Scheme and Syllabus

with

Exam Mode and Mode of Teaching

2020-21 Admitted batch

Mechanical Engineering

Upto VI 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 2020-2021***

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.	100012	BSC	Engineering Chemistry (BSC-2)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2/1)	MCQ
3.	100014	ESC	Engineering Graphics (ESC-1)	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 (3/0)	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-2)	-	-	-	-	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	19
		Offline	Online						
7	3	4	2	3	7	3	7	2	19
36.84	15.7	21.0	10.5	15.78	36.84	15.78	36.84	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-3)	50	10	20	20	-	-	-	100	2	1	-	3	Blended (2/1)	PP
3.	100021	ESC	Basic Mechanical Engineering (ESC-4)	50	10	20	20	-	-	-	100	2	1	-	3	Blended (2/1)	MCQ
4.	100022	ESC	Basic Electrical and Electronics Engineering (ESC-5)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2/1)	MCQ
5.	100023	ESC	Basic Computer Engineering (ESC-6)	50	10	20	20	60	40	-	200	2	1	2	4	Blended (2/1)	A+O
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**	**100**	**60**	**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	19
		Offline	Online						
0	0	10	5	4	6	4	7	2	19
0	0	52.6	26.3	21	31.5	21	36.84	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 (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.	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.	120312	DC	Mechanics of Materials (DC-3)	50	10	20	20	60	20	20	200	2	-	2	3	Offline (3/0)	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#	-	-	-	-	-	40	-	40	-	-	2	1	Online +Mentoring	SO
8.	200XXX	CLC	Novel Engaging Course	-	-	-	-	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**	**4**	**16**	**22**		
10	**1000001**	**MAC**	**Indian Constitution and Traditional Knowledge**	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	MCQ

$Proficiency in course/subject – includes the weightage towards ability/ skill/ competence /knowledge level /expertise attained /attendance etc. in that particular course/subject
#Compulsory registration for one online course using SWAYAM/NPTEL/ MOOC, evaluation through attendance, assignments and presentation

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								
5	0	5	4	7	1	13	4	0	1	4	22
22.7	0	22.7	18.1	31.8	4.5	59	18.1	0	4.5	18.1	100

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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 (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.	100003	BSC	Mathematics- III (BSC-4)	50	10	20	20	-	-	-	100	2	1	-	3	Offline (3/0)	PP
2.	120411	DC	Theory of Machines –II (DC-6)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2/1)	AO
3.	120412	DC	Design of Machine Elements (DC-7)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2/1)	AO
4.	120413	DC	Metal Cutting and Machine Tools (DC-8)	50	10	20	20	-	-	-	100	2	1	-	3	Blended (2/1)	PP
5.	120414	DC	Engineering Thermodynamics (DC-9)	50	10	20	20	-	-	-	100	2	1	-	3	Blended (2/1)	PP
6.	100004	MC	Cyber Security (MC)	50	10	20	20	-	-	-	100	2	-	-	2	Online (0/2)	MCQ
7.	120415*	DLC	Production Lab (DLC-2)	-	-	-	-	60	20	20	100	-	-	4	2	Offline (2/0)	SO
8.	200XXX	CLC	Novel Engaging Course	-	-	-	-	50	-	-	50	-	-	2	1	Interactive	SO
Total				**300**	**60**	**120**	**120**	**230**	**60**	**60**	**950**	**12**	**5**	**12**	**22**		
Summer Internship Project-II (Soft skills Based) for two weeks duration: Evaluation in V Semester																	
9.	1000002	MAC	Biology for Engineers	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	MCQ

***Virtual Lab to be conducted along with the traditional lab**
$Proficiency in course/subject – includes the weightage towards ability/ skill/ competence /knowledge level /expertise attained /attendance etc. in that particular course/subject

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								
3	2	8	4	4	1	10	8	2	1	1	22
13.6	9	36.36	18.18	18.1	4.5	45.4	36.3	9	4.5	4.5	100

