Scheme and Syllabus

with

Exam Mode and Mode of Teaching

2021-22 Admitted batch

Mechanical Engineering

Upto IV SEM

Credit distribution for common arrangements

Semester	Subject Name	Credits
I	-	-
II	-	-
III	Novel Engaging Course	1
	Summer Internship-I	2
	#Self-learning/Presentation (SWAYAM/NPTEL/MOOC)	1
IV	Novel Engaging Course	1
V	**Minor Project-I**	**2**
	Novel Engaging Course	1
	Summer Internship-II	2
	#Self-learning/Presentation (SWAYAM/NPTEL/MOOC)	1
VI	Minor Project-II	2
	Novel Engaging Course	1
VII	Summer Internship Project-III	2
	Creative Problem Solving (Evaluation)	**1**
VIII	**Internship/Project**	**9**
	Professional Development[#]	2

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Department of Mechanical Engineering

Scheme of Evaluation ***For batch admitted in Academic Session 2021-2022***

B.Tech. I Semester (Mechanical Engineering)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Offline/ Online)	Mode of Exam.
				Theory Slot				Practical Slot									
				End Sem.		Mid Sem. Exam.	Quiz/ Assignment	End Sem	Lab Work & Sessional	Skill Based Mini Project		L	T	P			
				End Term Evaluation	$Proficiency in subject /course												
1.	100011	BSC	Engineering Mathematics-I (BSC-1)	50	10	20	20	-	-	-	100	3	1	-	4	Offline (4/0)	PP
2.	100023	ESC	Basic Computer Engineering (ESC-1)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2/1)	A+O
3.	100014	ESC	Engineering Graphics (ESC-2)	50	10	20	20	-	-	-	100	1	2	-	3	Offline (3/0)	A+O
4.	100015	HSMC	Energy, Environment, Ecology & Society (HSMC-1)	50	10	20	20	-	-	-	100	3	-	-	3	Online (0/3)	MCQ
5.	100016	HSMC	Technical Language (HSMC-2)	50	10	20	20	-	-	-	100	3	-	-	3	Blended (2/1)	PP
6.	100017	HSMC	Language Lab (HSMC-3)	-	-	-	-	60	20	20	100	-	-	2	1	Offline (1/0)	SO
7.	100018	ESC	Engineering Graphics Lab (ESC-3)	-	-	-	-	60	20	20	100	-	-	2	1	Offline (1/0)	SO
Total				**250**	**50**	**100**	**100**	**180**	**60**	**60**	**800**	**12**	**4**	**6**	**19**		
Induction programme of three weeks (MC): Physical activity, Creative Arts,Universal Human Values,Literary,ProficiencyModules,Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations.																	

Mode of Teaching					Mode of Examination				Total Credits
Theory				Lab	Theory			Lab	
Offline	Online	Blended		Offline	PP	A+O	MCQ	SO	
		Offline	Online						19
7	3	4	2	3	7	7	3	2	19
36.84	15.7	21	10.5	15.78	36.84	36.84	15.78	10.5	100

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B.Tech. II Semester (Mechanical Engineering)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Offline/ Online)	Mode of Exam.
				Theory Slot				Practical Slot									
				End Sem.		Mid Sem. Exam.	Quiz/ Assignment	End Sem	Lab Work & Sessional	Skill Based Mini Project		L	T	P			
				End Term Evaluation	$Proficiency in subject /course												
1.	120211	DC	Material Science (DC-1)	50	10	20	20	-	-	-	100	3	-	-	3	Blended (2/1)	PP
2.	100020	ESC	Basic Civil Engineering & Mechanics (ESC-4)	50	10	20	20	-	-	-	100	2	1	-	3	Blended (2/1)	PP
3.	100021	ESC	Basic Mechanical Engineering (ESC-5)	50	10	20	20	-	-	-	100	2	1	-	3	Blended (2/1)	MCQ
4.	100022	ESC	Basic Electrical and Electronics Engineering (ESC-6)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2/1)	MCQ
5.	100012	BSC	Engineering Chemistry (BSC-2)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2/1)	MCQ
6.	100024	ESC	Manufacturing Practices (ESC-7)	-	-	-	-	60	20	20	100	-	-	2	1	Offline (1/0)	SO
7.	120026	ESC	Basic Mechanical Engineering Lab (ESC-8)	-	-	-	-	60	20	20	100	-	-	2	1	Offline (1/0)	SO
Total				**250**	**50**	**100**	**100**	**240**	**80**	**80**	**900**	**11**	**4**	**8**	**19**		
Summer Internship Project – I (Institute Level) (Qualifier): Minimum two-week duration: Evaluation in III Semester.																	

Mode of Teaching					Mode of Examination				Total Credits
Theory				Lab	Theory			Lab	
Offline	Online	Blended		Offline	PP	A+O	MCQ	SO	
		Offline	Online						19
0	0	10	5	4	6	0	11	2	19
0	0	52.6	26.3	21	31.5	0	57.8	10.5	100

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B. Tech. III Semester (Mechanical Engineering)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Online, Offline, Blended)	$$Mode of Exam.
				Theory Slot				Practical Slot				L	T	P			
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation								
				End Sem. Exam	$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assign-ment		Lab Work & Sessional	Skill Based Mini Project							
1.	100025	BSC	Engineering Mathematics-II (BSC-3)	50	10	20	20	-	-	-	100	2	1	-	3	Offline (3/0)	PP
2.	120311	DC	Manufacturing Process (DC-2)	50	10	20	20	-	-	-	100	2	1	-	3	Blended (2/1)	PP
3.	120319	DC	Mechanics of Materials (DC-3)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2/1)	PP
4.	120313	DC	Theory of Machines –I (DC-4)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2/1)	AO
5.	120314	DC	Fluid Mechanics and Hydraulic Machines (DC-5)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2/1)	PP
6.	120315	DLC	Software lab (DLC-1)	-	-	-	-	60	20	20	100	-	-	2	1	Offline (1/0)	SO
7.	120316	DLC	Self-learning/Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	40	-	40	-	-	2	1	Online +Mentoring	SO
8.	200XXX	CLC	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	50	-	-	2	1	Interactive	SO
9.	120318	DLC	Summer Internship Project–I (Institute Level) (Evaluation)	-	-	-	-	60	-	-	60	-	-	4	2	Offline	SO
Total				**250**	**50**	**100**	**100**	**350**	**120**	**80**	**1050**	**10**	**5**	**16**	**23**	-	-
10.	1000005	MAC	Project Management & Financing	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	MCQ

$ **proficiency in course/subject-includes the weightage towards ability/skill/competence/knowledge level/ expertise attained etc. in that particular course/subject.**

$$**MCQ:** Multiple Choice Question $$**AO:** Assignment + Oral $$**PP:** Pen Paper $$**SO:** Submission + Oral

Mode of Teaching						Mode of Examination					Total Credits
Theory				Lab	NEC	Theory			Lab	SIP/ SLP/ NEC	
Offline	Online	Blended		Offline	Interactive	PP	A+O	MCQ	SO	SO	
		Offline	Online								
3	0	8	4	7	1	14	4	0	1	4	23
13.04	0	34.78	17.3	30.43	4.3	60.86	17.3	0	4.3	17.3	100

Scheme of Evaluation

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Department of Mechanical Engineering

Scheme of Evaluation ***For batch admitted in Academic Session 2021-2022***

B. Tech. IV Semester (Mechanical Engineering)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	$\$\$$Mode of Exam.	Duration of Exam.
				Theory Slot				Practical Slot				L	T	P				
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation									
				End Sem. Exam.	$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab work & Sessional	Skill Based Mini Project								
1.	100003	BSC	Mathematics- III (BSC-4)	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP	2 hr
2.	120412	DC	Design of Machine Elements (DC-6)	50	10	20	20	60	20	20	200	2	1	2	4	Blended	AO	2 hr
3.	120413	DC	Metal Cutting and Machine Tools (DC-7)	50	10	20	20	-	-	-	100	3	1	-	4	Blended	PP	2 hr
4.	120414	DC	Engineering Thermodynamics (DC-8)	50	10	20	20	-	-		100	3	1	-	4	Blended	PP	2 hr
5.	100004	MC	Cyber Security (MC)	50	10	20	20	-	-	-	100	2	-	-	2	Blended	MCQ	1.5 hr
6.	120415	DLC	Production Lab (DLC-2)	-	-	-	-	60	20	20	100	-	-	4	2	Offline	SO	
7.	200XXX	CLC	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	50	-	-	2	1	Offline	SO	
Total				**250**	**50**	**100**	**100**	**170**	**40**	**40**	**750**	**12**	**4**	**8**	**20**	**-**	**-**	
8.	1000001	**MAC**	Indian Constitution and Traditional Knowledge	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	**MCQ**	**1.5 hr**
Summer Internship Project-II (Soft skills Based) for two weeks duration: Evaluation in V Semester																		

$proficiency in course/subject-includes the weightage towards ability/skill/competence/knowledge level/ expertise attained etc. in that particular course/subject.

