).
6	Heat and Mass Transfer Data Book, C. P. Kothandaraman and Subramanian, New Age International Publications, 8th Edition, 2020.
7	Fundamentals of Heat and Mass Transfer, C.P. Kothandaraman, New Age Publishers, 4th Edition.
8	Heat Transfer, Holman, J. P., McGraw Hill.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2.	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042

MOOCs Links and additional reading, learning, video material	
1.	https://onlinecourses.nptel.ac.in/noc19_ch23/preview
2.	https://www.classcentral.com/course/swayam-heat-transfer-10061

VI SEMESTER
23ME1602: Lab – Heat Transfer

Course Outcomes

Upon successful completion of the course the students will be able to:

1. **Analyze** heat transfer rates and temperature distributions across conduction, convection, and radiation modes.
2. **Determine** thermal parameters such as heat transfer coefficients, conductivity, conductance, emissivity, and the Stefan-Boltzmann constant using experimental methods.
3. **Evaluate** performance characteristics of heat transfer equipment based on efficiency, effectiveness, and NTU.
4. **Demonstrate** effective communication, ethical behavior, safety practices, and teamwork in conducting and reporting heat transfer experiments

Minimum Eight Practical's to be performed from the list as below

SN	**Experiments based on**
1.	Determination of thermal conductivity of metal bar.
2.	Determination of thermal conductivity of insulating material in the powder form Lagged Pipe).
3.	Determination of thermal conductance of a composite wall.
4.	Heat Transfer through FINs.
5.	Experiments based on CONVECTION:
6.	Determination of forced convection heat transfer coefficient for fluid flow through a closed conduit.
7.	Determination of natural convection heat transfer coefficient for a vertical surface.
8.	Experiments based on HEAT EXCHANGER:
9.	Determination of effectiveness and overall heat transfer coefficient for parallel flow
10.	and counter flow concentric tube heat exchangers.
11.	Experiments based on RADIATION:
12.	Determination of emissivity of non-black surfaces.
13.	Determination of Stefan-Boltzmann constant.

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B. Tech SoE and Syllabus 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Computer Technology)

B. Tech in Mechanical Engineering

SoE No. 23ME -101

VI SEMESTER

23ME1603: Dynamics of Machines

Course Outcomes :
Upon successful completion of the course the students will be able to: 1. Differentiate static and dynamic forces on different machines and mechanisms. 2. Analyze the unbalanced in rotating & reciprocating machines and corrections required to balance the same. 3. Identify the vibrations in different machines. 4. Evaluate and justify vibrations

Unit I:	**8 Hrs.**
Introduction: D'Alembert principle, Dynamic force analysis of simple mechanism. **Gyroscope:** simple precession and gyroscopic couple, gyroscopic effect on airplane, ship, vehicles and grinding mills.	
Unit II:	**7 Hrs.**
Governors – Classification, Watt, Portal, Proell, Hartnell governors etc, **Flywheel:** Turning moment Vs crank angle diagram for single- cylinder and multiple-cylinder engines, punching machines etc. Flywheel selection	
Unit III:	**8 Hrs.**
Balancing in rotating mechanism: Static & Dynamic balancing in rotating masses, balancing of multiple masses rotating in same plane, Balancing of several masses rotating in different planes, Dynamic balancing machine, Field Balancing.	
Unit IV:	**7 Hrs.**
Balancing of reciprocating masses: Primary and secondary unbalanced forces of reciprocating masses. Partial balancing of unbalanced primary forces in a reciprocating engine. Balancing of primary and secondary force and couples in multiple inline engine, Balancing of radial engines (Direct and reverse crank method)	
Unit V:	**8 Hrs.**
Vibration: Derivation of equation of motion for vibratory system. Free vibration of single-degree-of-freedom system with and without damping. Logarithmic decrement and damping estimation. Forced vibration of single-degree-of-freedom and vibration isolation, whirling of shaft and critical speed of rotors.	
Unit VI:	**7 Hrs.**
Torsional vibration: Torsional oscillation of sngle disc, two-disc and three disc rotors Lagranges equations and introduction to multi degree freedom systems. Equation of motion for two-degree-of-freedom system. Natural frequencies and mode shapes vibration absorber. Torsional oscillation of two-disc and three disc rotors	
Total Lecture	**45 Hours**

			July,2023	1.00	Applicable for AY 2023-24 Onwards
Chairperson	Dean (Acad. Matters)	Dean OBE	Date of Release	Version	

Textbooks:	
1.	Theory of Machines andMechanism 4 Edition (2009) Shigley Oxford University
2.	Theory of Machines andMechanism 2 Edition (1999 Ghosh & Mallik Affiliated East-West
3.	Theory of Mechanism 2 Edition (2005) Rattan S. S Tata McGraw-Hill
4.	Mechanism and Machine Theory 3rd edition 2004 Rao & Dukipatti Wiley & Sons
5	Theory of Vibrations 2nd edition 1995 Thomson W T Prentice Hall of India

Reference Books:	
1.	Theory of Machine 3rd Edition (2009) Thomas Bevan Pearson Education
2.	Theory of Machines 4th Edition (2006) Sandor & Erdman Prentice Hall
3.	Mechanical vibrations 3rd Edition (2009) Grover M.P prentice hall of india
4.	Theory of Machine 3rd Edition (2009) Thomas Bevan Pearson Education
5	Theory of Vibrations 2nd edition 1995 Thomson W T Prentice Hall of India

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1.	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/78.%20Engineering-Mechanics-Statics-and-Dinamics-E-W-Nelson-C-L-Best-W-G-McLean-1st-Ed-1997-Schaum-Outline-McGraw-Hill%20(1).pdf
2.	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/79.%20Engineering%20Mechanics.%20Statics-%20MERIAM%20%20AND%20KRAIGE.pdf
3.	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/81.%20Engineering%20Mechanics%201.pdf

MOOCs Links and additional reading, learning, video material	
1.	https://www.youtube.com/watch?v=nGfVTNfNwnk
2.	https://www.youtube.com/watch?v=6nguX-cEsvw
3.	https://nptel.ac.in/courses/112103108

VI SEMESTER
23ME1604: Lab. Dynamics of Machines

Course Outcomes
Upon successful completion of the course the students will be able to: 1. Differentiate static and dynamic forces ondifferent machines and mechanisms. 2. Analyze the unbalanced in rotating & reciprocating machines and corrections requiredto balance the same. 3. Identify the vibrations in different machines. 4. Evaluate and justify vibrations

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	To determine Gyroscopic couple on motorized Gyroscope
2	To determine Range of Speed, Sleeve Lift, Torque and Power on Watt Governor,.
3	To determine Range of Speed, Sleeve Lift, Torque and Power on Proell Governor,.
4	To determine Balancing of rotating mass, statically and dynamically
5	To determine Balancing of reciprocating masses of a Four Cylinder On-Line Engine.
6	To determine Natural frequency of longitudinal vibration
7	To determine Natural frequency of transverse vibration of beam..
8	To determine Natural frequency of simply supported beam using dunker lays method.
9	To determine Whirling speed of shaft.
10	To determine Natural frequency of torsional vibration of Single rotor system
11.	To determine Natural frequency of torsional vibration of Two rotor system

Nagar Yuwak Shikshan Sanstha's

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B. Tech SoE and Syllabus 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Computer Technology)

B. Tech in Mechanical Engineering

SoE No. 23ME -101

VI SEMESTER

23ME1605: Design of Machine Element

Course Outcomes :

Upon successful completion of the course the students will be able to

1. 1. Analyse the design process, its phases, and the fundamental theories of failure, fatigue, and material selection for mechanical components.
2. Design various types of joints, including welded, bolted, and riveted joints, considering mechanical loading conditions.
3. Design power transmission systems, including power screws, helical springs, leaf springs, brakes, and clutches, for practical applications.
4. Analyse and design pressure vessels and transmission shafts based on strength, rigidity, and industry standards.

Unit I:	**8 Hrs.**
Definition of design, types of design, design process, need, defining the problem, feasibility, design alternatives, final design selection, preliminary and final plant drawings.Theories of failure, Design for Fatigue & manufacturing considerations in design, basis of good design, failure of machine parts, Mechanical properties, Design considerations and selection of materials	
Unit II:	**8 Hrs.**
Design of Joints:Welded joint,design of single transverse, double transverse, parallel fillet, combination fillet butt joint, eccentrically loaded welded joints Design of riveted joints	
Unit III:	**7 Hrs.**
Power screw and Leaf spring :Design of power screw, Design of Helical and Leaf Springs.	
Unit IV:	**8 Hrs.**
Brakes and clutches: Kinematics of Friction Drives such as Brakes, Clutches Design of Friction Clutch, Single Plate, Multiple Plate, Cone, Centrifugal Clutch, Design of Brake, Shoe Brake, Band Brake,, Internal Expanding brake..	
Unit V:	**7 Hrs**
Pressure Vessel: Classification of Thick and Thin Cylindrical Pressure Vessel, Stresses in Thin and Thick Cylindrical Pressure Vessels when it is subjected to internal pressure, Expression for Circumferential and Longitudinal stresses, Design of pressure vessel, Heads and Cover Plate	
Unit VI:	**8 Hrs**
Design of Shafts: Design of transmission Shafts on the Basis of Strength and rigidity, ASME Code for shaft Design, Design of Stepped shaft Axle splined Shaft, Keys	
Total Lecture	**45 Hours**

			July,2023	1.00	Applicable for AY 2023-24 Onwards
Chairperson	Dean (Acad. Matters)	Dean OBE	Date of Release	Version	

Textbooks:	
1	Textbook of Machine Design, R.S. Khurmi, J.K. Gupta,A S. Chand & Company Ltd2022
2	Design of Machine Elements, V.B. Bhandari Tata McGraw-Hill Education2017
3	Mechanical Engineering Design J.E. Shigley, Charles R. Mischke, ,McGraw-Hill Education2022

Reference Books:	
1	Design of Machine Elements,M.F. Spotts, T.E. Shoup, L.E. Hornberger, Pearson
2	Machine Component Design Robert C. Juvinall, Kurt M. Marshek, 2021
3	Machine Design Data Handbook ,K. Lingaiah, McGraw Hill2003

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	https://drive.google.com/drive/folders/1QxdRbGdmv3A7or3oTElz78ao1oDDrbJX?usp=share_link
2.	https://drive.google.com/drive/folders/1wkyz1ZNhhY4T4-MfLsCC9mjZ2xihGgr7

MOOCs Links and additional reading, learning, video material	
1.	https://archive.nptel.ac.in/courses/112/105/112105125/
2.	https://archive.nptel.ac.in/courses/112/105/112105124/
3.	https://archive.nptel.ac.in/courses/112/106/112106137/

VI SEMESTER
23ME1606: Lab: Computer Aided Engineering

Course Outcomes
Upon successful completion of the course the students will be able to
1: **Understand** the principles of FEA and utilize CAE tools to analyze structural, thermal, and dynamic problems in engineering applications.
2: **Develop** models using CFD techniques to simulate and optimize aerodynamics, heat transfer, and fluid behavior in engineering systems.
3: **Utilize** computer-aided design (CAD) and simulation tools to enhance engineering product development, focusing on stress analysis, deformation, and failure modes.
4: **Apply** CAE tools to study coupled interactions between structural, thermal, electromagnetic, and fluid dynamics, enhancing efficiency in real-world engineering challenges.