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B.Tech. V 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/ Assignment		Lab work & Sessional	Skill Based Mini Project							
1.	**120519**	MC	Data Science	50	10	20	20	60	20	20	200	3	-	2	**4**	Blended (2/1)	MCQ
2.	**120511**	DC	Industrial Engineering (DC-10)	50	10	20	20	-	-	-	100	3	-	-	**3**	Blended (2/1)	PP
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.	**120514**	DC	Thermal Engineering (DC-12)	50	10	20	20	60	20	20	200	2	1	2	**4**	Blended (2/1)	PP
5.	**120515**	DC	Machine Design (DC-13)	50	10	20	20	60	20	20	200	2	1	2	**4**	Blended (2/1)	AO
6.	**120516**	DLC	Minor Project-I**	-	-	-	-	60	40	-	100	-	-	4	**2**	Offline (2/0)	SO
7.	**120517**	Seminar/ Self-Study	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.	**120518**	DLC	Summer Internship Project-II (Evaluation)	-	-	-	-	60	-	-	60	-	-	4	**2**	Offline	SO
Total				**250**	**50**	**100**	**100**	**410**	**160**	**80**	**1150**	**12**	**3**	**20**	**25**	-	-
10.	**1000006**	MAC	Disaster Management	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	MCQ
11.	**1000005**	MAC	Project Management & Financing	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	MCQ
Additional Course for Honours or minor Specialization				Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization													

$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

** **The Minor Project-I may be evaluated by an internal committee for awarding sessional marks.**

Compulsory registration for one online course using SWAYAM/NPTEL/MOOC, evaluation through attendance, assignments and presentation

Note: Students of 2020-21 admitted batch needs to appear and complete an additional MAC course of 30 Hrs. duration on Project Management & Financing. / Other modules related to futuristic technologies (Drones/ Robotics etc.)

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	**0**	**10**	**5**	**9**	**1**	**11**	**4**	**4**	**5**	**1**	**25**
0	**0**	**40**	**20**	**36**	**4**	**44**	**16**	**16**	**20**	**4**	**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 2020-2021***

B. Tech. VI 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.	Durati-on of Exam.
				Theory Slot				Practical Slot			MOOCs			L	T	P				
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation		Assign-ment	Exam								
				End Sem. Exam.	$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab work & Sessional	Skill Based Mini Project										
1.	120615	DC	Mechanical Vibrations (DC-14)	50	10	20	20	60	20	20	-	-	200	2	1	2	**4**	Blended	PP	2 hr
2.	120616	DC	Refrigeration and Air-Conditioning (DC-15)	50	10	20	20	60	20	20	-	-	200	2	1	2	**4**	Blended	PP	2 hr
3.	120617	MC	Artificial Intelligence & Machine Learning	50	10	20	20	60	20	20	-	-	200	3	-	2	**4**	Blended	MCQ	1.5 hr
4.	DE	DE	Departmental Elective* (DE-1)	-	-	-	-	-	-	-	25	75	100	3	-	-	**3**	Online	MCQ	3 hr
5.	OC	OC	Open Category (OC-1)	50	10	20	20	-	-	-	-	-	100	2	1	-	**3**	Blended	PP	2 hr
6.	120618	DLC	Minor Project-II	-	-	-	-	60	40	-	-	-	100	-	-	4	**2**	Offline	SO	
7.	200XXX	**CLC**	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	-	-	50	-	-	2	**1**	Offline	SO	
Total				**200**	**40**	**80**	**80**	**290**	**100**	**60**	**25**	**75**	**950**	**12**	**3**	**12**	**21**	**-**	**-**	
8.	**100008**	**MAC**	Intellectual Property Rights (IPR)	50	10	20	20	-	-	-	-	-	100	2	-	-	Grade	Online	**MCQ**	**1.5 hr**
Summer Internship-III (On Job Training) for Four weeks duration: Evaluation in VII Semester																				
Add. Course for Honours or minor Specialization			**Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization**																	

$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

***Course run through SWAYAM/NPTEL/ MOOC Learning Based Platform with credit transfer**

Departmental Elective (DE-1*)			Open Category (OC-1)		
S.No.	**Subject Code**	**Subject Name**	**S.No.**	**Subject Code**	**Subject Name**
1	120661	Fundamental of Welding Science and Technology	1	910108	Product Design
2	120662	Viscous Fluid Flow	2	910109	Robotics
3	120663	Properties of Materials (Nature and Properties of Material: III)			