$\$\$$**MCQ:** Multiple Choice Question $\$\$$**AO:** Assignment + Oral $\$\$$**PP:** Pen Paper $\$\$$**SO:** Submission + Oral

Mode of Teaching				Mode of Examination				Total Credits
Theory			Lab	Theory			Lab	
Offline	Online	Blended	Offline	PP	AO	MCQ	SO	
0	**0**	**17**	**3**	**11**	**4**	**2**	**3**	**20**
0	**0**	**85%**	**15%**	**55%**	**20%**	**10%**	**15%**	**Credits %**

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B.Tech. (Mechanical Engineering) V Semester

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Offline/ Online)	Mode of Exam.
				Theory Slot				Practical Slot									
				End Sem.		Mid Sem. Exam.	Quiz/ Assignment	End Sem	Lab Work & Sessional	Skill Based Mini Project		L	T	P			
				End Term Evaluation	$Proficiency in subject /course												
1.	120511	DC	Industrial Engineering (DC-9)	50	10	20	20	-	-	-	100	2	1	-	3	Blended (2/1)	PP
2.	120519	DC	Theory of Machines –II (DC-10)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (3/1)	AO
3.	120513	DC	Heat and Mass Transfer (DC-11)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2/1)	PP
4.	120515	DC	Machine Design (DC-12)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2/1)	AO
5.		MC	Data Science	50	10	20	20	60	20	20	200	3	-	2	4	Blended (2/1)	MCQ
6.	120516	DLC	Minor Project-I	-	-	-	-	60	40	-	100	-	-	4	2	Offline (2/0)	SO
7.	120517	DLC	Self-learning/ Presentation#	-	-	-	-	-	40	-	40	-	-	2	1	Online +Mentoring	SO
8.	20xxx	CLC	Novel Engaging Course	-	-	-	-	50	-	-	50	-	-	2	1	Interactive	SO
9.	120518	DLC	Summer Internship Project–II (Institute Level Evaluation)	-	-	-	-	60	-	-	60	-	-	4	2	Offline	SO
Total				250	50	100	100	410	160	80	1150	11	4	20	25		
Additional Courses for obtaining Honours/Minor Specialization by desirous students Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization																	
10.		MAC	Disaster Management	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	MCQ

Mode of Teaching						Mode of Examination					Total Credits
Theory				Lab	NEC	Theory			Lab	SIP/ SLP/ NEC	
Offline	Online	Blended		Offline	Interactive	PP	A+O	MCQ	SO	SO	
		Offline	Online								
0	0	10	5	7	2	11	4	3	2	4	24
0	0	41.6	20.8	29.1	8.3	45.8	16.6	12.5	8.3	16.6	100

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B.Tech. (Mechanical Engineering) VI Semester

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted									Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Offline/ Online)	Mode of Exam.
				Theory Slot				Practical Slot			MOOCs								
				End Sem.		Mid Sem. Exam.	Quiz/ Assign-ment	End Sem	Lab Work & Sessional	Skill Based Mini Project	Assign-ment	Exam.		L	T	P			
				End Term Evaluation	$Proficiency in subject /course														
1	120615	DC	Vibration and Noise Engineering	50	10	20	20	-	-	-	-	-	100	2	1	2	4	Blended (2/1)	MCQ
2	120616	DC	Refrigeration and Air-Conditioning ~~(DC-14)~~	50	10	20	20	60	20	20	-	-	200	2	1	2	4	Blended (3/1)	PP
3																		Blended (3/1)	PP
4	DE	DE	Departmental Elective-1(DE-1)	50	10	20	20	-	-	-	25	75	100	3	-	-	3	Blended (2/1)	PP
6	OC	OC	Open Category (OC-1)	50	10	20	20	-	-	-	-	-	100	2	1	-	3	Blended (2/1)	PP
		MC	AI & Machine Learning	50										3		2	4		
7	120617	DLC	Minor Project-II	-	-	-	-	60	40	-	-	-	100	-	-	4	2	Offline (2/0)	SO
8		CLC	Novel Engaging Course	-	-	-	-	50	-	-	-	-	50	-	-	2	1	Interactive	SO
Total				250	50	100	100	230	80	40	25	75	950	12	3	12	21		
Summer Internship-III (On Job Training) for Four weeks duration: Evaluation in VII Semester																			
Additional Courses for obtaining Honours/ Minor Specialization by desirous students								Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization											
8.		MAC	Intellectual Property Rights	50	10	20	20	-	-	-	-	-	100	2	-	-	Grade	Online	MCQ

***This course runs through SWAYAM/NPTEL/ MOOC platform**

Mode of Teaching						Mode of Examination					Total Credits
Theory				Lab	NEC	Theory			Lab	NEC	
Offline	Online	Blended		Offline	Interactive	PP	A+O	MCQ	SO	SO	
		Offline	Online								
0	2	10	5	4	1	14	0	5	2	1	22
0	9	45.5	22.7	18.1	4.5	63.6	0	22.7	9	4.5	100

DE-1 (Through Traditional Mode)			DE-2#			Open Category (OC-1)		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	120631	Metrology, Measurement and Control	1	120661	Viscous Fluid Flow	1		Robotics
2	120632	Statistical Quality Control	2	120662	Fundamental of Welding Science and Technology	2		Product Design
3	~~120633~~	~~Tribology and Maintenance Engineering~~	3	120663	Gear and Gear unit Design: Theory and Practice			
4	~~120634~~	~~Power Plant Engineering~~						

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B.Tech. (Mechanical Engineering) VII Semester

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted									Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Offline/ Online)	Mode of Exam.
				Theory Slot				Practical Slot			MOOCs								
				End Sem.		Mid Sem. Exam.	Quiz/ Assignment	End Sem	Lab Work & Sessional	Skill Based Mini Project	Assign-ment	Exam.		L	T	P			
				End Term Evaluation	$Proficiency in subject /course														
1.	DE	DE	Departmental Elective-3 (DE-2)	50	10	20	20	-	-	-	-	-	100	3	1	-	4	Blended (2/1)	PP
2.	DE*	DE	Departmental Elective -4 (DE-3)	-	-	-	-	-	-	-	25	75	100	3	-	-	3	Online (0/3)	MCQ
3.	OC	OC	Open Category-2 (OC-2)	50	10	20	20	-	-	-	-	-	100	2	1	-	3	Blended (2/1)	PP
4.	OC	OC	Open Category -3(OC-3)	50	10	20	20	-	-	-	-	-	100	3	-	-	3	Blended (2/1)	PP
5.	120715	DLC	**Reliability and Vibration Lab** (DLC-6)	-	-	-	-	60	20	20	-	-	100	-	-	2	1	Offline (1/0)	SO
6.	120716	DLC	Summer Internship Project–II (Institute Level) (Evaluation	-	-	-	-	60	40	-	-	-	100	-	-	4	2	Offline	SO
7.	120717	DLC	Creative Problem Solving (DLC-7)	-	-	-	-	60	20	20	-	-	100	-	-	2	1	Offline	SO
Total				**200**	**40**	**80**	**80**	**180**	**80**	**40**	**25**	**75**	**800**	**11**	**2**	**8**	**17**		
8		**MAC**	**Universal Human Values and Ethics**																
Additional Courses for obtaining Honors/Minor Specialization by desirous students				**Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization**															

***This course runs through SWAYAM/NPTEL/ MOOC platform**

Mode of Teaching						Mode of Examination					Total Credits
Theory				Lab	SIP	Theory			Lab	SIP	
Offline	Online	Blended		Offline	Interactive	PP	A+O	MCQ	SO	SO	
		Offline	Online								
0	2	6	3	1	3	9	0	2	1	3	15
0	13.3	40	20	6.6	20	60	0	13.3	6.6	20	100

DE-3 (Through Traditional Mode)			DE-4*			Open Category (OC-2)			Open Category (OC-3)		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	~~120731~~	~~Renewable energy Sources~~ APT	1	120761	Foundation of Computational Fluid Dynamics	1		Industrial Automation	1		Engineering Materials for Industrial Applications
2	120732	Basic of Finite Element Analysis/ SQC	2	120762	Introduction to Composites	2		Solar Energy	2		Maintenance Engineering

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3	120733	Total Quality Management	3	120763	Advanced Machining Processes							