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Analysis of Plane Truss & Spatial Truss with various cross sections and materials to determine member forces, member strains & stresses, joint deflections under static, thermal and combined loading.
2	2D & 3D beam analysis with different sections, different materials for different loads (forces and moments) with different end supports.
3	Static analysis of plate with a hole to determine the deformations, the Stresses to study the failure behavior.
4	Plane stress, plane strain and axisymmetric loading on the in-plane members with in plane loading to study the stresses and strains.
5	Static analysis of connecting rod with tetrahedron and brick elements.
6	Static Analysis of flat and curved shell due to internal pressure and moments to estimate the strains, stresses and reactions forces and moments with different boundary conditions.
7	Buckling analysis of plates, shells and beams to estimate Buckling Failure and modes.
8	Modal analysis of beams, plates and shells for natural frequencies and mode shapes.
9	Harmonic analysis of a Shaft subjected to periodic force and transient analysis of plate subjected to stepped and ramped loading with varying time
10	Steady state heat transfer Analysis Cross section of chimney and transient heat transfer analysis of solidification of castings.
11.	Nonlinear analysis of cantilever beam with non-linear materials at tip moment and post buckling analysis of shells for critical loads.
12.	CFD analysis of aerofoil design.

VI SEMESTER
23ME1607: Project Phase-I
Project (Phase-1)

Projects help to bridge the gap between theory-based learning and skills-based learning. The Projects fulfill the purpose of synthesizing the knowledge acquired during the years and demonstrating the student's aptitude by applying the knowledge.

Course Objectives of Major Project (Phase-1):

1. To provide an opportunity of designing and building complete system or subsystems based on areas where the student likes to acquire specialized skills.
2. To obtain hands-on experience in converting a small novel idea / technique into a working model / prototype involving multi-disciplinary skills.
3. To embed the skill in a group of students to work independently on a topic/ problem/ experimentation selected by them and encourage them to think independently on their own to bring out the conclusion under the given circumstances of the curriculum period in the budget provided with the guidance of the faculty.
4. To encourage creative thinking processes to help them to get confidence by planning and carrying out the work plan of the project and to successfully complete the same, through observations, discussions and decision-making process.

The students in a group of not more than FOUR will work under the guidance of the faculty member on the project work undertaken by them. The completion of work, the submission of the report and assessment should be done at the end of the Semester.

The project work may consist of,

1. A comprehensive and up-to-date survey of literature related to study of a phenomenon or product.
2. Design of any equipment and / or its fabrication and testing.
3. Critical Analysis of any design or process for optimizing the same.
4. Experimental verification of principles used in applications related to Production Engineering.
5. Product design and development
6. Software development for applications.
7. Industry needs based basic survey or Testing or Analysis etc.
8. A combination of the above.

Course Outcomes for Major-Project (Phase-1)

CO	STATEMENT
CO1	1) Plan (L5) and accomplish (L6) an innovative engineering mini-project, within given constraints, using knowledge and skills developed during the course.
CO2	2) *Investigate (L6) a complex problem by formulating (L6) a research question, appraising current literature and developments, and applying (L3) research principles/ methods to produce (L6) scientific content in the form of technical report, thesis, publications, posters and patents.*
CO3	3) Apply (L3) technological tools/methods/ software effectively to design (L6)/ formulate and conduct(L6) experiments and then Correlate (L4) the theoretical and experimental/simulations results and draw (L3) the proper inferences to come out with concrete solutions.
CO4	4) Develop (L6) conceptual and engineering design/ formulation of any process/mechanical components/ system and also to fabricate/ simulate/operate them applying (L3) different technical skills, engineering tools /management principles/ processes/ application software effectively within technical, budgetary, risk, ethical, societal and time constraints.
CO5	5) Apply (L3) problem-solving methodologies to generate (L6), evaluate (L5) and justify (L4) innovative solutions
CO6	6) Reflect (L5) on professional engineering practice, management principles and its impact on the project, including safety, ethical, legal, social, cultural and sustainability considerations, along with knowledge of contemporary issues
CO7	7) Demonstrate (L3) professionalism, integrity, ethical conduct and professional accountability in all aspects of project work, including teamwork and multidisciplinary approach.
CO8	8) Demonstrate (L3) effective professional written and oral communication to a variety of audiences through proposals, reports, documentation and presentations.
CO9	9) Justify (L5) the need for lifelong learning activities to cope up with technological changes.

VI SEMESTER
23ME1608: Design Thinking in Mechanical Engineering and Research Methodology

Course Outcomes :

Upon successful completion of the course the students will be able to

1. Demonstrate a proficient and deep understanding of the core concepts of 'design', 'designing', 'designer', 'designer lines' and 'design thinking'.
2. Critically reflect upon and evaluate their progress in understanding the importance of key design issues and values, such as accessibility, diversity, viability, and sustainability.
3. Critically evaluate designs-in-use and proposed design ideas, from the perspectives of key stakeholders, applying appropriate design values.
4. Explore a design challenge, being prepared to take the lead in formulating a clear and actionable brief, using participatory, empathetic, and creative research methods.
5. Critically evaluate the selection and application of different research methods when applied to design challenges with varying goals and complexities.

Unit I: **8 Hrs.**

Introduction to Design Thinking

Traditional engineering design vs design thinking; limitations of purely analytical design. Principles of design thinking: empathy, define, ideate, prototype, test; Double Diamond model (discover–define–develop–deliver). Role of design thinking in mechanical systems, products, and manufacturing (e.g., consumer products, automotive, medical devices). Formulating problem statements, "How Might We" questions, and design briefs specific to mechanical systems.

Unit II: **7 Hrs.**

Ideation and Concept Generation and Product Development

Function decomposition and concept generation for mechanical products; use of function structures and working structures. Iterative prototyping, design of experiments for concept evaluation, user testing and feedback capture. Integration with product development cycle: requirements, specification, material selection, manufacturability, life-cycle considerations. Systems mapping for complex mechanical systems: interfaces, dependencies, constraints.

Unit III: **7 Hrs.**

Research Fundamentals, Research Problem and Design, Literature Review

Research Fundamentals: Definition, objectives, and significance of research, Types of research: Basic, Applied, Descriptive, Analytical, Quantitative, and Qualitative.

Research Problem and Design: Criteria of good research, Techniques for defining and identifying a research problem, Features of good research problem/design, Necessity of defining the problem, Meaning of research design, Types of research design – Exploratory, Descriptive, Diagnostic, and Experimental

Literature Review: Importance and methods of conducting a literature review, Sources of information: Journals, conferences, patents, etc., Technical reading strategies.

Unit IV:	7 Hrs.

Sampling and Data Collection, Data Analysis and Interpretation, Technical Writing, Research Ethics

Sampling and Data Collection: Sampling techniques: Probability and Non-probability sampling, Characteristics of a good sample, Sample size determination, Data types: Primary and Secondary, Methods of primary data collection: Observation, Interview, Questionnaire, Schedule, Secondary data sources

Data Analysis and Interpretation: Processing and analyzing data, Statistical tools: Measures of central tendency, Dispersion, Correlation, Regression, Hypothesis testing: Null and alternative hypothesis, Use of software tools (e.g., Excel/SPSS/MATLAB for analysis), Interpretation of results

Technical Writing, Research Ethics: Publication ethics and responsibilities of researchers, Structure and components of research report, Types of technical reports and papers, Writing thesis and dissertations, Referencing and citation styles (APA, IEEE, etc.), Ethical considerations in engineering research., Plagiarism and research ethics

Textbooks:	
1	C.R. Kothari – Research Methodology: Methods and Techniques, New Age International.
2	Ranjit Kumar – Research Methodology: A Step-by-Step Guide for Beginners, Sage Publications.
3	Levine, Effective Problem Solving, 2nd edition, Prentice Hall, Upper Saddle River, NJ,1994
Reference Books:	
1	R. Panneerselvam – Research Methodology, PHI Learning.
2	Dawson, C. – Practical Research Methods, UBS Publishers.
3	Trochim, W.M.K. – Research Methods: The Concise Knowledge Base.
4	Activities for Teaching creativity and Problem Solving - By Arthur B Vangundy - Pfeiffer
5	Whimbey and J. Lochhead, Problem Solving & Comprehension, 6th edition, Lawrence Erlbaum, Mahwah, NJ, 1999.
6	Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
7	Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing.
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	https://drive.google.com/file/d/1O34NfmtQHJgRBGXuXn4cvwDsqVvpV76X/view
MOOCs Links and additional reading, learning, video material	
1	www.nptelvideos.in
2	www.coursera.com
3	www.udemy.com
4	swayam.gov.in

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech SoE and Syllabus 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Computer Technology)

B. Tech in Mechanical Engineering

SoE No. 23ME -101

VI SEMESTER

23ME1621: PE- II Vibration

Course Outcomes :

Upon successful completion of the course the students will be able to:

1. The student will have ability to analyze various types of Vibrations..
2. The student will have ability to measure Vibrations and carry out its analysis..
3. The student will have ability to analyze multi degree freedom systems.
4. The student will have ability to analyze continuous systems.
5. The student will have ability to use of FFT in vibration analysis for condition monitoring purpose.

Unit I:	**8 Hrs.**
SINGLE DEGREE OF FREEDOM: Free body diagram, free & forced vibration, un damped and damped single degree of freedom systems subjected to harmonic and other periodic excitations. Impulse response response to arbitrary excitation. Vibration isolation and transmissibility., structural damping	
Unit II:	**7 Hrs.**
Energy method applied to TWO degree freedom system. Lagranges equation. Generalized mass formulation of mass , damping and stiffness matrix and its numerical solutions . Vibration absorber, conservative and non conservative systems. Geared rotor system, Influence Coefficients and flexibility matrix of bending vibration of beam and multi-disc rotor. Mode shapes and orthogonality principle	
Unit III:	**8 Hrs.**
Numerical techniques for Multi **degree** freedom system. systems. Matrix iteration method. Holzer's method for torsional vibration. Dunkerley's method for critical speed determination of multi disc rotor. Rayleigh quotient sweeping matrix method for determination of all the natural frequencies and mode shapes. Rayleigh Ritz method. Modal matrix and expansion theorem. Free and forced response by modal analysis.	
Unit IV:	**7 Hrs.**
Vibration of continuous system. Axial vibration of rod, bending vibration of beam and torsional vibration of shaft. Hamilton's principle and derivation of equation of motion, Rayleigh quotient. Modal co-ordinates and modal forces.Free and forced response through modal analysis	
Unit V:	**8 Hrs.**
Vibration pickup, seismometers, accelerometer, proximity probe spectrum analyzer, FET & DFT (Discrete FT), torsional, Vibration measurement, Digital vibration measurement, philosophy of vibration. condition monitoring	
Unit VI:	**7 Hrs.**
Noise Control in Mechanical System: Noise Control in Mechanical System: Review of Fundamentals: Noise and vibration measurement units, levels, decibels, spectra.Objective/Subjective noise measurement-scales; Addition andsubtraction of decibles; Frequency analysis bandwidths; Industrial Noise and Vibration Control: Basic sources of industrialnoise and vibration, basic industrial noise and vibration control methods	
	Total Lecture **45 Hours**

			July,2023	1.00	Applicable for AY 2023-24 Onwards
Chairperson	Dean (Acad. Matters)	Dean OBE	Date of Release	Version	