Mode of Teaching				Mode of Examination				Total Credits
Theory			Lab	Theory			Lab	
Offline	**Online**	**Blended**	**Offline**	**PP**	**AO**	**MCQ**	**SO**	
0	**3**	**15**	**3**	**11**	**0**	**7**	**3**	**21**
0	**14.28%**	**71.4%**	**14.28%**	**52.38%**	**0**	**33.33 %**	**14.28%**	**Credits %**

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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-3)	50	10	20	20	-	-	-	-	-	100	3	-	-	3	Blended (2/1)	PP
2.	DE*	DE	Departmental Elective -4 (DE-4)	-	-	-	-	-	-	-	25	75	100	4	-	-	4	Online (0/2)	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	-	-	4	2	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**	**9**	**1**	**10**	**15**		

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	2	120762	Introduction to Composites	2		Solar Energy	2		Maintenance Engineering

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 – 4* (DE-4)	-	-	-	-	-	-	-	25	75	100	3	-	-	3	Online (0/3)	MCQ
3	OC*	OC	Open Category – 4* (OC-4)	-	-	-	-	-	-	-	25	75	100	3	-	-	3	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														6	-	22	17		
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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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	7	7	3	2
II	19	7	6	4	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-60 Min.Marks-19 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**
Departmental Core-DC	Material Science	190211/120211/120301/ 190301/BMEL305/ BAUL301/MEL302/3223	L	T	P	Max.Marks-60 Min.Marks-19 Duration-3hrs.
			3	-	-	

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 and Properties of Materials
Concept of crystalline and non-crystalline materials, Crystal structures analysis and Crystal system, Homogeneous and heterogeneous solidifications, Crystal imperfections. Miller indices and directions, Properties and uses of engineering materials. Stress-strain diagram for steels.

Unit-II Engineering Materials
Ferrous and non-ferrous metals and alloys, Nano-materials, Ceramic material, Composite material with their properties, uses and coding.

Unit-III Deformation of Materials
Types of deformations, Mechanism of deformations, Role of dislocations, Slip and twinning processes. Stages of deformation, Mechanism of ductile and brittle fracture.

Unit-IV Phase Diagrams
Concept of phases, Solidification of metals and alloys, Allotropy of iron, Fe-C diagram, Lever-rule, Eutectic, Eutectoid, Peritectic and Peritectoid systems.

Unit-V Heat Treatment of Steels
Micro constituents of steel, Importance of heat treatment processes, "S-curve and C-curve", Heat treatment processes and surface treatment processes.

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

CO1. State the principles of diffusion theory and various types of defects in 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. Elements of Material Science and Engineering **by** Lawrence, H. Vanvlackdison; Wesley.Mention the Year or the Edition and Publisher and Place of Publication
2. Material Science and Engineering **by** Raghvan, V; Prentice Hall of India.
3. 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	100022/100204/CEL/ MEL/CSL/EEL/ ELL/ITL/CHL/ BTL114/2X24	3	-	-	Max.Marks-60 Min.Marks-19 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

Lists of Experiments:

1. Study of simple 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 simple steam engines.
9. Study of Lathe machine.
10. Study of Vernier and Micrometer.
11. Study of Internal Combustion Engine Parts.

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Manufacturing Practices

Category	Title	Code	Credit-1			Practical End Sem
Engineering Science-ESC	Manufacturing Practices	100025/100106	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
			L	T	P	
Engineering Science-ESC	Basic Mechanical Engineering Lab	100026	-	-	2	Max.Marks-60 Min.Marks-19

Lists of Experiments:

1. Study of simple 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 simple 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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Manufacturing Processes

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

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/

List of Experiment

1. Performance on mold making of Simple component
2. Performance on pattern making of Simple component
3. Performance on Metal Casting of Simple component
4. Performance on Welding of simple workpiece (Example Arc Welding)
5. Performance on Sheet metal work of Simple component
6. Performance on hot forging of Simple component

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Mechanics of Materials

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
Departmental Core-DC	Mechanics of Materials	120312/190312/ 120302/190302/ BMEL-302/ MEL-305/3225	2	-	2	Max.Marks-50 Min.Marks-16 Duration-3hrs.