B.Tech. (Mechanical Engineering) VIII Semester

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted									Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Offline/ Online)	Mode of Exam.
				Theory Slot				Practical Slot			MOOCs								
				End Sem.		Mid Sem. Exam.	Quiz/ Assignment	End Sem	Lab Work & Sessional	Skill Based Mini Project	Assign-ment	Exam.		L	T	P			
				End Term Evaluation	$Proficiency in subject /course														
1	DE*	DE	Departmental Elective – 5* (DE-5)	-	-	-	-	-	-	-	25	75	100	3	-	-	3	Online (0/3)	MCQ
2	~~OC*~~	~~OC~~	~~Open Category – 4* (OC-4)~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~25~~	~~75~~	~~100~~	~~3~~	~~-~~	~~-~~	~~3~~	~~Online (0/3)~~	~~MCQ~~
3	OC*	OC	Open Category – 5* (OC-5)	-	-	-	-	-	-	-	25	75	100	2	-	-	2	Online (0/3)	MCQ
4.	120811	DLC	Internship/ Project (DLC-8)	-	-	-	-	250	150	-	-	-	400	-	-	18	9	Interactive	SO
5.	120812	PD	Professional Development#	-	-	-	-	-	50	-	-	-	50	-	-	4	2	Interactive	SO
Total														5	-	22	16		
Additional Courses for obtaining Honours/Minor Specialization by desirous students				Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization															

*All of these courses will run through SWAYAM/ NPTEL/ MOOC/COURSERA

#Evaluation will be based on participation/laurels brought by the students to the institution in national/state level technical and other events during the complete tenure of the UG program (participation in professional chapter activities, club activities, cultural events, sports, personality development activities, collaborative events, MOOCs & technical events.

Mode of Teaching						Mode of Examination					Total Credits
Theory				SIP/ Project	PDC	Theory			SIP/ Project	PDC	
Offline	Online	Blended		Interactive	Interactive	PP	A+O	MCQ	SO	SO	
		Offline	Online								
0	9	0	0	6	2	0	0	9	6	2	17
0	52.9	0	0	35.2	11.7	0	0	52.9	35.2	11.7	100

DE-5*			Open Category (OC-4)*			Open Category (OC-5)*		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	120861	Quality Design and Control	1		Waste to Energy Conversion	1		Mechatronics
2	120862	Robotics: Basics and Selected Advanced Concepts	2		Product Design and Manufacturing	2		Elements of Solar Energy Conversion
3	120863	Steam and Gas Power Systems	3		Automatic Control	3		Traditional and Non-Traditional Optimization

								Tools

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Department of Mechanical Engineering

Mode of Teaching					
Semester	**Total Credits**	**Offline**	**Online Credits**	**Blended Teaching**	**Interactive**
I	19	10	0	9	0
II	19	4	0	15	0
III	22	12	0	9	1
IV	22	7	0	14	1
V	24	7	0	15	2
VI	22	4	2	15	1
VII	15	1	2	9	3
VIII	17	0	9	0	8
	Total (160)	**45**	**13**	**86**	**16**
	Credit %	**28.12**	**8.12**	**53.75**	**10**

Mode of Examination					
Semester	**Total Credits**	**MCQ**	**PP**	**AO**	**SO**
I	19	3	7	7	2
II	19	11	6	0	2
III	22	0	13	4	5
IV	22	2	10	8	2
V	24	3	11	4	6
VI	22	5	14	0	3
VII	15	2	9	0	4
VIII	17	9	0	0	8
	Total (160)	**35**	**70**	**23**	**32**
	Credit %	**21.8**	**43.75**	**14.37**	**20**

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YEAR	SEMESTER	COURSE CATEGORY							TOTAL COURSES
		BASIC SCIENCE COURSES (BSC)	HUM. AND SOCIAL SCI. INCLUDING MGMT. COURSES (HSMC)	ENGINEERING SCIENCE COURSES (ESC)	DEPARTMENTAL CORE (DC)	DEPARTMENTAL ELECTIVE (DE) (Offline + Online)	OPEN CATEGORY (OC) (Offline+Online)	MANDATORY COURSE (MC)	
I YEAR	I	2	2	1	-	-	-	-	5
	II	-	-	4	1	-	-	-	5
II YEAR	III	1	-	-	4	-	-	-	5
	IV	1	-	-	4	-	-	1	6
III YEAR	V	-	-	-	5	-	-	-	5
	VI	-	1	-	1	2	1	1	6
IV YEAR	VII	-	-	-	-	2	2	1	5
	VIII	-	-	-	-	1	2	-	3
TOTAL COURSES		**4**	**3**	**5**	**15**	**5**	**5**	**3**	**40**
EXAM MODES									
MCQ based subjects		**1**	**2**	**2**	**1**	**4**	**2**	**3**	**15**
Percentage of MCQ subjects		**25%**	**66.6%**	**40%**	**6.66%**	**80%**	**40%**	**100%**	**37.5%**
Pen paper (PP) based subjects		**3**	**1**	**1**	**10**	**1**	**3**	**-**	**19**
Percentage of PP subjects		**75%**	**33.3%**	**20%**	**66.66%**	**20%**	**60%**	**-**	**47.5%**
Assignment+ oral based subjects		**-**	**-**	**2**	**4**	**-**	**-**	**-**	**6**
Percentage of AO subjects		**-**	**-**	**40%**	**26.66%**	**-**	**-**	**--**	**15%**
NPTEL based subject		**-**	**-**	**-**	**-**	**3 (Online/MCQ)**	**2 (Online/MCQ)**	**-**	**5**
Percentage of NPTEL subjects		**-**	**-**	**-**	**-**	**60%**	**40%**	**-**	**12.5**

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Engineering Graphics

Category	Title	Code	Credit-3			Theory Slot
			L	T	P	
Engineering Science-ESC	Engineering Graphics	100014/100105/CEL/MEL/CSL/ EEL/ELL/ITL/CHL/ BTL105/1X25/BEEL/BELL/ BETL/BCHL/BAUL105/ BCEL/BMEL/BCSL/ BITL/BBTL204	1	2	-	Max.Marks-50 Min.Marks-16 Duration-3hrs.

Course Objective:

1. To inculcate the imagination and mental visualization capabilities for interpreting the geometrical details of common engineering objects.
2. To impart knowledge about principles/methods related to projections of one,two and three dimensional objects.

Syllabus:

Unit - 1

Introduction and scale: Basics of instruments, Lettering and dimensioning, Plane geometrical constructions. Plain and diagonal scale - Representative fraction, Unit conversion and Exercises based on linear, area, volume and speed. Scale of chord.

Engineering curves: Cycloidal curves - cycloid, epicycloid and hypocycloid curve, tangent and normal. Spiral curves - Archimedean and logarithmic spiral curves. Tangent & normal on the curves. Involute curve.

Unit - 2

Projection of points: Introduction, types of projections, quadrant system, positions of points and Exercise.

Projection of straight line: Introduction, Orientation of a straight line, Traces of a line and Exercise.

Unit - 3

Projection of planes: Introduction, Types of planes, Traces of planes, Position of planes and Exercise.

Projection of solids: Introduction, Types of solids, Positions of solids and Exercise.

Unit - 4

Section of solids: introduction, Types of section planes and Anti-section and Exercise.

Development of surfaces of right solids: Introduction, Methods of development & anti-development and Exercise.

Intersection of cylinders: Introduction, methods of developments, intersection of cylinder by another cylinder and exercise.

Unit - 5

Isometric projections: Introduction, isometric scale, isometric axis, isometric view and isometric projections from orthographic views, orthographic views from pictorial view and exercise.

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Computer Aided Drafting using Auto CAD: Introduction, software's basic commands, transformation and editing commands.

Course Outcomes: After successful completion of this course students will be able to:
CO1. **Visualize** the geometric details of engineering objects.
CO2. **Translate** the geometric information of engineering objects into engineering drawings.
CO3. **Draw** orthographic projections and sections.
CO4. **Develop** knowledge to read, understand and explain drawing.
CO5. **Improve** their skills so that they can apply these skills in developing new products.
CO6. **Prepare** simple layout of factory, machine and buildings.

Text books:

1. Engineering Drawing by N. D. Bhatt, Charotar Publication Pvt. Ltd.
2. Engineering Drawing by P.S. Gill, S. K. kataria& sons, Delhi
3. Engineering Drawing by BasantAgrawal& C. M. Agrawal, Tata McGraw Hill Education Pvt. Ltd.
4. Engineering Graphics by K. Venugopal, New Age International Publication, India

NPTEL Link for Engineering Graphics:

http://nptel.ac.in/courses/112103019/

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Material Science

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
Departmental Core-DC	Material Science	190211/120211	3	-	-	Max.Marks-50 Min.Marks-16 Duration-3hrs.

Course Objectives: To make the students to understand:

1. The basic fundamentals of materials science and engineering.
2. The different classes of materials, their properties, structures and imperfections present in them.
3. The functional properties of materials and the roles of microstructure, heat treatment defects and environment play in typical engineering applications.