Textbooks:	
1.	Theory of vibration- 2007 – 5 Edition- Thomson W.T **Publisher** Prentice hall
2.	Elements of vibration analysis2007 Special Indian Edition Meirovitch L McGraw-Hill Science/Engineering/Math; 2 Sub edition (January 1, 1986)
3.	Mechanical vibration 2011 – 5 Edition Rao J.S.;Gupta K Wiley Eastern, c1984

Reference Books:	
1.	Theory of vibrations 1983 Morse TSE; Hinkle New Delhi: CBS Publishers, 1983.
2.	Advanced theory of vibration 1992Rao J.SWiley, 1992
3.	Hibbeler R.C, Engineering Mechanics (Statics and Dynamics), Pearson Publication, Singapore, 2000.
4.	Vibration condition Monitoring ofMachines 2000 Rao J.S Alpha Science International Limited, 2000
5.	Beer F.P. and Johnston E.R; Vector Mechanics for Engineers, 9th edition Tata Mc. Graw Hill Publication, New Delhi. 2007.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/78.%20Engineering-Mechanics-Statics-and-Dinamics-E-W-Nelson-C-L-Best-W-G-McLean-1st-Ed-1997-Schaum-Outline-McGraw-Hill%20(1).pdf
2	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/79.%20Engineering%20Mechanics.%20Statics-%20MERIAM%20%20AND%20KRAIGE.pdf
3	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/81.%20Engineering%20Mechanics%201.pdf
MOOCs Links and additional reading, learning, video material	
1.	https://www.youtube.com/watch?v=nGfVTNfNwnk
2.	https://www.youtube.com/watch?v=6nguX-cEsvw
3.	https://nptel.ac.in/courses/112103108

VI SEMESTER

23ME1622: PE – II- Lab - Vibration

Course Outcomes
Upon successful completion of the course the students will be able to: 1. 1. The student will have ability to analyze varioustypes of Vibrations.. 2. The student will have ability Evaluate vibrations and carry out its analysis.. 3. The student will have ability to analyze Predict/judge vibration parameters and evaluate through different approaches for multidegree freedom system. 4. The student will have ability to analyze continuous systems.

Minimum Eight Practical's to be performed from the list as below

SN	**Experiments based on**
1	To determine Frequency of single degree freedom system.
2	To Study the Transverse Vibrations of Cantilever Beam and to determine the frequency or period ofVibration (oscillation) theoretically and actually by experiment.
3	determination of modes shapes for two degree freedom systems
4	determination of modes shapes for three degree freedom systems
5	To determine natural frequency of Torsional vibration of geared system
6	To Study the forced vibration of equivalent spring mass System
7	To Study the Free Vibration of two rotor and three rotor System and to determine the natural frequency ofvibration theoretically & experimentally.
8	To verify the Dunkerley's Rule.
9	Determination of Whirling of shaft.
10	To Study the Free Vibration of Multi rotor System and to determine the natural frequency of vibration theoretically & experimentally
11	To study the effect of damping on natural frequency and plot frequency response curves at various damping coefficient.
12	To determine vibration parameters (Amplitude Velocity acceleration for machines using Vibrometer on Engine
13	To determine vibration parameters (Amplitude Velocity acceleration for machines using Vibrometer on Motor

VI SEMESTER

23ME1623: PE-II : Refrigeration Air conditioning and Cryogenics

Course Outcomes :

Upon successful completion of the course the students will be able to:

1. Understand and determine various psychrometric properties of air, analyze various psychometric process and will be able to apply it to live problems.
2. Analyze various types of VCRS and Cryogenics systems.
3. The students will be able to understand about other refrigeration systems

Unit I:	**8 Hrs.**

Psychrometry: Introduction, psychometric properties of air, psychometric chart, psychometric Processes, bypass factor, apparatus dew point temperature.

Human Comfort: Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart

Unit II:	**7 Hrs.**

Advanced Psychrometry: Application of psychrometry to various air-conditioning systems. RSHF, GSHF, ESHF, air washers, air coolers.

Heat Load Calculations: Data collection for load calculation. Various components of heat load estimate. Methods of cooling load calculation. Demonstration of air conditioning systems to students

Unit III:	**8 Hrs.**

Refrigeration: Introduction, Definition, Applications. Study of simple vapour compression refrigeration system. Analysis of simple vapour compression refrigeration system, effect of sub cooling, superheating, polytropic compression & pressure drops on the performance of the system. Demonstration of performance of VCRS to students.

Unit IV:	**7 Hrs.**

Multistage Vapour Compression Refrigeration Systems:

Multiple compressor & multiple evaporator systems, cascade refrigeration systems. Study of equipment's such as compressors, evaporators, expansion devices & controls defrosting methods (types & principle only). Testing & charging of refrigeration systems. Demonstration of above equipment's to students.

REFEGERANTS:

Nomenclature of refrigerants, refrigerant properties, mixture refrigerants, global warming potential & Ozone depletion potential, Montreal & Kyoto protocol, alternate refrigerants.

Importance of the ethical principles in the selection and use of refrigerants, focusing on environmental impact, sustainability, and compliance with national and international regulations like the Montreal and Kyoto Protocols.

Unit V:	**8 Hrs.**
Study of Vapour Absorption Refrigeration System: Introduction Ammonia-Water, Lithium bromide-water systems, three fluid refrigerators. **Other Refrigeration Techniques:** Air cycle refrigeration, Applications in air refrigeration systems, Vortex tube, and thermoelectric refrigeration	
Unit VI:	**7 Hrs.**
Cryogenics: Introduction and applications of cryogenics, Cascade refrigeration, Joules Thomson effect, methods of air liquefaction, Linde's and Claude's cycle. Liquefaction of hydrogen, Liquefaction of helium, cryogenic insulation. Hazards and safety, production of dry ice.	
Total Lecture	**45 Hours**

Textbooks:	
1.	Arora C.P.; Refrigeration and Air conditioning, 4th Ed.; 2021 Tata Mc Graw Hill Publication
2.	Ballaney P.L.; Refrigeration and Air conditioning; Khanna publishers, 2020
3.	Prasad Manohar; Refrigeration and Air conditioning, 3rd Ed.; New edge Publication.2021
4.	Arora, Domkundwar; A course in Ref. &Air Conditioning, 8th Ed.; Dhanpat Rai Publications. 2016

Reference Books:	
1.	Pita Edward G.; Air conditioning principles and systems, 4th Ed.; Prentice Hall
2.	Dossat Roy J.; Principles of Refrigeration, 4th Ed.; Pearson Education Asia Publication
3.	ASHRAE handbook and CARRIER hand book.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	**https://books.google.com/books/about/Textbook_of_Refrigeration_and_Air_Condit.html?id=4vhP2jXJ3HEC**
MOOCs Links and additional reading, learning, video material	
1.	https://archive.nptel.ac.in › courses
2.	https://archive.nptel.ac.in › courses

VI SEMESTER

23ME1624: PE – II- Lab - Refrigeration Air conditioning and Cryogenics

Course Outcomes

Upon successful completion of the course the students will be able to:

1. Understand and determine various psychrometric properties of air, analyze various psychrometric process and will be able to apply it to live problems.
2. Analyze various types of VCRS and Cryogenics systems.
3. The students will be able to understand about other refrigeration systems

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Experiment on Determination of COP of Air conditioning trainer [CO:1]
2	Experiment on Determination of COP of Refrigeration trainer [CO:2]
3	Trial on ice-plant test rig [CO:2]
4	Study of expansion devices used in vapour compression refrigeration system [CO:2]
5	Study of condensers and cooling towers used in vapour compression refrigeration system [CO:2]
6	Study of Evaporators used in vapour compression refrigeration system [CO:2]
7	Study of vapour absorption refrigeration system [CO:3]
8	Study of Electrolux refrigeration system [CO:3]
9	Study of controls used in refrigeration system [CO:2]
10	Visit to air liquefaction plant [CO:4]
11	Visit to cold storage [CO:4]
12	Visit to Industrial cooling tower [CO:4]
13	Visit to ice plant [CO:4]

VI SEMESTER
23ME1625: PE-II: Vehicle Engineering

Course Outcomes :
Upon successful completion of the course the students will be able to 1. **Classify & Evaluate** various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle. 2. **Analyze and Discuss** various power transmission systems from clutch to wheel in vehicle. 3. **Analyze** control systems like steering, suspension and brakes in vehicle 4. **Analyze and recommend** the necessary electrical and luxurious systems and safety system in vehicle.

Unit I:	**7 Hrs.**
Introduction to Automobile: Introduction, Automobile history and development and classification. Vehicles layout. Engine Classification, construction and working 2 stroke and 4-stroke cycle. Introduction to Fuel supply system: Carburettor and fuel injection.(Only basic). Engine cooling and lubrication systems.	
Unit II:	**7 Hrs.**
Primary Transmission System: Clutch – Necessity, requirements of a clutch system. Types of Clutches: Single & multi plate clutch, Diaphragm clutch and centrifugal clutch. Gear box: Necessity of gear box with gear theory, working principle, Classification: Sliding mesh, constant mesh, synchromesh, and Transfer case gear box, Gear Selector mechanism, Defects and remedies in Gear box. Working of CVT (Continuous variable transmission)	
Unit III:	**7 Hrs.**
Secondary Transmission System: Transmission system: Propeller shaft, Universal joint, Hotchkiss drive, torque tube drive. Differential - Need and working principle and Differential lock. Rear Axles and Front Axles Wheel and Tyres: Classification, various constituents of tyres with cross section, specification, factors affecting tyre performance.	
Unit IV:	**8 Hrs.**
Control system of automobile: Steering systems, principle of steering, steering linkages, steering geometry and wheel alignment, steering gear box and its types. Brakes - Need, types: Mechanical, hydraulic (Master and wheel cylinder), Air brakes. Drum and Disc brakes, Comparison Suspension systems – Function, conventional and independent suspension System,	
Unit V	**8 Hrs.**
Electrical System of Automobile: Electrical systems: Battery construction. Specification. Operation and maintenance of Batteries. Alternator, starter motor, Battery Ignition and magneto ignition systems, Lighting, Horn, Side indicator, wiper. (only basic)	

Unit VI	8 Hrs.
Resistance to vehicle motion: Air, Road and gradient resistance and power calculation. Advances in automobiles such as ABS, Power Steering. Automobile air-conditioning. Panel board instruments. Safety aspect in Automobile. Overall Vehicle specifications. Servicing, Overhauling and Engine tune up	
Total Lecture	45 Hours

Textbooks:	
1.	Kirpal Singh, Automobile engineering Vol-1, Standard Publishers Distributor Delhi, 2017
2.	Kirpal Singh, Automobile engineering Vol-2, Standard Publishers Distributor Delhi, 2017

Reference Books:	
1.	Automotive Technology, By H.M. Sethi: Publication: Tata McgraHill
2.	Automobile Engineering :S. K. Kataria & sons I & II :By P.S. Gill Publication
3.	Automotive Machanics By Joseph Heitner

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1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042
MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/112/103/112103280/
2.	https://nptel.ac.in/courses/106/106/106106179/
3.	https://nptel.ac.in/courses/127/105/127105007/

VI SEMESTER
23ME1626: PE – II- Lab - Vehicle Engineering

Course Outcomes
Upon successful completion of the course the students will be able to 1. **Classify & Evaluate** various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle. 2. **Analyze and Discuss** various power transmission systems from clutch to wheel in vehicle. 3. **Analyze** control systems like steering, suspension and brakes in vehicle 4. **Analyze and recommend** the necessary electrical and luxurious systems and safety system in vehicle

Minimum Eight Practical's to be performed from the list as below

SN	**Experiments based on**
1	Demonstration and analysis of various layouts for automobile.
2	Demonstration of various I.C. Engine systems and components
3	Demonstration of Clutch
4	Demonstration of Gear box
5	Demonstration of Final drive
6	Demonstration of working Hydraulic Braking system
7	Demonstration of front wheel steering geometry and steering mechanisms.
8	Demonstration of suspension system of a four-wheeler.
9	Demonstration of Electrical systems Battery, Charging and self-starting system etc
10	Visit Report

VI SEMESTER
23ME1627: PE- II Computer Integrated Manufacturing

Course Outcomes :

Upon successful completion of the course the students will be able to:

1. Design and evaluate experimentation on CNC machines.
2. Designing of GT cell layouts for transforming into flexible manufacturing system.
3. Compose and transform robot programs various industrial applications.
4. Justify the role of CAPP and CAQC in computer integrated manufacturing.