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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Department of Mechanical Engineering

For batches admitted in Academic Session 2020-21

Theory of Machines-I

Category	Title	Code	Credit-4			Theory Paper
Departmental Core-DC	Theory of Machines-I	120313/ 120303/ 190411/190401	L	T	P	Max.Marks-50 Min.Marks-16 Duration-3hrs.
			2	1	2	

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 clutch.
8. Study of various types of brakes.
9. Study of various types of dynamometer.
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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Fluid Mechanics and Hydraulic Machines

Category	Title	Code	Credit-4			Theory Paper
Departmental Core-DC	Fluid Mechanics and Hydraulic Machines	120314/190314	L	T	P	Max.Marks-50 Min.Marks-16 Duration-3hrs.
			2	1	2	

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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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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120411: Theory of Machines-II

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Theory of Machines-II	120411/ 120401	2	1	2	Max.Marks-50 Min.Marks-16 Duration-2 hrs.

Course Pre-Requisite:
Engineering Graphics
Mechanics of Materials
Theory of Machines

Course Objectives: To make the students:
1. Understand the basics of synthesis of simple mechanisms.
2. Apply fundamental of mechanics to machines elements which include gear, gear train, cams etc.,
3. Develop an ability to design a system, component, or process to meet desired needs within realistic constraints.

Syllabus

Unit- I Gears: Classification, Terminology, Law of gearing, Forms of teeth, Tooth profile, Cycloidal and Involute tooth forms, path of contact, teeth in contact, Interference. Spur, Helical, Spiral, Worm and Bevel gears.

Unit- II Gear Trains: Simple, Compound, Reverted and Epicyclic gear trains, Velocity Ratio. Various applications of gear trains - Motor car gear box, Differential mechanism, cyclometer mechanism etc.

Unit-III Balancing: Introduction, Balancing of rotating and reciprocating masses, Locomotive balancing, Balancing of multi cylinder in line engines, Balancing of radial engines, Direct and reverse crank method of balancing.

Unit-IV Cams and Cam Dynamics: Introduction, Classification of cams and followers, Terminology, Displacement, Velocity and acceleration diagrams for different follower motions, Synthesis of cam profiles. Cams with specified contours, Cam dynamics.

Unit-V Synthesis of Linkages: Introduction, Types, Number and Dimensional synthesis, Function Generation, Chebychev's spacing of accuracy points, Synthesis with three accuracy points of 4-bar and slider-crank mechanisms, Synthesis of crank rocker mechanisms with optimum transmission angle, Path generation.

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

CO 1.Identify the motion and the dynamical forces acting on mechanical systems composed of linkages, gears and cams.
CO 2.Classify various components of machines like gear, gear train cam etc
CO 3.Solve numerical problems of various components of machines like gear, gear train cam etc.
CO 4.Analyze the forces and motion of complex systems of linkages, gears and cams.

CO 5. **Evaluate** the applications of components e.g. gear, gear train, balancing, cam etc. and select appropriate machine elements for the required applications.

CO 6. **Design** the mechanism or components to justify the demands of work such as linkage, cam, gear, gear train mechanism etc.

Text & References Books:

1. Design of Machinery **by** Robert L.Norton; TATA McGraw Hill.
2. Theory of Machines **by** S S Rattan; Tata McGraw Hill.
3. Theory of Machines **by** R S Khurmi; J K Gupta; S. Chand.
4. Mechanism & Machine Theory **by** Ashok G. Ambekar; PHI (Prentice-Hall India).
5. Theory of Machines **by** Sadhu Singh; Pearson Education.
6. Theory of Machines and Mechanisms **by** P L Ballaney; Khanna Publishers.
7. Theory of Machines **by** R K Bansal; Laxmi Publications.