Syllabus

Unit-I Structure of materials

Fundamentals of crystal structures and crystal system, crystallographic planes and directions, linear and planar density, single crystal, polycrystalline material and non-crystalline materials, Homogeneous and heterogeneous solidifications, Crystal imperfections: point, line, surface and volume defects.

Unit-II Material testing and mechanical properties

Mechanical properties in static tensile, compression and bending tests, Hardness: Rockwell, Brinell, Vicker's, Impact toughness and fracture toughness.

Role of dislocations in plastic deformation, slip and twinning processes. Mechanism of ductile and brittle fracture. Fatigue: Cyclic stresses, S-N curve, crack initiation and propagation, factors affecting fatigue life; Creep: Generalized creep behavior, stress and temperature effects.

Unit-III Engineering Materials

Ferrous (Steels and Cast irons with role of different alloying elements) and non-ferrous metals and alloys (Aluminum, Magnesium, Titanium, Copper, Nickel alloys), Nano-materials, Ceramic material, Composite material with their properties and applications, Smart materials, Bio-materials

Unit-IV Phase diagrams and phase transformation of metal alloys

Concept of phases, Gibb's phase rule, Lever-rule, binary isomorphous and eutectic phase diagrams, Eutectoid, Peritectic and Peritectoid systems, allotropy in iron, Fe-Fe_3C phase diagram; Isothermal transformation of austenite, continuous cooling transformation of austenite, Objectives of heat treatments, Annealing, Normalizing, Hardening (bulk and surface)

Unit-V Environmental consideration and some case studies

Corrosion: Introduction, types & its prevention; generalized material selection process, material selection for torsionally-stressed cylindrical shaft, Automotive valve spring, orthopedic implants, Integrated circuit and etc.

Course Outcomes: After successful completion of this course students will be able to:

CO1. State fundamental relationship between structure and properties of materials.

CO2. Discuss mechanical properties of materials
CO3. Compare the different processes to alter the material properties.
CO4. Determine the effect of different phases, impurities on the behavior of materials.
CO5. Analyze crystal structure and composition of different materials.
CO6. Create the different engineering materials and alloys.

Text & Reference Books

1. Material Science and Engineering: An Introduction, William D. Callister, John Willey & Sons Inc., 7th edition
2. Elements of Material Science and Engineering **by** Lawrence, H. Vanvlackdison; Wesley.Mention the Year or the Edition and Publisher and Place of Publication
3. Material Science and Engineering **by** Raghvan, V; Prentice Hall of India.
4. Introduction to Engineering Materials **by** Agrawal, B.K; Tata McGraw Hill, N. Delhi.

NPTEL Link for Material Science

https://onlinecourses.nptel.ac.in/noc18_mm05/preview

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Basic Mechanical Engineering

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
Engineering Science-ESC	Basic Mechanical Engineering	100021/100204/CEL/ MEL/CSL/EEL/ ELL/ITL/CHL/ BTL114/2X24	2	1	-	Max.Marks-50 Min.Marks-16 Duration-3hrs.

Course Objectives: To make the students:

1. Develop the fundamentals of Engineering materials, measurement and reciprocating machines.
2. Develop an ability to understand the Thermodynamic laws, steam generator and reciprocating machines for solving engineering problems.
3. Demonstrate Engines and Boiler fundamentals using models.

Syllabus

UNIT-I:

Materials: Classification of engineering material, composition of cast iron and carbon steels on iron-carbon diagram and their mechanical properties; Alloy steel and their applications; Stress-Strain diagram, Hooks law and modulus of elasticity. Tensile, shear, hardness and fatigue testing of materials.

UNIT-II:

Measurement: Temperature, pressure, velocity, flow, strain, force and torque measurement, concept of measurement error & uncertainty analysis, measurement by Vernier caliper, micrometer, dial gauges, slip gauges, sine-bar and combination set; introduction to lathe drilling, milling and shaping machines.

UNIT-III

Fluids: Fluid properties, pressure, density and viscosity; pressure variation with depth, static and kinetic energy; Bernoulli's equation for incompressible fluids, viscous and turbulent flow, working principle of fluid coupling, pumps, compressors, turbines, positive displacement machines and pneumatic machines. Hydraulic power & pumped storage plants for peak load management as compared to base load plants.

UNIT-IV

Thermodynamics: Zeroth, First, second and third law of thermodynamics; steam properties, steam processes at constant pressure, volume, enthalpy & entropy, classification and working of boilers, efficiency & performance analysis, natural and induced draught, calculation of chimney height. Refrigeration, vapour absorption and compression cycles, coefficient of performance (COP).

UNIT-V

Reciprocating Machines: Steam engines, hypothetical and actual indicator diagram; Carnot cycle and ideal efficiency; Otto and diesel cycles; working of two stroke & four stroke petrol and diesel IC engines.

Course Outcomes: After successful completion of this course students will be able to:

CO1. **Define** the essential concepts of thermal, design and production used in Mechanical Engineering.
CO2. **Summarize** fundamental techniques and process used in power generating machines
CO3. **Solve** the various problems based on basic concepts of Mechanical Engineering.
CO4. **Analyze** the various gas, steam and air cycles.

CO5. **Evaluate** the problems of Steam Generator, Thermodynamics, Steam and I.C. engines
CO6. **Generate** the skills to demonstrate steam Generator and reciprocating machine in depth.

Reference Books:

1. Narula; Material Science; TMH
2. Agrawal B & CM; Basic Mechanical Engineering; TMH
3. Nag PK, Tripathi et al; Basic Mechanical Engineering; TMH
4. Rajput; Basic Mechanical Engineering;
5. Sawhney GS; Fundamentals of Mechanical Engibneering; PHI
6. Nakra and Chaudhary; Instrumentation and Measurement; TMH
7. Nag PK; Engineering Thermodynamics; TMH
8. Ganesan; Combustion Engines; TMH

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Manufacturing Practices

Category	Title	Code	Credit-1			Practical End Sem
Engineering Science-ESC	Manufacturing Practices	100024/100106	L	T	P	Max.Marks-60 Min.Marks-19 .
			-	-	2	

Course Objectives:

1. To familiarize with the basics of tools and equipments used in fitting, carpentry, sheet metal, welding and smithy.
2. To with the production of simple models in the above trades.
3. To develop general machining skills in the students.

Syllabus

UNIT-I

Introduction: Manufacturing Processes and its Classification, Casting, Machining, Plastic deformation and Metal forming, Joining Processes, Heat treatment process, Assembly process.

Black Smithy Shop

Use of various smithy tools. Forging operations; Upsetting, Drawing down, Fullering, swaging, Cutting down, Forge welding, Punching and drafting.

Suggested Jobs: Forging of chisel, forging of Screw Driver.

UNIT-II Carpentry Shop

Timber: Type, Qualities of timber disease, Timber grains, Structure of timber, Timber seasoning, Timber preservation. Wood Working Tools: Wood Working Machinery, joints and joinery, various operations of planning using various carpentry planes sawing & marking of various carpentry joints.

Suggested Jobs: Name Plate, Any of the carpentry joint like mortise or tennon Joint.

UNIT-III Fitting Shop:

Study and use of measuring instruments, Engineer steel rule, Surface gauges caliper, Height gauges, feeler gauges, Micrometer. Different types of files, File cuts, File grades, Use of surface plate, Surface gauges drilling tapping Fitting Operations: Chipping filling, Drilling and Tapping.

Suggested Jobs: Preparation of job piece by making use of filing, sawing and chipping, drilling and tapping operation.

UNIT-IV Foundry:

Pattern Making: Study of pattern materials, pattern allowances and types of patterns. Core box and core print, Use and care of tool used for making wooden patterns.

Moulding: Properties of good mould& Core sand, Composition of Green, Dry and Loam sand. Methods used to prepare simple green and bench and pit mould dry sand bench mould using single piece and split patterns.

UNIT-V Welding: Study and use of tools used for Brazing, Soldering, Gas& Arc welding. Preparing Lap & Butt joints using Gas and Arc welding methods, study of TIG and MIG welding processes. Safety precautions.

Course Outcome: After successful completion of this course students will be able to:
CO1. **Discuss** the hand tools, machine tools and power tools.
CO2. **Utilize** appropriate tools required for specific operation.
CO3. **Apply** safety measures required to be taken while using the tools in floor shops, Machine ships and carpentry shop.
CO4. **Use** the techniques, skills, and modern engineering tools necessary for manufacturing and production engineering.
CO5. **Conduct** experiments in the field of Production engineering.
CO6. **Design** a system, components, or process to meet desired needs, ethical, health and safety, manufacturability and sustainability.