Unit I:	**8 Hrs.**
Concept and scope of CIM, components of CIM, benefits, limitations.Basics of computer graphics NC basics, NC words, Manual part programming (NC part programming) Punch Tape, Tape Format CNC , DNC, APT programming Adaptive control, application. Tooling for CNC machine.	
Unit II:	**7 Hrs.**
Introduction to Group Technology, Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT. Part families , classification and coding , Production flow analysis , Machine cell design , Benefits	
Unit III:	**8 Hrs.**
Introduction & Components of FMS , Application work stations , Computer control and functions , Planning, scheduling and control of FMS , Scheduling , Knowledge based scheduling , Hierarchy of computer control , Supervisory computer Manufacturing data systems , data flow , CAD/CAM considerations , Planning FMS database	
Unit IV:	**7 Hrs.**
Industrial robotics Robot anatomy, Robot control, accuracy, repeatability, End Effectors Sensor, Introduction to robot programming, Robot application (Material handling processing assembly and inspection) introduction to robot Kinematics.	
Unit V:	**8 Hrs.**
Process Planning in the Manufacturing cycle , Process Planning and Production Planning Process Planning and Concurrent Engineering, CAPP, Variant process planning , Generative approach , Forward and Backward planning, Input format, Logical Design of a Process Planning , Implementation considerations ,manufacturing system components, Automated material handling systems, AS/RS, general considerations , selection, evaluation and control . Inspection and Quality control, CAQC, CMM types, working, applications Expert process planning	
Unit VI:	**7 Hrs.**
Totally integrated process planning systems, Integration of CNC robotics for CIM, Agile manufacturing, Nano Manufacturing. Simulation	
	Total Lecture **45 Hours**

Textbooks:	
1.	Groover, M.P., *Automation, Production Systems, and Computer Integrated Manufacturing*, 3rd Edition, Prentice-Hall, 20077.
2.	Zhuming Bi, Xiaoqin Wang, *Computer Aided Design and Manufacturing*, Wiley, 2020
3.	PHI Learning, *Computer Integrated Manufacturing*, PHI Learning Pvt. Ltd., 2008
4.	Zhuming Bi, Xiaoqin Wang, *Pltw CIM Computer Integrated Manufacturing Study Guide*, 2020

Reference Books:	
1.	Chang, T.C., Wysk, R.A., Wang, H.P., *Computer-Aided Manufacturing*, 3rd Edition, Prentice-Hall, 2006
2.	Rembold, U., Blume, C., Dillman, R., *Computer-Integrated Manufacturing Technology and Systems*, CRC Press
3	Boothroyd, G., Poli, C., Murch, L.E., *Automatic Assembly*, CRC Press
4	Talavage, J., Hannam, R.G., *Flexible Manufacturing Systems in Practice: Applications, Design, and Simulation*, CRC Press
5	Nolen, J., *Computer-Automated Process Planning for World-Class Manufacturing*, CRC Press
6	Arabian, J., *Computer Integrated Electronics Manufacturing and Testing*, CRC Press

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	
MOOCs Links and additional reading, learning, video material	
1.	NPTEL: Computer Integrated Manufacturing (Prof. Janakarajan Ramkumar, IIT Kanpur)
2.	NPTEL Archive: Computer Integrated Manufacturing (Dr. Janakarajan Ramkumar, IIT Kanpur)

VI SEMESTER
23ME1628: PE – II- Lab - Computer Integrated Manufacturing

Course Outcomes
Upon successful completion of the course the students will be able to: 1. **Demonstrate** and **operate** various CAD, CNC, and robotic systems to illustrate the fundamental principles of Computer Integrated Manufacturing. 2. **Develop** and **analyze** part programs for CNC Lathe and Milling machines using both manual and APT programming techniques. 3. **Design** and **evaluate** Group Technology cell layouts and Flexible Manufacturing Systems to optimize manufacturing processes. 4. **Compose** and **simulate** robot programs and automated guided vehicle systems for diverse industrial applications, and **justify** the use of CAPP and CAQC in integrated manufacturing environments.

Minimum Eight Practical's to be performed from the list as below:

SN	Experiments based on
1	Study of CIM (Computer Integrated Manufacturing).
2	Study of CAD systems.
3	Numerical Control – Fundamentals & Applications.
4	CNC Lathe – Features, Specification, & Part Programming.
5	CNC Milling – Features, Specification, & Part Programming.
6	Group Technology.
7	FMS (Flexible Manufacturing Systems) & CIM.
8	Computer Aided Process Planning.
9	Manual Part Programming.
10	APT Part Programming.
11	Robots – Fundamentals and Applications.
12	AGVS (Automated Guided Vehicle Systems) – Fundamentals and Applications.
13	CNC Lathe – Programming, Simulation & Actual Machining of Part (Thread Cutting, Facing, Turning, Grooving, etc.).
14	CNC Milling – Programming, Simulation & Actual Machining of Part (Profile Cutting, Various Interpolation, Pocketing, Mirroring, etc.).
15	Programming and Simulation of Robot.

VI SEMESTER

23ME1629: PE- II I.C. Engines

Course Outcomes :
Upon successful completion of the course, the students will be able to. 1.Understand I.C. Engines fundamentals 5. Analyze thermodynamic cycles, fuel injection systems in SI And CI engine 6. Analyze combustion and combustion process in C. I. Engines and S. I. Engine. 7. Analyze Engine performance of I C engine and emissions

Unit I:	**8 Hrs.**
Engines classification, Working cycles and operation, P-V, Valve Timing diagrams, Engine components and their material. Engine cycle Energy Balance, various losses in the engine like Frictional losses, blow by losses, pumping loss etc. Engine Lubrication systems, cooling systems and their importance	
Unit II:	**7 Hrs.**
I.C. Engines fuel and its desirable properties. Requirements of Spark Ignition and Compression Ignition Engine fuel other fuel like CNG, LPG, Alcohols. Rating of I.C. engine fuels.	
Unit III:	**8 Hrs.**
S. I. Engine: A-F mixture requirements, Basic principle, Simple Carburetor and systems like main metering, choke, idle, acceleration pump. Operating difficulties for carburetors. Petrol Injection SPFI, MPFI, Direct Gasoline Injection, Ignition system & components for S.I. Engine - Battery, Magneto & Electronic.	
Unit IV:	**8 Hrs.**
Combustion in S. I. Engine: Stages of combustion with p-θ diagram. Factors affecting various stages of combustion. Abnormal combustion Pre ignition, Detonation and Knocking. S.I. Engine combustion chamber	
Unit V:	**7 Hrs.**
Fuel supply systems for C.I. Engine: Requirements of an ideal FI system, Types of Injection, Fuel injection pumps, fuel injectors and nozzles. Combustion in C. I. Engines. Stages of combustion with p-θ diagram, Factors affecting various stages of combustion. Abnormal combustion Diesel Knock, Supercharging and turbo charging in engine.	
Unit V:	**7 Hrs.**
. Engine performance Parameters. MEP, Torque, speed, power, Specific fuel consumption and various efficiencies., Air measurement, Excess air and Volumetric efficiency, Measurement and Testing of friction power, indicated power, Brake power, Fuel consumption, Air consumption, etc. Heat balance sheet calculation. Air pollution from I.C. Engines and their control using EGR, Catalytic converters, particulate traps	
Total Lecture	**45 Hours**

			July,2023	1.00	Applicable for AY 2023-24 Onwards
Chairperson	Dean (Acad. Matters)	Dean OBE	Date of Release	Version	

Textbooks:	
1	Heywood, J. B, , *Internal Combustion Engine Fundamentals*, McGraw Hill Publishing Co., New York, 1990
2	I. C. Engines by Mathur & Sharma, Dhanpatrai, 2018
3	I. C. Engines by V.Ganeshan, Tata McGraw Hill, 2017
4	I. C. Engines by Domkundwar & Domkundwar, Dhanpatrai, 2018
5	I. C. Engines by R.K.Rajput, Laxmi Prakashan, 2017
6	I. C. Engines by R. Yadav, Central Pub., Allahabad, 2017

Reference Books:	
1	Sharma, S. P, Chandramohan, Fuels and Combustion, Tata McGraw Hill Publishing Co, 1987
2	Pulkrabek, W. W., Engineering Fundamentals of the Internal Combustion Engine, Prentice-Hall of India Private Limited, 2002
3	Prof. P.L. Ballaney, Internal Combustion Engines, Khanna Publications, Delhi, India
4	R.K. Mohanty, A Text Book of Internal Combustion Engines, Standard Book House, Delhi, India
5	Fundamental of Internal Combustion Engine – Paul W. Gill, James H. Smith, Eugene J. Ziurys Oxford and IBH Publishing Company
6	Obert, E.F., Internal Combustion Engine and Air Pollution, International Text Book Publishers, 1983.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	https://link.springer.com/book/10.1007/978-3-662-43715-5
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042
3	https://onlinelibrary.wiley.com/doi/10.1002/9781119902973.ch4
4	https://onlinelibrary.wiley.com/doi/book/10.1002/9781119902973?SeriesKey=10.1002/97804701042
MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/112106133
2	https://nptel.ac.in/courses/112103249

VI SEMESTER
23ME1630: PE – II- Lab - I.C. Engines

Course Outcomes

Upon successful completion of the course the students will be able to

1. Apply concepts of thermodynamics to identify and explain the working of IC engine systems and their subcomponents.
1. Analyze lubrication, cooling, and fuel systems to assess their impact on engine performance and efficiency
2. Evaluate engine performance parameters and prepare heat balance sheets based on experimental observations
3. Apply instrumentation and teamwork to conduct experiments and document technical findings of IC engine tests. Develop Skills in Documentation, Technical Communication, Ethics, and Safety Practices

Minimum Eight Practical's to be performed from the list as below

SN	**Experiments based on**
1	Demonstration and working of 2-Stroke Petrol Engine
2	Demonstration and working of 4-Stroke Petrol and Diesel Engines
3	Study of Lubrication Systems in Internal Combustion Engines
4	Study of Cooling Systems in Internal Combustion Engines
5	Study of Fuel System for Spark Ignition (SI) Engines
6	Study of Fuel System for Compression Ignition (CI) Engines
7	Performance Testing of a Diesel Engine Setup
8	Heat Balance Sheet for Petrol Engine
9	Heat Balance Sheet for Diesel Engine

VI SEMESTER
23ME1631: PE- II Earth Moving Equipment's

Course Outcomes :
Upon successful completion of the course, the students will be able to; **1.Summarize** the knowledge in Earth Moving Equipments and its Mechanical components. **2.Summarize** the knowledge in basic Hydraulic hardware system components used in Earth Moving Equipments. **3.Summarize** the knowledge in Electrical and Electronic system used in Earth Moving Equipments **4. Analyze** and **Evaluate** the problems in Earth Moving Equipments systems and provide solution.