NPTEL Link for Theory of Machines-II

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

List of experiments

1. Study of various types of gears.
2. Study of various types of gear trains.
3. Balancing of rotating masses.
4. Balancing of reciprocating masses.
5. Study of kinematic synthesis of mechanisms.
6. Study of cams and followers.
7. To draw cam profile, velocity and acceleration diagrams of a given cam-follower mechanism.
8. Draw the profile of various cams with different types of followers.
9. Plot the follower displacement vs angle of cam rotation curves for changing compression spring, follower weights and cam speed.
10. Calculate the epicyclic gear ratio, input torque, holding torque and output torque.

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

CO1 **Identify** the kinematic chain and mobility, and perform the kinematic analysis of a given mechanism.
CO2 **Analyze** various motion transmission elements like gears, gear trains, cams, belt drive and rope drive
CO3 **Determine** the degrees-of-freedom (mobility) of a mechanism
CO4 **Apply** the fundamental principles of statics and dynamics to machinery.
CO5 **Evaluate** the dynamic forces for various machines.
CO6 **Analyze** the fundamentals of machines for desired kinematic or dynamic performance.

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120412: Design of Machine Elements

Category	Title	Code	Credit-4			Theory Paper
Departmental Core-DC	Design of Machine Elements	120412/ 120402	L	T	P	Max.Marks-50 Min.Marks-16 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: 3			Theory Paper
			L	T	P	
Departmental Core-DC	Metal Cutting and Machine Tools	120413/190512 120502/ 190502	2	1	-	Max.Marks-50 Min.Marks-16 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 Min.Marks-16 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/ 120405/190405	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

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.

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For batches admitted in Academic Session 2020-21

190511/120511: Industrial Engineering

Category	Title	Code	Credits: 2			Theory Paper
Departmental Core-DC	Industrial Engineering	190511/120511/ 190501/120501	L	T	P	Max.Marks-50 Min.Marks-16 Duration-2hrs.
			2	-	-	

Course Objectives: Industrial engineering is concerned with the design, improvement, installation, and management of integrated systems of men, material, and machine. After completing this course, students will learn a set of skills that includes mathematical modeling, probability and statistics, computer science, human factors, interpersonal skills, project management, and an ability to manage and administer large technical engineering and research projects. Thus, industrial engineering may be thought of as applied problem-solving, from inception to implementation.

Syllabus

UNIT-I
Production Systems and Productivity: Production Management: design of production systems (product, job shop and batch). Definition and types of productivity, Measurement of productivity, factors affecting the productivity and productivity improvement programs.
Production Planning and Control: Aggregate production planning, Capacity planning: capacity measurement, long-term and short-term strategies, aggregate production planning, and graphical method to choose aggregate plan.

UNIT-II
Forecasting techniques: Need and type of forecasting, factors affecting forecasting, forecasting in decision making, time series analysis, demand patterns, qualitative methods- measures of forecast accuracy and error analysis in quantitative forecasting.

UNIT-III
Inventory Control – Objectives and functions, need and classifications- codification and standardization ABC analysis, deterministic inventory models, quantity discount; perpetual and periodic inventory control systems. Probabilistic inventory management, economic ordering quantity procurement cost, carrying charges, lead-time, reorder point.

Unit-IV
Facility Locations and Plant Layout: Facility location factors and evaluation of alternate locations; qualitative aspects, quantitative models for layout decisions, types of plant layout and their evaluation; computer aided layout design techniques; assembly line balancing, materials handling systems.
Project management - Project Scheduling, Network diagram, critical path method (CPM), Project Evaluation and review techniques (PERT), Time cost trade off.

UNIT-V
Master Production Scheduling and MRP: Functions, planning horizon and planning periods for master production schedule, types of master production schedule, Bill of Material, Independent Demand versus dependent demand, Functions of material requirements planning and manufacturing resource planning (MRP I and MRP II), inputs for MRP system, performance characteristics of MRP system, materials requirement planning explosion.