Text & References Books:

1. Bawa HS; Workshop Practice, TMH
2. Rao PN; Manufacturing Technology-Vol.1 & 2, TMH
3. John KC; Mechanical Workshop Practice; PHI
4. HazraChoudhry; workshop Practice-Vol.1 & 2.
5. Jain R. K.; Production Technology

NPTEL Link for Manufacturing Practices

http://nptel.ac.in/courses/112107145/

Laboratory Work:

Relevant shop floor exercises involving practice in forging, Carpentry, fitting, pattern making, Sand casting, Moulding, Welding, Sheet metal fabrication techniques.

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Engineering Graphics Lab

Category	Title	Code	Credit-1			Practical End Sem
HSMC	Engineering Graphics Lab	100018	L	T	P	Max.Marks-60 Min.Marks-19
			-	-	2	

Laboratory Work

List of Experiments:

1. To prepare sheet of Plain scale, diagonal scale and Scale of chord.
2. To prepare sheet of Cycloidal curves.
3. To prepare sheet of Projection of points and lines.
4. To prepare sheet of Projection of Planes.
5. To prepare sheet of Projection of Solids.
6. To prepare sheet of Section of Solids.
7. To prepare sheet of Development of Surfaces.
8. To prepare sheet of Isometric and Intersection of Solids

Course Outcomes: After successful completion of this course students will be able to:
CO1. **Visualize** the geometric details of engineering objects.
CO2. **Translate** the geometric information of engineering objects into engineering drawings.
CO3. **Draw** orthographic projections and sections.
CO4. **Develop** knowledge to read, understand and explain drawing.
CO5. **Improve** their skills so that they can apply these skills in developing new products.
CO6. **Prepare** simple layout of factory, machine and buildings.

Text books:

1. Engineering Drawing by N. D. Bhatt, Charotar Publication Pvt. Ltd.
2. Engineering Drawing by P.S. Gill, S. K. kataria& sons, Delhi
3. Engineering Drawing by BasantAgrawal& C. M. Agrawal, Tata McGraw Hill Education Pvt. Ltd.
4. Engineering Graphics by K. Venugopal, New Age International Publication, India

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Basic Mechanical Engineering Lab

Category	Title	Code	Credit-1			Practical End Sem
Engineering Science-ESC	Basic Mechanical Engineering Lab	100026	L	T	P	Max.Marks-60 Min.Marks-19
			-	-	2	

Lists of Experiments:

1. Study of vertical boilers.
2. Study of Locomotive boilers.
3. Study of Babcock and Wilcox boilers.
4. Study of Lancashire, Cornish and Cochran boilers.
5. Study of boiler mounting and accessories.
6. Study of 2 stroke diesel and petrol engines.
7. Study of 4 stroke diesel and petrol engines.
8. Study of steam engines.
9. Study of Lathe machine.
10. Study of Vernier and Micrometer.
11. Study of Internal Combustion Engine Parts.

Course Outcomes: After successful completion of this course students will be able to:

CO1. **Define** the essential concepts of thermal, design and production used in Mechanical Engineering.
CO2. **Summarize** fundamental techniques and process used in power generating machines
CO3. **Solve** the various problems based on basic concepts of Mechanical Engineering.
CO4. **Analyze** the various gas, steam and air cycles.
CO5. **Evaluate** the problems of Steam Generator, Thermodynamics, Steam and I.C. engines
CO6. **Generate** the skills to demonstrate steam Generator and reciprocating machine in depth.

Reference Books:

1. Narula; Material Science; TMH
2. Agrawal B & CM; Basic Mechanical Engineering; TMH
3. Nag PK, Tripathi et al; Basic Mechanical Engineering; TMH
4. Rajput; Basic Mechanical Engineering;
5. Sawhney GS; Fundamentals of Mechanical Engibneering; PHI
6. Nakra and Chaudhary; Instrumentation and Measurement; TMH
7. Nag PK; Engineering Thermodynamics; TMH
8. Ganesan; Combustion Engines; TMH

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120311/190319: Manufacturing Processes

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
Departmental Core-DC	Manufacturing Processes	120311/190319/ 190414/120403 /190404	2	1	-	Max.Marks-50 Min.Marks-16 Duration-2hrs.

Course Objectives: To make students:

1. Able to learn the various methods and types of castings, welding processes, sheet metal forming, powder metallurgy

2. Able to **e**xamine the principles associated with basic operations involving the forming, machining and welding of engineering materials;

3. Aware of the necessity to manage manufacturing processes and systems for the best use of material and human resources.

Course Pre-Requisites: Manufacturing Practice

Syllabus

Unit-I Casting: Brief History, Basic principle & survey of casting processes. Sand casting, pattern materials, and allowances. Green and dry moulding, moulding methods, moulding sand properties and testing. Elements of mould and design considerations. Cores use, core materials and core making practice. Die, investment and centrifugal casting processes. Melting practice and concepts in solidification. Inspection and defects analysis.

Unit-II Forming: Elastic and plastic deformation, Concept of strain hardening. Rolling, forging, extrusion, spinning, wire and tube drawing processes, machines and equipment's, parameters and force calculations.

Unit-III Sheet Metal Working: Role of sheet metal components.Cutting mechanism. Description of cutting processes like blanking. Piercing, lancing etc. Description of forming processes like bending cup drawing, coining, embossing etc. Basic elements of presses for sheet metal working. Punch and Die clearances and die elements.

Unit-IV Welding: Principle of welding, soldering, brazing and adhesive bonding.Survey of welding and allied processes. Arc welding: power sources and consumables. MMAW, TIG& MIG processes and their parameter selection. Resistance Welding: principle and equipment. Spot, projection and Seam welding processes, Gas welding and cutting: Processes and equipment.

Unit-V Powder Metallurgy: Powder manufacturing, compaction and sintering processes. Advantages and applications of P/M. Manufacturing of Powder metallurgy components.

Course Outcomes: After successful completion of this course students will be able to:

CO1- Describe the different types of manufacturing processes and their applications.

CO2- Identify suitable manufacturing process to achieve the required product shape with the aim of avoid defects, material and time wastage.

CO3-Illustrate the advantage and limitations of various manufacturing processes with regard to shape formation and surface quality.

CO4-Analyse the manufacturing processes for given problem and able to select an appropriate process according to a specific requirement.
CO5-Evaluate the procedures and techniques involved for the manufacturing of components for its optimization.
CO6-Propose a simplified manufacturing processes with the aim of reduction of cost and manpower.

Text &Reference Books

1. Jain R.K., Production Technology, Khanna Publishers, 2001.
2. Hajra Choudhry, Elements of Workshop Technology, Vol – II Media Promoters & Publishers, 1994.
3. Production Technology by HMT, Tata McGraw-Hill.
4.Chapman, W.A.J., Workshop Technology, Vol - II, Oxford & IBH Publishing Co. Ltd.,
5. Manufacturing Processes by Amstead, B.H., P.F. Oswald and M.L. Begeman, John Wiley and Sons Inc., New York.
6. Manufacturing Technology Vol. 1 by P.N. Rao.
7. Modern Manufacturing Process Engineering by Neibel, B.W., Alan B. Draper and R.A. Wysk, McGraw-Hill Publishing Co., New York.
8. Manufacturing Engineering and Technology by Kalpakjian, S, Addison-Wesley Publishing Co., New York.
9. Materials and Processes in Manufacturing by E. Paul DeGarmo, J. Temple Black, and Ronald Kohser, Macmillan Publishing Co., New York.
10. Introduction to Manufacturing Processes John A. Schey, McGraw-Hill Book Co., New York.

NPTEL Link for Manufacturing Process

http://nptel.ac.in/courses/112107145/

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120319/190317: Mechanics of Materials

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Mechanics of Materials	120312/190312/ 120302/190302/ BMEL-302/ MEL-305/3225	2	1	2	Max.Marks-50 Min.Marks-16 Duration-2hrs.

Course Pre-Requisites:

Basic Civil Engineering and Mechanics

Course Objectives: To make the students:
1. Learn the basic concepts and principles of strength of materials.
2. Calculate stresses and deformations of objects under external loadings.
3. Apply the knowledge of strength of materials on engineering applications and design problems.

Syllabus

Unit- I Stress and strain: Stress-strain relationship and elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain, compound and combined stresses, thermal stresses.
Unit-II Stresses in beams: Shear Force & Bending Moment diagram, theory of simple bending, Section Modulus, bending Stresses and Shear stresses in beam.
Slope and deflection: Equation of Elastic Curve, Macaulay's Method, Area Moment Method, Strain Energy Methods etc.
Unit- III Shear stress distribution: Horizontal, Vertical, Transverse, Longitudinal Shear Stress, Graphical Methods for Different Sections.
Shafts: Torsion of circular shaft, stress concentration in shafts; series and parallel combination.
Unit -IV Column and Struts: Euler's theory of column, Rankine's formula, slenderness ratio; strut with eccentric load.
Thin cylinder: Stress and Strain in thin cylinder, wire wound thin cylinder; thin spherical shells.
Unit- V Materials testing: Tensile, compressive, hardness, impact and torsion testing. Strain Gauges - types of strain gauges, electrical strain gauges, Gauge factor, strain rosette.
Strain Energy: Strain energy due to direct stress, simple shear, torsion, bending, shear force in beams.
Course Outcomes: After successful completion of this course students will be able to:

CO-1 **Identify** various structural elements and its application.