Unit I:	**8 Hrs.**
Introduction: Earthmoving equipment's: Introduction, Types and applications. **Hydraulic systems:** Components, advantages, applications in the field of Earthmoving Equipments. **Seals**, sealing materials, selection of seals. **Filters**, strainers, sources of contamination of fluid & its control. **Hoses & Pipes**: Types, materials, pressure drop in hoses/pipes, valves and fittings. Hydraulic piping connections. **Types of Hydraulic fluid** petroleum based, synthetic & water based. Properties of fluids. Selection of fluids, additives, effect of temperature & pressure on hydraulic fluids.	
Unit II:	**7 Hrs.**
Mechanical Systems : Super Structure : Cabin:- dashboard , drive controls and hydraulic controls. Boom, arm and related components. **Under Carriage :** Transmission system: drive system , hydraulic systems for earthmoving, Turning system . Gear box and related components. **Attachments :** Buckets: Backacter, cam shelve, screening adapter, special buckets. End effectors: Earthwork attachments, drilling and boring attachment, piling attachment, crusher adapters, breakers, jaws, grabbing and loading attachments	
Unit III:	**8 Hrs.**
Hydraulic Systems: Pumps: Types, classification, principle of working & constructional details of vane pump, gear pumps, radial & axial plunger pumps, power and efficiency calculations, characteristic Curves, selection of pumps for hydraulic power transmission. **Accumulators & Intensifiers**: Types & functions of accumulators & intensifiers, applications, selection	
Unit IV:	**7 Hrs.**
Hydraulic Systems: Valves: Types & functions of valves, applications, selection **Actuators:** Linear & Rotary actuators. **Hydraulic motors:** Types, vane, gear piston, radial piston. Hydraulic motor performance. **Hydraulic Cylinders:** Types of cylinder & mountings, calculations of piston velocity, thrust under static & dynamic applications. Design consideration for cylinders. **Hydraulic Circuits**: JIC symbols / ISO Symbols for hydraulic circuits Different hydraulic circuits used in Construction equipments. Hydraulic circuit analysis	

Unit V:	7 Hrs.
Electrical and Electronics System: Basic electrical components switches, cables, colour coding of cables, Relays,. The basic connections – series and parallel circuits. Electric circuits of earthmoving equipments.. **Electronics Circuits:** Symbols for Electronics circuits Different Electronics circuits used in earthmoving equipments. Electronics circuit analysis	
Unit VI:	**8 Hrs.**
Maintenance of Earthmoving Equipments: Preventive, predictive & breakdown maintenance. Trouble shooting & safety precautions. Electronics diagnostic and Computer Aided Diagnostic systems	
Total Lecture	**45 Hours**

Textbooks:	
1.	James L Johnson , Introduction to Fluid Power, Delmar Thomson Learning, 2002
2.	Anthony Esposito, Fluid Power With Applications, PEARSON Prentice Hall, 6TH Edition
3.	J.J. Pipenger & T. G. Hicks, Industrial Hydraulics, McGraw Hill Co., 3RD Edition
4.	S. R. Majumdar, Pneumatic Systems: Principles and Maintenance, Tata McGraw-Hill Education, 2016

Reference Books:	
1.	Michael J. Pinches , Power pneumatics, Prentice Hall,, 2007
2.	Vickers, Vickers manuals on Industrial Hydraulics, Vickers, 1996
3.	Harry L. Stewart, Hydraulics & Pneumatics, Industrial Press, 4TH Edition
4.	Franklin D. Yeaple, Fluid Power Design Handbook, Marcel Dekker, 1996

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	
MOOCs Links and additional reading, learning, video material	
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VI SEMESTER
23ME1632: PE – II- Lab - Earth Moving Equipments

Course Outcomes
Upon successful completion of the course, the students will be able to; 1. **Summarize** the knowledge in Earth Moving Equipments and its Mechanical components. 2 **Summarize** the knowledge in basic Hydraulic hardware system components used in Earth Moving Equipments. 3 **Summarize** the knowledge in Electrical and Electronic system used in Earth Moving Equipments 4 **Analyze** and **Evaluate** the problems in Earth Moving Equipments systems and provide solution.

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Types Of Earthmoving Equipments
2	Hoses, Seals & Hydraulic Oils
3	Mechanical Components Of Earthmoving Equipments
4	Study Of Pumps
5	Study Of Valves
6	Hydraulic Cylinders And Circuits
7	Basic Electrical And Electronics System
8	Trouble Shooting And Computer Aided Diagnostic System
9	Industry Visit
10	Industry Visit

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B. Tech SoE and Syllabus 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Computer Technology)

B. Tech in Mechanical Engineering

SoE No. 23ME -101

VI SEMESTER

23ME1633: PE- II Computational Fluid Dynamics

Course Outcomes :

Upon successful completion of the course, the students will be able to;

1.Student will be able to develop an understanding for the major theories, approaches and methodologies used in CFD. [PO 1, PO 2, PO 5]

2.Student will be able to build up the skills in the actual implementation of CFD methods (e.g. boundary conditions, turbulence modelling etc.) in using commercial CFD codes. [PO 1, PO 2, PO 5]

3.Student will be able to gain experience in the application of CFD analysis to real engineering designs. [PO 1, PO 2, PO 5]

4.Student will be able to understand the elimination of numerical errors (verification), modeling errors (validation), and uncertainties for CFD. [PO 1, PO 2, PO 5]

Unit I:	**8 Hrs.**
Equations of fluid dynamics : Basic concepts Eulerarian and Lagrangian methods of describing fluid flow motion, acceleration and deformation of fluid particle, vorticity, Laws governing fluid motion, continuity, Navier – stokes & energy equations. Boundary layer equation, Euler equations, potential flow equations, Bernoulli's equation and vorticity transport equation. Initial and boundary conditions. Classification of equation of motions – hyperbolic, parabolic, elliptic	
Unit II:	**7 Hrs.**
Mathematical Preliminaries: Numerical integration. Review of linear algebra, solution of simultaneous linear algebraic equations – matrix inversion, solvers – direct methods, elimination methods, ill conditioned systems, Gauss- Seidel method, successive over relaxation method.	
Unit III:	**8 Hrs.**
Grid Generation: General principles of grid generation – structured grid's in two and three dimensions, differential equations based grid generation; Elliptic grid generation, algorithm, Grid refinement, Adaptive grids, Moving grids. Algorithms, CAD interfaces to grid generation.	
Unit IV:	**7 Hrs.**
Finite Difference Discretisation – I: Elementary finite difference coefficients, basic aspects of finite difference equations, steady and unsteady state heat conduction with FDM approach, consistency, explicit and implicit methods, errors and stability analysis. Stability of elliptic and hyperbolic equations.	
Unit V:	**8 Hrs.**
Finite Difference Discretisation – II: Fundamentals of fluid flow modelling-conservative property, upwind scheme, transporting property, higher order upwinding. Finite difference applications in heat transfer – conduction, convection.	
Unit VI:	**7 Hrs.**
Finite Volume Method: Introduction, Application of FVM in diffusion and convection problems, steady and unsteady state heat conduction with FDM approach, NS equations – staggered grid, SIMPLE algorithm. Solution of discretised equations using TDMA. Finite volume methods for unsteady problems – explicit schemes, implicit schemes.	
Total Lecture	**45 Hours**

			July,2023	1.00	Applicable for AY 2023-24 Onwards
Chairperson	Dean (Acad. Matters)	Dean OBE	Date of Release	Version	

Textbooks:	
1.	Anderson John D., Computational Fluid Dynamics, Mc-Graw Hill Corp., 1995

Reference Books:	
1.	Versteeg, H. K. and Malalasekara, W., Introduction to Computational Fluid Dynamics: The Finite Volume Method, 2nd Edition, (Indian Reprint) Pearson Education.
2.	Patankar S V, Numerical Heat Transfer and Fluid Flow, Mc-Graw Hill Corp., 1962.
3.	Ferziger J. H. and Springer P. M., Computational Methods for Fluid Dynamics, Verlag Berling.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	http://ftp.demec.ufpr.br/disciplinas/TM702/Versteeg_Malalasekera_2ed.pdf
MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/112105045

VI SEMESTER
23ME1634: PE – II- Lab - Computational Fluid Dynamics

Course Outcomes
Upon successful completion of the course the students will be able to 1.Student will be able to develop an understanding for the major theories, approaches and methodologies used in CFD. [PO 1, PO 2, PO 5] 2.Student will be able to build up the skills in the actual implementation of CFD methods (e.g. boundary conditions, turbulence modelling etc.) in using commercial CFD codes. [PO 1, PO 2, PO 5] 3.Student will be able to gain experience in the application of CFD analysis to real engineering designs. [PO 1, PO 2, PO 5] 4.Student will be able to understand the elimination of numerical errors (verification), modeling errors (validation), and uncertainties for CFD. [PO 1, PO 2, PO 5]

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Introduction of ANSYS software
2	Domain modelling
3	Mesh Generation and Refinement
4	Steady state heat transfer problem (2D)
5	Transient heat transfer problem (2D)
6	Steady state heat transfer problem (3D)
7	Transient heat transfer problem (3D)
8	Fluid flow problem 1 (2D)
9	Fluid flow problem 2 (2D)
10	Fluid flow problem 1 (3D)
11	Fluid flow problem 2 (3D)
12	Radiation heat Transfer Problem

VI SEMESTER
23ME1635: PE- II Solar Energy and Utilization

Course Outcomes :

Upon successful completion of the course the students will be able to:

1. Know the fundamentals of geometry of solar radiation and its measurement.
2. Make Students capable of analyzing solar systems and storage.