Course outcomes: After learning the course the students should be able to:

CO1. **Define** and measure productivity.
CO2. **Understand** Production planning and control required for industry to analyze the engineering problems.
CO3. **Apply** engineering design to produce solutions that meet specified needs of manufacturing industry
CO4. **Analyze** practice through various Management and Operation Tools for Improving Quality and Quantity.
CO5. **Evaluate** various kinds of problems or issues faced by service and manufacturing industries like Inventory control, sales forcasting economic consideration, optimum utilization of resources, productivity.
CO6. **Create** new mathematical models for efficient production planning and control.

Text Books:

1. Industrial Engineering and Production Management, Martand Telsang, S. Chand
2. Production and Operation Management by R. Panneerselvam, PHI, Latest Edition
3. Manufacturing planning and control for SCM by Vollmann; TMH, Latest Edition.
4. Purchasing & Materials Management by Dobler & Lee, PHI, Latest Edition

Reference Books:

1. Operations Management by Krajewski, L. J., Ritzman, L. P. and Malhotra, M. K., Prentice Hall, New Delhi; Latest Edition.
2. Production/Operations Management by Ebert, J and Adams, D.J., Prentice Hall of India, New Delhi; Latest Edition.
3. Production and Operations Management: manufacturing and services by Chase, R. B., Aquilano, N. J. and Jacob, F. R., TMH, New Delhi; Latest Edition .
4. Modern Production/Operations Management by Buffa and Sarin, Wiley India; Latest Edition.

List of Open Source Software/learning website:

1. Operation Management, IIT Roorkee, Dr. Inderdeep singh, https://nptel.ac.in/courses/112107238
2. Operation and Supply chain Management, IIT Madras, Prof. G. Srinivasan
https://nptel.ac.in/courses/110106045

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190513/120513: Heat and Mass Transfer

Category	Title	Code	Credits -4			Theory Paper
			L	T	P	
Departmental Core-DC	Heat and Mass Transfer	190513/120513/ 120503/190503	2	1	2	Max.Marks-50 Min.Marks-16 Duration-2 hrs.

Course Objectives: To make the students understand:

1. the comprehensive of physical science and its fundamentals applicable to the engineering discipline of heat and mass transfer.
2. the fundamentals of heat transfer mechanisms in fluids and solids.

Syllabus

UNIT I - Fundamental of Heat Transfer: Modes of heat transfer, Fourier's, Newton's and Stefan Boltzmann's law, thermal conductivity and its variation with temperature, film coefficient of heat transfer, general heat conduction equations, Steady state heat transfer: Thermal resistances and conductance, overall Heat transfer Coefficient, Heat transfer through plane and composite wall, hollow and composite hollow cylinder and sphere, thermal diffusivity, one dimensional steady state conduction with heat generation , critical thickness of insulation. Unsteady State Heat Transfer: Transient and periodic conduction, Lumped System Analysis, heating and cooling of bodies with known temperature distribution, response of thermocouple.

UNIT II - Convection Heat Transfer: Introduction to Free and Forced Convection, laminar and turbulent flow, forced convection through hydrodynamic and thermal boundary layers, analysis of hydrodynamic and thermal boundary layer. Empirical equations of convection heat transfer. Heat Transfer in a circular pipe (forced convection). Applications of dimensional analysis to free and forced convection. Reynolds Number, Prandtl Number, Grashoff Number, Nusselt numbers, and Boit Number

UNIT III - Heat Exchangers: Basic types of heat exchanger. Logarithmic Mean Temperature Difference (LMTD), fouling factor, heat exchanger effectiveness, NTU Methods. Extended surfaces: Pin-Fin and rectangular fin of uniform cross section. Effectiveness and efficiency of Fin. Use of fin analysis for measuring, thermometric error, triangular and parabolic profile.

UNIT IV – Thermal radiation: Basic concept. Monochromatic and total emissive power, absorptivity, reflectivity and transmissivity, Kirchhoff's law, Concept of Black & Grey bodies. Plank's distribution law.Wien's displacement law. Steffen – Boltzmann law, Concept of Shape factor. Condensation heat transfer: Introduction, process, Theory of laminar film condensation. Nusselt's Theory. Drop wise condensation. Influence of the presence of non-condensable gases. Boiling heat transfer: Nature, Boiling regimes, Bubble size consideration, bubble growth and Collapse. Critical diameter, Rosen how Correlation.