CO-2 **Illustrate** different types of stress and strain on various types of structural elements like beam, shaft column etc.

CO-3 **Calculate** principal stresses, maximum shearing stress, and the different stresses acting on a structural member.

CO-4 **Analyze** stresses and deflection for beam, shaft, long columns, thin cylinder etc.

CO-5 **Select** appropriate materials in design considering engineering properties, sustainability, cost and weight.

CO-6 **Design** simple bars, beams, and circular shafts to meet desired needs in terms of strength and deformation.

Text & Reference Books

1. Strength of Materials (MoM) **by** R S Lehri and A S Lehri; S K Katariya and Sons Pub.
2. Strength of Materials **by** S S Rattan; McGraw Hill Pub.
3. Mechanics of Materials **by** F P Beer, E R Johnston, J T DeWolf; TATA McGraw Hill Pub.
4. Strength of Materials **by** S. Timoshenko; D Van NostrandCompnay,
5. Mechanics of Solids **by** Mubeen; Pearson Education Pub
6. Strength of Materials **by** S Ramamrurtham, R Narayan; DhanpatRai sons Pub.
7. Strength of Materials **by** Sadhu Singh; Khanna Publisher Pub.
8. Mechanics of Materials **by**AdarashSwaroop, New Age international Pub.

NPTEL Link for Mechanics of Material

https://onlinecourses.nptel.ac.in/noc18_ce04/preview

LIST OF EXPERIMENTS

1. To Study Universal Testing Machine
2. To perform the Tensile test on metal specimen
3. To perform the Compression test on metal specimen
4. To perform Bending test on metal specimen
5. To perform single shear and double shear on UTM
6. To perform Hardness testing with Brinell hardness
7. To perform Hardness testing with Rockwell hardness
8. To study the impact testing machine and perform the IZOD impact test
9. To Perform Charpy impact test
10. To study and Perform Fatigue test
11. To study Bending Moment Diagram

12. To Study stiffness of spring and Modulus of rigidity of spring wire

13. Study of weight measurement using strain gauge

Lab Course Outcomes: After successful completion of this course lab students will be able to:

CO1. **Evaluate** the values of yield stress, breaking stress and ultimate stress of the given specimen under tension test.

CO2. **Conduct** the torsion test to determine the modulus of rigidity of given specimen.

CO3. **Perform** compression tests on spring and wood.

CO4. **Justify** the Rockwell hardness test over with Brinell hardness and measure the hardness of the given specimen.

CO5. **Determine** elastic constants using flexural and torsion tests.

CO6. **Examine** the stiffness of the open coil and closed coil spring and grade them.

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120313/190411: Theory of Machines-I

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Theory of Machines-I	120313/ 120303/ 190411/190401	2	1	2	Max.Marks-50 Min.Marks-16 Duration-2hrs.

Course Pre-Requisite:
Engineering Graphics
Mechanics of Materials

Course objectives: To make the students:

1. Familiarize with different types of mechanisms.
2. Understand the basics of synthesis of simple mechanisms.
3. Apply fundamental of mechanics to machines which include engines, linkages etc.

Syllabus

Unit-I Mechanism: Machine, Mechanism, Kinematics Links, Pairs, Chains, Degree of freedom. Mechanisms and its Inversions; Slider, Double Slider and 4 bar mechanism. Lower pair mechanisms: pantograph, Straight line motions. Davis and Ackerman Steering Mechanisms.

Unit-II Kinematic Analysis: Displacement, velocity and acceleration analysis of plane mechanisms; relative velocity, instantaneous centre, Kennedy's Theorem, Klein's construction methods. Coriolis component.

Unit-III Dynamic Analysis: D'Alembert's principle. Equivalent dynamic system, Graphical and analytical methods of dynamic forces, analysis of mechanisms and machines including reciprocating engines.
Flywheel: Introduction, Turning-moment diagrams and Flywheel analysis.

Unit-IV Brakes: Analysis of simple brake assuming uniform pressures and uniform wear, band brake, block brakes, internal and external shoe brakes, braking of vehicles.
Clutches: Single plate and multi plate clutches, cone clutches, centrifugal clutches.
Dynamometers: Different types and their applications.

Unit-V Governors: Introduction, Types of governors, Various gravity and spring-controlled governors, governor characteristics, Effort and power of a governor, Controlling force diagrams, Coefficient of insensitiveness.

Gyroscopes: Gyroscopic couple, Effect of Gyroscopic couple on the stability of four wheel and two-wheel vehicles, Aeroplanes and Naval ships, Gyrostabilisers.

Course Outcomes: After successful completion of this course students will be able to:

CO 1.Identify basic mechanisms in real life applications.

CO 2.Discuss about mechanics of various machines.

CO 3.Apply fundamental principles of statics and dynamics to machinery.

CO 4.Analyze various types of motions and mechanisms of machinery.

CO 5.Compare various components suitable for different applications.e.g. different types of governor, clutch, brakes, flywheel etc.

CO 6.Create the mechanism or components to justify the demands of work.

Text &Reference Books:

1. Theory of Machines by Rattan, SS; TMH full detail of publicaiton
2. Theory of Machine by Norton, RL; TMH
3. Theory of Machine byBallaney, PL;Kanna Pub.
4. Mechanism and Machine Theory by Ambekar, AG; PHI.
5. Theory of Mechanism and Machines by Sharma, CS and Purohit K; PHI.
6. Theory of Machines by Bevan, Thomos; Pearson/ CBS PUB Delhi.
7. Mechanism and Machine Theory byRao, JS and Dukkipati; NewAge Delhi.
8. Theory of Machines byLal,Jagdish; Metropolitan Book Co; Delhi –
9. Theory of Mechanisms & Machines byGhosh,A.,Mallik,AK; Affiliated East West Press,Delhi.

NPTEL Link for Theory of Machines-I

http://nptel.ac.in/courses/112104121/1 and http://nptel.ac.in/courses/112104114/

List of experiments (expandable)

1. Study of Kinematics links pairs and chains.
2. To find degree of freedom of a given mechanism.
3. To study all inversions of four-bar mechanisms using models.
4. Draw velocity and acceleration polygons of all moving link joints in slider crank mechanism.
5. Study of inertia forces in reciprocating parts and analysis of flywheel.
6. Study of various types of governors.
7. Study of various types of clutches.
8. Study of various types of brakes.
9. Study of various types of dynamometers.

10. Use virtual lab for any two experiments.
11. Determine the gyroscopic effect of a rotating disc.
12. Determine the Coriolli's component of acceleration.
13. Find the total slip, creep, velocity ratio and coefficient of friction between belt and pulley system.
14. Measure the percentage slip at fixed belt tension by varying load on brake drum

Lab Course Outcomes: After successful completion of this course lab students will be able to:

CO1. **Design** and **analyze** mechanism required for the specified type of motion.

CO2. **Draw** inversions and determine velocity and acceleration of different mechanisms.

CO3. **Construct** different types of cam profile for a given data.

CO4. **Analyze** various motion transmission elements like gears, gear trains, cams, belt drive and rope drive.

CO5. **Compare** the various components related to machines and mechanism.

CO6. **Determine** the degrees-of-freedom (mobility) of a mechanism.

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120314/190314: Fluid Mechanics and Hydraulic Machines

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Fluid Mechanics and Hydraulic Machines	120314/190314	2	1	2	Max.Marks-50 Min.Marks-16 Duration-2hrs.

Course Objectives: To make the students understand:
1. Fundamentals of Fluid Mechanics, which is used in the applications of Aerodynamics,

Hydraulics, Marine Engineering, Gas dynamics etc.
2. And give fundamental knowledge of fluid, its properties and behavior under various

conditions of internal and external flows.
3. And develop understanding about hydrostatic law, principle of buoyancy and stability

of a floating body and application of mass, momentum and energy equation in fluid flow.

Course Pre-Requisite:
Basic Mechanical Engineering.