Unit I:	**8 Hrs.**
Basics of solar energy Brief History of solar energy &utilization, Various approaches of utilizing solar energy, Blackbody radiation, Relation between radiation field energy density and radiation spectrum, Planck's formula in energy unit, Maximum spectral density, Planck's formula in wavelength unit, Wien displacement law, Stefan - Boltzmann law, Photoelectric effect, Einstein's theory of photons, Einstein's derivation of the black-body formula	
Unit II:	**7 Hrs.**
Solar radiation, measurement and estimation History of solar energy utilization, basic definitions, Solar radiation and modeling, Empirical equations for predicting the availability of solar radiation, Measurement of global, direct and diffuse radiation, Radiation computations on inclined surfaces, Angstrom's turbidity, Solar chart, Standard radiation scale, Measurement of solar radiation, Solar energy measuring instruments, Pyranometer, Pyrheliometer, Sunshine recorder, Estimation of average solar radiation, Ratio of beam and total radiation on tilted surface of that on horizontal surface.	
Unit III:	**8 Hrs.**
Liquid based solar Flat Plate collector, Air based solar flat plate collector and concentrating collector, Trough or linear collectors, central receiver with heliostats, and parabolic dish concentrator with on -axis tracking,	
Unit IV:	**7 Hrs.**
Solar distillation, Solar drying. Thermal storage. Solar Passive Architecture Passive heating and cooling of Buildings. Solar Cooking, Distillation, Desalination, Solar Drying, Solar Chimney. Importance of the ethical, environmental, and societal implications of solar energy utilization, including adherence to national laws and standards for sustainable energy practices.	
Unit V:	**8 Hrs.**
Formation of a PN–junction, Space charge and internal field, Quasi - Fermi levels, The Shockley diode equation, Structure of a solar cell, the solar cell equation, Fill factor and maximum power, Crystalline silicon solar cells, Thin film solar cells: CIGS, Cite and silicon – Tandem solar cells, Dye - sensitized solar cells, Organic solar cells. Photovoltaic applications: battery charger, domestic lighting, street lighting, water pumping etc., solar PV power plant, Net metering concept	
Unit VI:	**7 Hrs.**
Types of Energy Storage, Thermal Storage, Simple water and rock bed storage, pressurized water storage system, Solar Pond, Electrical Storage, Fundamental concept of batteries, measuring of battery performance, charging and discharging of a battery, storage density, energy density, and safety issues.	
Total Lecture	**45 Hours**

Textbooks:	
1.	G. D. Rai, Solar Energy Utilization, 5TH ed 2014, Khanna Publishers.
2.	G. D. Rai, Non-Conventional Energy sources, 6th Edition 2017, Khanna Publishers.
3.	S. P. Sukhatme Solar Energy 3rd edition 2012 Tata Mc. Graw Hill Publication.

Reference Books:	
1.	G. N. Tiwari Hand book of Solar Energy, Springer publisher.
2.	Michela Raybova, Solar Energy Systems. Energy Science, Engineering and Technology. 2019
3.	Malti Goel , Solar Energy, Green Energy and Technology, Springer
4.	H P Garg, Solar Energy, Fundamental and Application's, Tata Mc. Graw Hill Publication

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	https://www.advan-kt.com/principlesofsolarengi.pdf
2	https://courses.edx.org/c4x/DelftX/ET.3034TU/asset/solar_energy_v1.1.pdf
MOOCs Links and additional reading, learning, video material	
1.	https://onlinecourses.nptel.ac.in ›

VI SEMESTER
23ME1636: PE – II- Lab - Solar Energy and Utilization

Course Outcomes
Upon successful completion of the course the students will be able to
1. know the fundamentals of geometry of solar radiation and its measurement.
2. Make Students capable of analyzing solar systems and storage.

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Solar Radiation Measurements.
2	Flat Plate Solar Water Heater.
3	Flat Plate Solar Air Heater
4	Flat Plate Collector with Reflector.
5	Parabolic Tube Collector
6	Evacuated Tube Collector
7	Solar Cookers
8	Thermal Storage System
9	Study on Solar Cell Characteristics.
10	Testing of SPV Standalone Systems
11	Testing of SPV system with tracking unit.
12	Performance Evaluation of SPV.

PROFESSIONAL Elective - III

VI SEMESTER

23ME1641: PE-III: Tool Design

Course Outcomes :

Upon successful completion of the course the students will be able to :

1. Apply the fundamentals of Tool Design.
2. Compute the Design of various cutting tools, Sheet Metal Dies, Jigs / Fixtures and Forging dies.
3. Evaluate the failure modes of tools and costing.
4. Illustrate planning for manufacturing of tools for various components..

Unit I:	**8 Hrs.**
Theory of metal Cutting Introduction, Mechanics of chip formation, Cutting tool materials, Single point cutting tool, Designation of cutting tools, ASA system, Importance of Tool angles, Orthogonal rake system, Classification of cutting tools, Types of chips, determination of shear angle, velocity relationship, force relations, Merchant's Theory, Cutting power, Energy consideration in metal cutting, Tool wear, Tool life, Tool life criteria, variable affecting tool life.	
Unit II:	**8 Hrs.**
Design of single Point Cutting Tool, Drills- Introduction, Types, Geometry, Design of drill. Milling cutters - Introduction, Types, Geometry, and Design of milling cutters.	
Unit III:	**7 Hrs.**
Press tool Design Introduction, Press operations - Blanking, piercing, Notching, Perforating, Trimming, Shaving, Slitting, Lancing, Nibbling, Bending, Drawing, Squeezing. Press working equipment - Classification, Rating of a press, Press tool Equipment, arrangement of guide posts. Press selection, press working \Terminology, Working of a cutting die, Types of dies - Simple dies, inverted die, Compound dies, combination dies, progressive dies, Transfer dies, multiple dies**.**	
Unit IV:	**8 Hrs.**
Bending Forming & Drawing dies Bending methods - Bending Terminology, V- Bending, Air bending, bottoming dies, spring back & its prevention. Design Principles - Bend radius, Bend allowance, Spanking, width of die opening, Bending pressure. Metal flow during drawing, Design, Design consideration - Radius of draw die, Punch radius, Draw clearance, Drawing speed, Calculating blank size, Number of draws, Drawing pressure, Blank holding pressure.	
Unit V:	**7 Hrs.**
Forging Die Design: Introduction, Classification of forging dies, Single impression dies, Multiple Impression dies. Forging design factors - Draft, fillet & corner radius, parting line, shrinkage & die wear, mismatch, finish allowances, webs & ribs Preliminary forging operation - fullering, edging,	

bending, drawing, flattering, blacking finishing, cutoff. Die design for machine forging – determination of stock size in closed & open die forging.	
Unit VI:	**7 Hrs.**
Design of jigs & fixture: - Introduction, locating & clamping - principle of location, principle of pin location, locating devices, radial or angular location, V - location, bush location. Design principle for location purpose, principle for clamping purposes, clamping devices, design principles common to jigs & fixtures. Drilling Jigs: - Design principles, drill bushes, design principles for drill bushings, Types of drilling jigs - Template jig, plate type jig, open type jig, swinging leaf jig, Box type jig, channel type jig . Jig feet. Milling Fixtures: - Essential features of a milling fixtures, milling machine vice, Design principles for milling fixtures, Indexing jig & fixtures.	
	Total Lecture **45 Hours**

Textbooks:	
1.	Donaldson , "Tool design", Edition 2011, Tata Mc. Graw Hill Education Pvt. Ltd., New Delhi
2.	ASTME Hand book, "Fundamentals of Tool design", 1988 Tata Mc. Graw Hill Education Pvt. Ltd., New Delhi,

Reference Books:	
1.	Pollock, "Fundamentals of Tool design" 1962, Reston Publishing Company
2.	Kempster, "Fundamentals of Tool design" , 1971, Hall of India Pvt. Ltd
3.	Rong , Yeming, " Computer aided fixture design", Marcel Dekker

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042
	MOOCs Links and additional reading, learning, video material
1.	http://www.digimat.in/nptel/courses/video/112105233/L13.html
2.	https://archive.nptel.ac.in/courses/112/105/112105233/

VI SEMESTER

23ME1642: PE- III Reliability Engineering

Course Outcomes :
Upon successful completion of the course the students will be able to: **1.** Interpret Reliability, Maintainability and Availability of engineering systems. **2.** Apply Reliability Modeling as a tool for evaluating system performance. **3.** Analyze the failure of a machine and failure rate of systems or components 4. Create production & maintenance schedule of particular engineering system using various tools used for failure data analysis

Unit I:	**8 Hrs.**
Fundamental concepts:- Reliability definitions, failure, Failure density, Failure Rate, Hazard Rate, Mean Time To Failure, MTBF, maintainability, availability , safety and reliability, Quality, cost and system effectiveness, Life characteristic phases, modes of failure, Quality and reliability assurance rules, product liability, Importance of Reliability	
Unit II:	**7 Hrs.**
Probability theory: Set theory, laws of probability, total probability theorem, probability distributions, parameters and applications.	
Unit III:	**8 Hrs.**
System reliability and modeling: Series and parallel components, mixed configuration, complex systems. Redundancy, element redundancy, unit redundancy, standby redundancy. Types of standby redundancy, parallel components. Markov models for reliability estimation.	
Unit IV:	**7 Hrs.**
Maintainability and Availability: Objectives of maintenance, types of maintenance, Maintainability, factors affecting maintainability, system down time. Availability - Inherent, Achieved and Operational availability, reliability and maintainability trade-off. Markov models for availability estimation.	
Unit V:	**8 Hrs.**
System reliability Analysis:Reliability allocation or apportionment. Reliability apportionment techniques . Reliability block diagrams and models. Reliability predictions. Life testing and accelerated testing.	
Unit VI:	**7 Hrs.**
Strength based reliability:Safety factor, safety margin, Stress strength interaction, Failure Mode, Effects and Criticality Analysis-, , FMECA examples, Ishikawa diagram .fault tree construction, basic symbols development of functional reliability block diagram, Fault tree analysis, fault tree evaluation techniques, Design of Mechanical components and systems:-Material strengths and loads.	
Total Lecture	**45 Hours**

Textbooks:	
1.	Concepts of Reliability Engg 1985 L.S. Srinath Affiliated East-Wast Press (P) Ltd
2.	Reliability Engineering 1983 A.K. Govil Tata McGraw-Hill Publishing Co. Ltd
3.	Reliability Engineering 1984 E. Balagurusmy Tata McGraw-Hill Publishing Co. Ltd
4.	Engineering Reliability 1980 B.S. Dhillion, C. Singh John Wiley & Sons
5.	Probabilistic, Reliability 1968 M.L. Shooman McGraw-Hill Book Co.,
6.	Practical Reliability Engg 1985 Patric D.T.O'connor Heyden and sons ltd.
7.	Reliability in Engineering Design 1977 K.C. Kapur, L.R. Lamberson John-Wiley and sons.
8.	Reliability Engineering, Theory and Practice Third Edition, 1999 A.Birolini Springer,

Reference Books:	
1.	
2.	

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	MOOCs Links and additional reading, learning, video material
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2	https://nptel.ac.in/courses/105/108/105108128/# IISc Bangalore

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(Department of Computer Technology)

B. Tech in Mechanical Engineering

SoE No. 23ME -101

VI SEMESTER

23ME1643: PE- III Advanced Manufacturing Techniques

Course Outcomes :

Upon successful completion of the course the students will be able to

1. **Distinguish and Identify** the various non-traditional manufacturing process based on energy sources.
2. **Evaluate** various advanced manufacturing process for new materials and the requirements of complex features on the basis of various parameters.
3. **Justify** various advanced welding techniques for different welding applications.
4. **Illustrate** the applications of additive manufacturing techniques in industries.

Unit I:	**(8 Hrs.)**
Mechanical Processes: Need, classification of AMT, Abrasive jet Machining, Water jet Machining & ultrasonic Machining, Abrasive-Water Jet Machining, Abrasive Flow Machining, Magnetic Abrasive Finishing & Ultrasonic Machining. Contemporary issues	
Unit II:	**(6 Hrs.)**
Chemical Processes: Chemical Processes & Electro-chemical Processes: Electrochemistry of ECM, tool design, effect of variable on performance chemical milling, Chemical Engraving, Photo chemical machining, EC grinding. Contemporary issues	
Unit III:	**(9Hrs.)**
Thermo-electric Processes : Electric Discharge Machining, Wire Electric Discharge Machining. Electron Beam Machining, Laser Beam Machining, Ion Beam Machining & Plasma Arc Machining. Contemporary issues	
Unit IV:	**(6 Hrs.)**
HERF : High energy rate forming processes: Burnishing, ballizing process and other miscellaneous forming processes, electroforming. Thermoform High velocity forming, Vacuum forming.. Contemporary issues	
Unit V:	**(9 Hrs.)**
Unconventional welding techniques : Laser beam welding , electron beam welding, plasma arc welding, atomic hydrogen welding, submerged arc welding, explosive welding techniques. solid phase welding technique such as ultrasonic welding, friction welding. Contemporary issues	
Unit VI:	**(7 Hrs.)**
Additive Manufacturing: Overview, Basic principle need and advantages of additive manufacturing, Procedure of product development in additive manufacturing, Classification of additive manufacturing processes, Materials used in additive manufacturing, Challenges in Additive Manufacturing. Contemporary issues	
	Total Lecture **45 Hours**

			July,2023	1.00	Applicable for AY 2023-24 Onwards
Chairperson	Dean (Acad. Matters)	Dean OBE	Date of Release	Version	

Textbooks:	
1.	Ghosh and Malik, Manufacturing sciences, OAFFO, 2010.
2.	Gary F. Benedict , Non traditional processes Talyor and francis, CRC Press , 1ed,2019.
3.	V. K. Jain, Advanced Machining Processes, Allied Publishers,4th Edition (2009)
4.	Ghosh and Malik, Manufacturing sciences, OAFFO, 2010.

Reference Books:	
1.	J. A. McGeough, Advanced Methodes of machining , Chapman and Hall ,1988.
2.	Cherry Lemon , , Advanced Methodes of machining , M Hill Didactics Co, 2019.
3.	Paul and Jinoop , Additive Manufacturing , Mc Graw hill, 2021.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	http://103.152.199.179/YCCE/yccelibrary.html
	MOOCs Links and additional reading, learning, video material
1	https://archive.nptel.ac.in/courses/112/107/112107078/
2	https://archive.nptel.ac.in/courses/112/107/112107077/
3	https://archive.nptel.ac.in/courses/112/107/112107078/
4	https://onlinecourses.nptel.ac.in/noc24_me72/preview
5	https://nptel.ac.in/courses/112104162
6	https://nptel.ac.in/courses/112103202
7	https://onlinecourses.nptel.ac.in/noc25_me51/preview

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B. Tech in Mechanical Engineering

SoE No. 23ME -101

VI SEMESTER

23ME1644: PE- III Total Quality Management

Course Outcomes :
Upon successful completion of the course the students will be able to: 1. Develop an understanding on quality management philosophies and frameworks. 2. Develop in-depth knowledge on various tools and techniques of quality management. 3. Evaluate the applications of quality tools and techniques in both manufacturing and service industry. 4. Analyze quality management methods and solving problems of organization

Unit I:	**8 Hrs.**
Principles of Quality Management, Pioneers of TQM, Quality costs, Quality system Customer Orientation, Benchmarking, Re-engineering	
Unit II:	**7 Hrs.**
Leadership, Organizational Structure, Team Building, Information Systems and Documentation – Quality Auditing, ISO 9000 - QS 9000.QMS, Quality awards.	
Unit III:	**7 Hrs.**
Single Vendor Concept, J.I.T., Quality Function deployment, Quality Circles, KAIZEN, SGA POKA - YOKE, Taguchi Methods. SMED, Kanban system. Cost of quality. Robust design	
Unit IV:	**8 Hrs.**
Methods and Philosophy of Statistical Process Control, Control Charts for Variables and Attributes	
Unit V:	**8 Hrs.**
Cumulative sum and exponentially weighted moving average control charts, Others SPC Techniques – Process Capability Analysis. Acceptance Sampling Problem, Single Sampling Plans for attributes, double, multiple and sequential sampling,	
Unit VI:	**7 Hrs.**
Six sigma manufacturing concepts. Six-sigma philosophy Quality strategy and policy. Motivation and leadership theories. Continuous vs. breakthrough improvements. Management of change, DMAIC Methodology. Lean manufacturing	
	Total Lecture **45 Hours**

Textbooks:	
1.	Total Quality Management for Engineers 1991 Mohamed Zairi Woodhead Publishing Limited 1991
2.	Production and Operations management - Total Quality and Responsiveness 1995 Harvid Noori and Russel McGraw-Hill Inc, 1995
3.	Managing for Total Quality 1998 N.Logothetis Prentice Hall of India Pvt .Ltd,1998

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Reference Books:	
1.	The Essence of Total Quality Management 1995 John Bank Prentice Hall of India Pvt. Ltd., 1995.
2.	Introduction to Statistical Quality Control 1991 Douglus C. Montgomery2nd Edition, John Wiley and Sons, 1991.
3.	Statistical Quality Control 1984 Grant E.L and Leavenworth, McGraw-Hill, 1984.

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B. Tech SoE and Syllabus 2023

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(Department of Computer Technology)

B. Tech in Mechanical Engineering

SoE No. 23ME -101

VI SEMESTER

23ME1645: PE- III Thermal Engineering Systems

Course Outcomes :
Upon successful completion of the course, the students will be able to; 1. describe and analyze the Solar, Wind and Biogas Energy Systems 2. Describe and analyze the working of Refrigeration system. 3. evaluate the Psychrometric properties and describe the air conditioning processes. 4. To understand the concept of electric and Hybrid vehicle

Unit I:	**(8 Hrs.)**
Solar Energy: Introduction, solar constant, spectral distribution of solar radiation, beam & diffuse radiation, Solar radiation geometry, solar angles. Types of collectors, liquid flat plate collectors, solar air heaters Concentrating collectors, Applications of solar energy to water heating, space heating, space cooling, drying refrigeration, solar cookers, solar thermal electric conversion system, solar photo-voltaic.	
Unit II:	**(7 Hrs.)**
Wind Energy: - Power in wind, forces on blades, wind energy: Basic principle of wind energy conversion, basic components of WECS Classification of WEC systems, savonius and darrieus rotars applications of wind energy **Biogas: -** Introduction, bio gas generation, fixed dome & floating drum biogas plants their constructional details, raw material for biogas production, factors affecting generation of biogas and methods of maintaining biogas, production, fuel properties of biogas and utilisation of biogas	
Unit III:	**(8 Hrs.)**
Refrigeration: Introduction, unit of refrigeration, Vapour compression refrigeration system. Multi stage vaopur compression system.	
Unit IV:	**(7 Hrs.)**
Introduction, psychrometric properties, Evaporative cooling, Bypass factor, Air Conditioning Processes, Typical summer and winter air conditioning system.	
Unit V:	**(8 Hrs.)**
Electric Vehicle – Need - Types – Cost and Emissions – End of life. Electric Vehicle Technology – layouts, cables, components, Controls. Batteries – overview and its types. **Hybrid Electric vehicles** – Classification – Micro, Mild, Full, Plug-in, EV. Layout and Architecture – Series, Parallel and Series-Parallel Hybrid, Propulsion systems and components. Regenerative Braking,	
Unit VI:	**(7 Hrs.)**
Energy Auditing Introduction, Global and Indian Energy Scenario, need of importance of energy conversion, Importance of energy audit, Procedure for carrying Energy Audit, Instruments used for energy audit, such as Power Analyser, Multipoint heat flow meter, Lux meter, Portable infrared Radiation thermometer, Thermocouple based temperature indicator. Payback period, Return on investment, Life cycle cost, Sankey diagram, Specific energy consumption.	
	Total Lecture **45 Hours**

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Textbooks:	
1.	S. P. Sukhatme Solar Energy 3rd edition 2012 Tata Mc. Graw Hill Publication
2.	G. D. Rai, Solar Energy Utilization, 5TH ed 2014, Khanna Publishers
3.	Arora C.P.; Refrigeration and Air conditioning, 4th Ed.; 2021 Tata Mc Graw Hill Publication
4.	Jack Erjavec and Jeff Arias, "Alternative Fuel Technology – Electric, Hybrid and Fuel Cell Vehicles", Cengage Learning Pvt. Ltd., New Delhi, 2007
5.	Jack Erjavec and Jeff Arias, "Hybrid, Electric and Fuel Cell Vehicles", Cengage Learning, 2012.

Reference Books:	
1.	H P Garg, Solar Energy, Fundamental and Aplications, Tata Mc. Graw Hill Publication
2.	Dossat Roy J.; Principles of Refrigeration, 4th Ed.; Pearson Education Asia Publication
3.	Michela Raybova, Solar Energy Systems. Energy Science, Engineering and Technology. 2019
4.	Hybrid Electric Vehicles – Teresa Donateo, Published by ExLi4EvA, 2017.
5.	Hybrid Electric Vehicle System Modeling and Control - Wei Liu, General Motors, USA, John Wiley & Sons, Inc., 2017.
6	Electric and Hybrid Vehicles, Tom Denton, Taylor & Francis, 2018

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
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B. Tech in Mechanical Engineering

SoE No. 23ME -101

VI SEMESTER

23ME1646: PE- III Optimization Techniques

Course Outcomes :

Upon successful completion of the course the students will be able to

1. **Solve** linear programming problems using Revised Simplex, Dual Simplex, Duality Theory, and Sensitivity Analysis.
2. **Apply** advanced linear programming techniques, including Integer, Zero-One, Goal, and Multi-Objective Programming.
3. **Develop** dynamic programming models for sequential decisions in planning, allocation, and control.
4. **Analyse** queuing systems using theory and Monte Carlo simulation for performance evaluation.
5. **Apply** Game Theory and Nonlinear Optimization for strategic decision-making under uncertainty.

Unit I:	**8 Hrs.**
Linear programming: - Formulation, solutions (LPP) by Revised simplex method and dual simplex method, duality theory and Sensitivity analysis	
Unit II:	**8 Hrs.**
Advanced Linear Programming: - Pure and mixed integer programming, zero-one programming. Introduction to multi-objectives programming and Goal programming	
Unit III:	**7 Hrs.**
Dynamic programming - characteristics, approach and its formulations. Application of Dynamic programming in Employment smoothening problem, Resource allocation, Inventory control & Linear programming	
Unit IV:	**8 Hrs.**
Queuing Theory: Queuing Systems, Kendelalls for representing queuing models, Classification of queuing models (No derivations expected), Simulations, Monte- Carlo Simulation.	
Unit V:	**7 Hrs.**
Game Theory: -Decision-making, alternatives, choices, outcomes, preferences, uncertainty, risk, logic, decision theory, normative, descriptive, prescriptive, strategies, players, payoffs, competition, cooperation, Nash equilibrium, game theory, rationality.	
Unit VI:	**7 Hrs.**
Non-Linear programming: - Fibonacci and golden section search, powells pattern search algorithm, Kuhn tucker conditions, complimentary pivot algorithm, optimization by geometric programming	
Total Lecture	**45 Hours**

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Textbooks:	
1.	Introduction to operation research, computer oriented algorithmic approach Gillet B.E Nelson 1985, Tata Mc. Hill.
2.	Operation research by P.K. Gupta and D.S. Hira, S Chand publication 2015.
3.	Operation research theory and application by J.K.Sharma , Macmillan 2012.