Syllabus

Unit-I Properties of fluid: Pressure, density, specific weight, viscosity, dynamic and kinematic viscosity Newton's law of viscosity and its applications.
Fluid Static: Pressure variation with depth, pressure measurement, pressure on immersed surface centre pressure, Buoyancy, flotation, stability of floating bodies.
Unit-II Fluid Kinetics: One dimensional flow approximation, control volumes concept, continuity equation in 3-D, its differential and integral form, velocity and acceleration of fluid particle, stream line, path line. Rotation, vorticity and circulation. Stream function and velocity potential function. Flow net, Free and forced vortex flow.
Unit-III Fluid Dynamics: Momentum theorem, Impulse momentum equation and its application, Euler's equation in 3-D, Bernoulli's equation for incompressible fluid flow, engineering applications of energy equation, Pitot -Tube, Venturi meter, Orifice meter.
Unit-IV Flow through Pipes: Critical Reynolds's number, velocity distribution in pipes, friction factor. Moody's chart, Laminar flow through pipe, Hagen-Poiseulli's equation, Turbulent flow through pipe, Hydraulic gradient line and total energy line. Minor head losses in pipes, Pipe Networking and Transmission of power through pipes.
Unit-V Water Turbine and Pump: Impulse and Reaction principles, Pelton, Francis and Kaplan turbines, velocity diagrams, Work done by turbines, Draft Tube theory. Application of dimensional analysis, similarity to turbines and pumps, Classification, advantage over reciprocation type, definition of manometric head gross head, static head, vector diagram and work done. Performance and Characteristics of turbines and pumps.

Course Outcomes: After successful completion of this course students will be able to:

CO1: **Define** the fundamental properties of fluids.
CO2: **Relate** the concepts of mechanics with various laws of fluid mechanics.

CO3: **Identify** the laws of fluid mechanics applicable for the body in various fluids under different conditions.
CO4: **Analyse** various forces and their effects, related to fluids mechanics.
CO5: **Measure** and compare losses in different fluid flow conditions.
CO6: **Compare** different turbo machines depending on their behaviour and their merits and demerits

Text &Reference Books:

1. Fluid Mechanics by Streeter &Wylis; McGraw-Hills Pub.
2. Fluid Mechanics by Modi& Seth; Standard publishing house.
3. Fluid Mechanics by D.S. Kumar ;Katson publisher.
4. Fluid Mechanics by R.K. Bansal; Laxmi Publishing House.
5. Fluid Mechanics byYunus A Cengel& John M. Cimbala; Tata McGraw Hill Edition.

NPTEL Link for Fluid Mechanics and Hydraulic Machines

http://nptel.ac.in/courses/112105171/1

List of Experiments:

1. To find out coefficient of discharge of a given Venturimeter.
2. To determine the hydraulic coefficient C_v , C_c , and C_d of an Orifice
3. To study the flow over a Rectangular notch to find the coefficient of discharge for it.
4. To determine the coefficient of friction for pipes of different sizes.
5. Experimental determination of Metacentric height of a ship model
6. Study of Redwood viscometer.
7. To study of different types of flow (Reynold's experiment).
8. To verify Bernoulli's Equation Experimentally.
9. To study the performance characteristics of a centrifugal pump and to determine the characteristic with maximum efficiency.
10. To conduct load test on Pelton Wheel Turbine and to study the characteristics of Pelton wheel turbine.
11. To conduct load test on Francis turbine and to study the characteristics of Francis turbine.
12. To study the characteristics of a Kaplan turbine.

13. To study the performance characteristics of a reciprocating pump and to determine the characteristic with maximum efficiency

Laboratory Course Outcomes: After successful completion of this course students will be able to:

CO1: **Conduct** experiment with flow measurement devices like Venturi meter and orifice meter.

CO2: **Estimate** the friction and measure the frictional losses in fluid flow.

CO3: **Predict** the coefficient of discharge for flow through pipes.

CO4: **Evaluate** pressure drop in pipe flow using Hagen-Poiseuille's equation for laminar flow in a pipe.

CO5: **Calculate** the Critical Reynolds's Number through Pipe Set Apparatus.

CO6: **Apply** thermodynamic concepts to analyze Fluid machines.

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120315/190315: Software Lab

Category	Title	Code	Credit-1			Practical End Sem
Departmental Lab Core-DLC	Software Lab	120315/ 190315 120305	L	T	P	Max.Marks-60 Min.Marks-19 .
			-	-	2	

Course Pre-Requisites:
Engineering Graphics
Course Objectives: To make the students:
1. Develop an ability to make familiar with 2D, 3D modelling and simulation software
2. Develop an ability to create and modify complex 2D and 3D entities using CATIA software
3. Develop creative skills in developing new ideas.

SYLLABUS:

Auto CAD: Auto CAD interface, work space setting, Basic commands, viewports and printing.
Snaps: snap to grid, show to grid. Orthographic polar snap, object snap, dynamic UCS.
2D and 3D commands: Trim, extend, Offset, move, mirror, scale, rotate, extrude, union, subtract etc. commands. Units: properties, measure and dimension.

CATIA concepts: Display-Tree appearance, Three button move, view tool bar, Normal standard and shading view**,** 2D toolbar, sketch tools, constraint, profile, operation.
Toolbar: Sketch based features toolbar, commands-Pad, Pocket, shaft, groove, holerib etc. Dress up feature, Transformation features, Boolean operation.

Simulation: Assembly and simulation in CATIA, Linear and rotational motion, Nut-bolt mechanism simulation

Course Outcomes: After successful completion of this course students will be able to:
CO1 Describe AutoCAD and CATIA toolbars
CO2 Summarize 2D and 3D commands
CO3 Solve real time problems using AutoCAD and CATIA software
CO4 Analyse various mechanical engineering problems.
CO5 Evaluate technical drawings of machine assemblies as a design engineer
CO6 Generate 2D and 3D solid models with new features in machine elements

Text Books and Reference books:

1. Franke& Roger: Modelling and simulation for chemical engineering, Willey Interscience
2. Luyben-Process modelling simulation and control for chemical engineers, IInd, McGraw Hill,1989
3. Fundamentals of Engineering drawing Interactive graphics by Luzzader WJ, Duff JM;PHI
4. A general guide to computer aided design and drafting-CAD by Duggal, Vijay, cadd primer; CAD malimax publications.

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120412: Design of Machine Elements

Category	Title	Code	Credit-4			Theory Paper
Departmental Core-DC	Design of Machine Elements	120412	L	T	P	Max.Marks-50 Duration-2 hrs.
			2	1	2	

Note: Use of PSG Design Data book is permitted in exam.

Course Pre-Requisites:
Mathematics-I
Mechanics of Materials

Course Objectives: To make the students:
1. Able to identify, formulate and solve design engineering problems.

2. Develop an ability to use the techniques, skills and modern design engineering tools necessary for engineering practice.

3. Demonstrate the ability to make proper assumptions, perform correct analysis while design upon various mechanical machine elements.

Syllabus

Unit-I Introduction: Design process, Factor of safety, design standards and units, Material selection in Mechanical Design, surface finish symbols, Surface Roughness, limit, fit, and tolerance, Gauge design, Tolerance analysis in manufacturing and assembly, Design for Manufacturability, Comparison between conventional design process and modern design process

Unit-II Bolted, Riveted and Welded joints: Definition, Nomenclatures, Classifications, Applications, Methods of joining, Loadings & Failures, Design procedures, Eccentric loading problems.

Unit-III Cotter and Knuckle joints: Definitions, Nomenclature, Classifications, Comparison between keys and cotters, Design of Socket and spigot cotter joint, Sleeve type Cotter joint, Cotter with Gib, Knuckle Joint, Suspension link, Pin joint, Adjustable joint, Turn-buckle.

Unit-IV Shafts, Keys and Couplings: Definitions, Classifications and Applications. Design under various loads and cases.

Unit-V Theories of Failures: Maximum normal stress and shear stress theory, maximum normal strain and shear strain theory, maximum distortion energy theory. Applications of theories to different material. Introduction to 2D, 3D modules and tools, Fundamentals and applications of CAD/CAM. Concept of computer aided drafting and Machine drawing.

Course Outcomes: After successful completion of this course students will be able to:

CO1 Describe the basic design process and function of Permanent and temporary joints used in Machine Design
CO2 Summarize the design techniques, skills and tools used in design

CO3 Solve the various design engineering problems by formulate and proper assumptions for practice.
CO4 Analyze the stress and strain on mechanical components; and understand, identify and quantify failure modes for mechanical parts
CO5 Evaluate the cases of Temporary and permanent joints problems successfully
CO6 Create design techniques for a mechanical component under variety of environmental and service conditions.