Reference Books:	
1.	Operation research by S.D.Sharma , Kedar nath ram nath, Meerut 2014.
2.	Operation research theory and application, J.K.Sharma , Macmillan 2012.
3.	Optimization theory and application, S.S.Rao , Wesley Eastern 1991.
4.	Operation research Tata Hamdy, Prentice hall of india 2012.
5.	Operation research by H.A.Taha , Macmillan 2016.
6.	Operation research by S.D.Sharma , Kedar nath ram nath, Meerut 2014.

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2	https://www.youtube.com/watch?v=4U3B5lr-MqM
3	https://www.youtube.com/watch?v=qxls3cYg8to
4	https://www.youtube.com/watch?v=xGkpXk-AnWU
5	https://youtu.be/BUGIhEecipE?si=l13V7mlIUvQl-aNv
	MOOCs Links and additional reading, learning, video material
1	https://www.youtube.com/watch?v=C7HeGfl8U9I&pp=ygUdT1BFUkFUSU9OIFJFU0VBUkNIIFRFQ0hOSVFVRVM%3D
2	https://nptel.ac.in/courses/110106062
3	https://www.youtube.com/watch?v=8M0tQKZzdDY&list=PL23dd-8zssJDLv4Zc6975_FKKd4MXwsTC

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VI SEMESTER

23ME1647: PE- III Project Evaluation & Management

Course Outcomes :

Upon successful completion of the course, the students will be able to

1. **Identify** project ideas based on objectives, SWOT analysis, market demand, and feasibility considerations.
2. **Evaluate** technical feasibility factors such as process selection, automation, plant capacity, and technology acquisition.
3. **Apply** economic feasibility techniques, including cost estimation, working capital analysis, breakeven analysis, and financial projections.
4. **Analyze** project planning and control techniques such as WBS, scheduling, PERT, CPM, and resource allocation.
5. **Develop** a detailed project report including risk assessment, sensitivity analysis, capital-raising methods, and project safety management.

Unit I:	**7 Hrs.**
Project Identification: Considering objectives and SWOT analysis, Screening of Project Ideas, Technical, Market, Financial, Socioeconomic, Ecological Appraisal of a project, Demand forecasting, Secondary data, Confidence Level, and Uncertainty	
Unit II:	**7 Hrs.**
Economic feasibility: Cost of Project, working capital analysis, fixed cost, means of finance, estimation of sales & production price analysis, Breakeven point, Projected cash flow statements, projected balance sheet, projected profit & loss statement, projected cash flow, rate of return, Discounted payback period, cost-benefit analysis, return after taxes.	
Unit III:	**9 Hrs.**
Economic feasibility: Cost of Project, working capital analysis, fixed cost, means of finance, estimation of sales & production price analysis, Breakeven point, Projected cash flow statements, projected balance sheet, projected profit & loss statement, projected cash flow, rate of return, Discounted payback period, cost-benefit analysis, return after taxes.	
Unit IV:	**7 Hrs.**
Project Planning and Control: Work breakdown structure and network development. Basic Scheduling, Critical Path, and four kinds of floats. Scheduling under probabilistic durations, Time Cost tradeoffs, CPM, PERT, Optimum project duration, and resource allocation.	
Unit V:	**7 Hrs.**
Project report: Preparation of Project Report, Risk Analysis, Sensitivity Analysis, and Methods of Raising Capital.	
Unit VI:	**8 Hrs.**
Initial Review: Performance analysis, ratio analysis, sickness, project revival, Project Monitoring with PERT/Cost, Organizational aspects, Computer packages, Project Completion, Environmental & Social Aspects.	
Total Lecture	**45 Hours**

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Textbooks:	
1.	Projects Prasanna Chandra Tata McGraw-Hill Publishing Company Ltd.
2.	Finance series 'Project management', Vol-I1 and Vol-III, ICFAI, ICFAI, Press Hyderabad

Reference Books:	
1.	Financial Management Chandra, Prasanna, Tata McGraw-Hill Education, 1997
2.	Engineering Economics, G. J. Thuesen, Wolter J. Fabrycky, Prentice Hall, 1
3.	CPM & PERT, L. S. Srinath, East West publisher
4.	Projects, P.K. Joy, Macmillan
5.	Engineering Economy, H. G Thuesen, W J Fabricky, G, J, Thuersen, Prentice-Hall
6.	Finance Management, M.Y. Khan, Tata McGraw-Hill

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book
	MOOCs Links and additional reading, learning, video material
1	**https://nptel.ac.in/courses/110107081**
2	**https://nptel.ac.in/courses/110104073**

VI SEMESTER
23ME1648: PE- III Fuel Cell Technology

Course Outcomes :

Upon successful completion of the course the students will be able to

1. **Apply** knowledge of performance, behavior, operational issues and challenges for all major types of fuel cells for its commercialization.
2. **Investigate and Apply** know-how of thermodynamics, electrochemistry, heat transfer, and fluid mechanics principles to design and analysis of this emerging technology.
3. **Design & Analyze** innovative fuel cell systems, fuel cell charge transport and mass transport, the techniques, skills, and modern engineering tools necessary for design and analysis.
4. **Examine and Evaluate** the methodology to design the components of fuel cells and specific type of fuel cell systems.

Unit I:	**7 Hrs.**
Introduction to Fuel Cells : Brief history of fuel cells, Operating principles, Types of fuel cells- Solid Oxide Fuel Cell (SOFC), Alkaline Fuel Cell (AFC), Molten Carbonate Fuel Cell (MCFC), Phosphoric Acid Fuel Cell (PAFC), Fuel Cell Stack, Advantages, Limitations and Applications of Fuel Cell, Polarization curve for performance characterization of fuel cells, Representing various losses (Activation, Ohmic, concentration loss), Hydrogen Production, Storage and Transportation.	
Unit II:	**7 Hrs.**
Fuel Cell Thermodynamics: Heat Potential (Enthalpy of Reaction), Work Potential (Gibbs free energy), Reversible fuel cell voltage (Nernst equation), Fuel Cell Efficiency. Fuel cell Thermodynamics mathematical analysis	
Unit III:	**7 Hrs.**
Fuel Cell Electrochemistry : Electrochemical Reaction basics, Faraday's law, Tafel equation, Butler- Volmer equation, Exchange current, Electrochemical cell mathematical analysis,	
Unit IV:	**8 Hrs.**
Fuel Cell Charge Transport and Mass Transport : Ion Transport (Electrolyte), Electron Transport, Gas phase (single phase) mass transport in different fuel cell components (Diffusion layer, flow channels), Multiphase Mass Transport in fuel cell components, Fuel Crossover and Internal Currents, Heat generation and transport in fuel cell. Fuel cell resistance, and ohmic loss mathematical analysis	
Unit V:	**8 Hrs.**
Fuel Cell Characterization: In Situ Versus Ex Situ Characterization, Polarization Test, Electrochemical Impedance Spectroscopy, Linear Sweep Voltammetry, Cyclic Voltammetry, Current Interrupt, High frequency resistance. Demonstration on Electrochemical Software	

Unit VI:	8 Hrs.
Polymer Electrolyte Membrane Fuel Cell (PEMFC): Components and Materials: Membrane, Catalyst Layer, Bipolar Plate, Current Collector, Water Management, Thermal Management, Direct Liquid Fuel Cell (DLFC), Advantage of Liquid Fuel over Gaseous Fuel, Different types of DLFC, Direct Methanol Fuel Cell (DMFC), Demonstration of Direct Ethanol Fuel cell model with DC electronic load	
Total Lecture	**45 Hours**

Textbooks:	
1.	O'Hayre, R.P.,S. Cha, W. Colella, F.B.Prinz, Fuel Cell Fundamentals, Wiley, NY (2006).
2.	J. Larminie and A. Dicks, Fuel Cell Systems Explained, 2nd Edition, Wiley (2003).

Reference Books:	
1.	Matthew M. Mench, Fuel Cell Engines, Wiley (2008).
2.	S. Srinivasan, Fuel Cells: From Fundamentals to Applications, Springer (2006)
3.	X. Li, Principles of fuel cells, Taylor & Francis (2005).

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	https://onlinelibrary.wiley.com/doi/book/10.1002/9781118878330
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2	https://archive.nptel.ac.in/courses/103/102/103102015/
3	https://www.youtube.com/watch?v=Op6pUCAdBxo

VI SEMESTER

23ME1649: PE- III Design of Experiments and Taguchi Methods

Course Outcomes :

Upon successful completion of the course the students will be able to

1. Apply frequency distribution, histograms, probability, and averages to organize and understand engineering data.
2. Analyse confidence intervals, hypothesis testing, and relationships in data using MINITAB software.
3. Evaluate factorial experiments and response surface methods to find the best settings for engineering processes.
4. Validate the Taguchi method including signal-to-noise ratios and design of experiments to improve process performance.
5. Create new solutions by using statistical techniques to improve efficiency and quality in engineering and industrial applications.

Unit I:	**8 Hrs.**
quency Distribution Frequency Distribution & Histograms, Probability & its Distribution, Measures of Central Tendency & Distribution, Presentation of Statistical Data. Importance and significance of statistics in an engineering industry. **(CO-1)**	
Unit II:	**7 Hrs.**
Confidence Intervals Confidence intervals, Hypothesis Testing, Correlation, Liner & Multiple Repression Analysis, Signification Testing, Introduction to MINITAB. **(CO-2)**	
Unit III:	**8 Hrs.**
Factorial Method Full & fractional factorial experiments, analysis of variance, Latin squares, response surface methodology **(CO-3)**	
Unit IV:	**7 Hrs.**
Taguchi Method Taguchi Method: - Introduction, System Design, Parameter Design and Tolerance Design. Quality, Taguchi Quality Loss Function, Classification of Parameters, Process Diagram (P-Diagram. **(CO-4)**	
Unit V:	**8 Hrs.**
Quality Characteristics Signal to Noise Ratio & its Types, Equations of S/N ratio. Steps of Taguchi Method, Design of Experiments (DOE), Orthogonal Array (OA), Selection of OA, Computation of Number of experimentation, Comparison of Taguchi Method to Conventional Methods	
Unit VI:	**7 Hrs.**
Response Table, Selection of Rank for process parameters, Main Effect Plot, Identification of Optimal setting, Analysis of Variance (**ANOVA**), Additive model, Computation of Predictive output parameters. Verification of predictive model by confirmatory test.	

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		Total Lecture	**45 Hours**

Textbooks:	
1.	Thomas P. Ryan, Statistical Methods for Quality Improvement, John Wiley & Sons, 2011
2.	George W. Cobb and David A. S. Fraser, Introduction to Design and Analysis of Experiments, 2015
3.	William G. Cochran , Gertrude M. Cox , Experimental Designs (Wiley Series in Probability and Statistics), 2005

Reference Books:	
1.	J. Susan Milton, Jesse Arnold, Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences Mc. Graw Hill Publication, 2002.
2.	Ross, Phillip J , Taguchi techniques for quality engineering, New York : McGraw-Hill 2021
3.	Madhav S. Phadke , Quality Engineering Using Robust Design, Pearson, 2008

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2	https://www.youtube.com/watch?v=BIlH-sIYo-8
3	https://www.youtube.com/watch?v=YcqzmJFnOJE

V SEMESTER
Mandatory Learning Course (Audit Course)
MLC2126 : YCAP6