Text &Reference Books

1. Mechanical Engineering Design byShigley JE et al; TMH
2. Machine Design byMubeen
3. Design of Machine elementsbyBhandari VB; TMH
4. Text Book of Machine Drawing byJohn KC; PHI Learning
5. Engineering design – George Dieter, MGH, New York.
6. Machine Drawing byBhat, ND; Charotar.
7. Machine Drawing byNarayana and Reddy; New age, Delhi.
8. Design data book **by** PSG
9. Fundamental of Engg Drawing Interactive Graphics **by**Luzzader WJ, Duff JM; PHI.
10. Mechanical design data book **by** Mahadevan and Reddy's;CBS

NPTEL Link for Design of Machine Elements

http://nptel.ac.in/courses/112105124/

List of Experiments

1. Design and drawing of Single, double and triple riveted joint
2. Design and drawing of Single and double strap butt joint
3. Design and drawing of Welded joint
4. Design and drawing of Socket and Spigot cotter joint
5. Design and drawing of Gib and Cotter joint.
6. Design and drawing of Knuckle joint
7. Study of Theories of failure
8. Design and drawing of Solid and hollow shaft
9. Design and drawing of Rigid coupling

10. Design and drawing of Flexible coupling

Laboratory Course Outcomes: After the completion of the course Lab students will be able **to**

CO1 **Design** and analysis the different part of an I.C Engine like Piston, cylinder, connecting rod , crank shafts , flywheel.

CO2 **Compare** the materials used in designing the automobile engine parts.

CO3 **Use** the software like AUTO CAD , CATIA , PRO/E, SOLID WORKS.

CO4 **Select** the spring for a proper application also can select the proper material of spring.

CO5 **Design** the different types of gear like spur gear, helical gear , worm gear , bevel gear and also able to know their practical applications.

CO6 **Create** a gear box for modern Automotive vehicles and can use this for the benefits of society.

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Metal Cutting and Machine Tools

Category	Title	Code	Credit: 4			Theory Paper
			L	T	P	
Departmental Core-DC	Metal Cutting and Machine Tools	120413	3	1	-	Max.Marks-50 Duration-2 hrs.

Course Objectives: To make the students understand:

1. The fundamental knowledge and principles in material removal processes.
2. The fundamentals and principles of metal cutting to practical applications through
3. The fundamentals of machining processes and machine tools.

Syllabus

Unit-I Mechanics of Metal Cutting: Introduction to manufacturing and machining, Classification of metal removal processes, Geometry of single point cutting tool and tool angles. Tool nomenclature. Conversion of tool angles from one system to another, Mechanics of chip formation and types of chips, chip breakers. Orthogonal and oblique cutting, cutting forces and power required, theories of metal cutting. Thermal aspects of machining and measurement of chip tool interface temperature. Friction in metal cutting. **Machinability & Cutting Fluids:** Concept and evaluation of machinability, tool life, mechanism of tool failure, tool life and cutting parameters, machinability index, factors affecting machinability. Advanced Cutting Tool Materials, Cutting Fluids

Unit-II General Purpose Machine Tool: Constructional detail of milling, shaper and planer machines. Tooling, attachments and operations performed, selection of cutting parameters, calculation of forces and time for machining. Broaching operation. Capston and turret Lathes, single and multiple spindle automates, operations, planning and tool layout.

Unit-III Abrasive Processes & surface Finishing: Abrasive, natural and synthetic, manufacturing nomenclature. Selection of grinding wheels, wheel mounting and dressing. **Surface Finish:** Elements of surface roughness, evaluation and representation and measurement of surface roughness, relationship of surface roughness to production methods.

Unit-IV Gear Manufacturing Processes: Introduction, materials, methods of gear manufacturing, Gear Milling, Gear Hobbing& Gear Shaping Machine Tools and processes. Modern gear manufacturing methods, gear inspection.

Unit-V Non Conventional machining: Benefits, general application and survey of Non-conventional machining processes. Mechanism of metal removal, tooling and equipment and specific applications of EDM, LBM, EBM, ECM, USM, AJM, WJM, AWJM, PAM processes

Course Outcomes: After successful completion of this course students will be able to

CO1: **apply** cutting mechanics to metal machining based on cutting force and power consumption.

CO2: **operate** lathe, milling machines, drill press, grinding machines, etc.

CO3: **select** cutting tool materials and tool geometries for different metals.

CO4: **choose** appropriate machining processes and conditions for different metals.

CO5: **optimize** parameters for material removal in unconventional machining processes.

CO6: **identify** the process parameters, their effect and applications of different processes

Text Books

1. Fundamentals of Metal Cutting and Machine Tool **by** Boothroyd Geofery; McGH, Kogakuha Ltd.
2. Production Technology **by** Jain, R.K. and Gupta, S.C; Khanna Publishers.

Reference Books:

1. Workshop Technology **by** Chapman, Volume I, II, & III, ELBS.
2. Production Technology **by** HMT; McGraw Hill, New Delhi.

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Engineering Thermodynamics

Category	Title	Code	Credit-3			Theory Paper
Departmental Core-DC	Engineering Thermodynamics	120414/ 190413	L	T	P	Max.Marks-50 Duration-2 hrs.
			2	1	-	

Course Objective: To make students able to:

1. Understand the nature and role of the various thermodynamic properties of matter.
2. Represent a thermodynamic system by a control mass or control volume and identify work and/or heat interactions between the system and surroundings.
3. Recognize the different forms of energy and restrictions imposed by the laws of thermodynamics on conversion from one form to another.

Course Prerequisites: Basic Mechanical Engineering

Syllabus

Unit–I Basic Concepts: Thermodynamics, Property, Equilibrium, State, Process, Cycle, Zeroth law of thermodynamics, Statement and significance, Concept of an Ideal gas, Gas Laws, Avogadro's Hypothesis, Heat and work transfer. First law of thermodynamics –Statement of first law of thermodynamics, first law applied to closed system undergoing a cycle, Process analysis of closed system flow process, Flow energy, Steady flow process analysis of closed system processes, Limitations of first law of thermodynamics.

Unit –II Properties of pure substances: - P-V-T surfaces, h-s, T-S, P-V, P-h, T-V diagrams of pure substance, saturated and sub-cooled liquid, superheated vapour, quality of steam, Mollier diagram, steam table, different processes, measurement of quality of steam

Unit –III Second law of thermodynamics: Heat engine, Heat reservoir, Refrigerator, Heat pump, COP, Carnot's theorem, Carnot's cycle, Efficiency of Carnot's cycle, Statement of second law, Reversible and Irreversible processes, Consequences of Second law.

Unit –IV Availability and Irreversibility: Entropy, Entropy changes of Ideal gas, Available energy, T-S diagram, Availability and Irreversibility.

Unit- V Thermodynamics Relations: Thermodynamics relations, e.g Maxwell relations and their applications.
Air Standard Cycles: Carnot, Sterling, Ericssion, Otto, Diesel, Dual cycles and determination of their air standard efficiencies and their comparison. Brayton cycle, Atkinson cycle. PVT relationship, Mixture of ideal gases Properties of mixture of gases**.**

Course Outcomes: After successful completion of this course students will be able to:
CO1: Define energy interactions between system and surroundings.
CO2: Correlate the law of thermodynamics to real life applications
CO3: Apply the laws of thermodynamics to analyze boilers, heat pumps, refrigerators, heat engines, compressors and nozzles
CO4: Analyze the thermal efficiency of air standard cycles

CO5: Analyze the entropy concept in thermodynamic systems.
CO6: Describe benefits of improvements to thermodynamic systems.

Text &Reference Books:

1. Engineering thermodynamics **by** P.K. Nag
2. Thermal engineering **by** R.K. Rajput
3. Thermal engineering **by** P.L. Ballaney
4. P L Dhar Thermal Engineering

NPTEL Link for Engineering Thermodynamics

https://onlinecourses.nptel.ac.in/noc18_ch03/preview

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Production Lab

Category	Title	Code	Credit-2			Practical Slot
Departmental Lab Core-DLC	Production Lab	120415/190415	L	T	P	Max.Marks-60 Min.Marks-19
			-	-	4	

Course Objective:

1. To demonstrate the fundamentals of machining processes and machine tools.
2. To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms.
3. To apply the fundamentals and principles of metal cutting to practical applications through multiple labs using lathes, milling machines, grinding machines, etc.

List of Experiments:

1. Step Turning and Taper Turning on Lathe.
2. Threads Cutting and Knurling on Lathe.
3. Machining Flat Surface using Shaper Machine.
4. Manufacturing of Spur Gear using Milling Machine.
5. Making Internal Splines using Slotting Machine.
6. Hole on work piece through Drilling.
7. Grinding of Single Point Cutting Tool
8. Slot / Groove cutting using shaping machine.
9. Performance on mold making of Simple component.
10. Performance on pattern making of Simple component.
11. Performance on Metal Casting of Simple component.
12. Performance on Welding of simple work piece (Example Arc Welding)
13. Performance on Sheet Metal work of Simple component.
14. Performance on hot forging of Simple component
15. All Students must complete one skill based project assigned by faculty

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

CO1 Define the different conventional method of material removal and function of different parts.

CO2 Apply the theory of metal cutting in experiments.

CO3 Perform step, taper turning, knurling and threading.

CO4 Produce stepped surface using shaper and keyway using milling machine.

CO5 Demonstrate knowledge of different machine tools used in machine shop.

CO6 Evaluate the chip thickness ratio, shear angle and material removal rate.