Unit V - Diffusion Mass Transfer: Fick's law. Steady state diffusion of gases and liquids through solids, Equi-molal diffusion, isothermal diffusion, isothermal evaporation of water into air. Mass transfer coefficient. Convective Mass Transfer: Mass transfer through boundary layer. Analogy between momentum heat & mass transfer. Dimensional analysis, application to convective mass transfer. Forced convection mass transfer in laminar and turbulent flow through tubes. Simultaneous heat and mass transfer.

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

CO1. Formulate and solve one-dimensional conduction with and without heat generation
CO2. Apply the empirical equations to analyze various convection problems
CO3. Evaluate the performance of various types of heat exchangers
CO4. Develop the mathematical and physical concept of radiation heat transfer
CO5. Apply the physics of heat transfer in the processes like Condensation and Boiling
CO6. Analyze and solve the problems in diffusion and convective mass transfer

Text Books:

1. Kumar D. S, Heat & Mass Transfer, Latest Edition, Katson Publication.
2. Rajput R. K., Heat & Mass Transfer, Latest Edition, S. Chand Publication.

References Books:

1. Arora & Domkundwar, A course in Heat & Mass Transfer, Latest edition, Dhanpat Rai& Co. Publication.
2. Nag P K, Heat Transfer, Latest Edition, McGraw-Hill
3. Holman J. P., Heat Transfer, Latest Edition, TMH.
4. Kreith & Bohn, Principles of Heat Transfer, Latest Edition, CL Engineering Publication.
5. Cengel Yunus A., Heat and Mass Transfer, Latest Edition, TMH.
6. Thirumaleshwer M., Heat and Mass Transfer by, Latest Edition, Pearson

List of Experiments:

1. Determination of Thermal Conductivity of Metal Rod.
2. Determination of Thermal Conductivity of Insulating Powder.
3. Measurement of Emissivity.
4. Determination of Stefan-Boltzmann constant.
5. Determination of Heat Transfer coefficient by Pin-Fin Apparatus.
6. Determination of Effectiveness of Shell and Tube heat exchanger.
7. Determination of Effectiveness of Parallel and Counter Flow Heat Exchanger.
8. Determination of Heat transfer coefficient by Forced Convection.
9. Determination of Heat Transfer coefficient during drop and film wise condensation.
10. To study the drying characteristics of different wet granular materials using natural and forced circulation in a tray dryer.
11. To determine the diffusion coefficient of liquid vapor in air by Stefan's tube.

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

CO1: Determine the thermal conductivity of metal rod and insulating powder.
CO2: Estimate the Stefan-Boltzmann constant and measurement of emissivity.
CO3: Determine the effectiveness of various types of heat exchangers.
CO4: Evaluate the Heat Transfer coefficient in various heat transfer phenomena.
CO5: Evaluate the diffusion coefficient of liquid vapor in air by Stefan's tube.

For batch admitted in Academic Session 2020-21

120514: Thermal Engineering

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Category	Title	Code	Credits -4			Theory Paper
Departmental Core-DC	Thermal Engineering	120514	L	T	P	Max.Marks-50 Min.Marks-16 Duration-2 hrs.
			2	1	2	

Course Objectives: To make the students understand:

1. the fundamental principles of IC engines and combustion phenomena
2. the basic principles of nozzles and diffusers
3. the application of basic thermodynamics and fluid mechanics in steam and gas turbine power plants

Syllabus

UNIT I - Vapor Power Cycles: Vapor Carnot cycle and its limitations, Rankine cycle and modified Rankine cycle, actual vapor power cycle, Reheat cycle, ideal regenerative cycle, actual regenerative cycle, Reheat – regenerative cycle, feedwater heaters, cogeneration of power and process heat, working fluids in vapor power cycle, binary vapor cycles, the efficiency of coupled cycles. Basics of condensers.

UNIT II – IC Engine Basics and Combustion in IC Engines

Basics of CI and SI Engines, Basics of two-stroke and four-stroke IC engines, Valve timing diagram, Performance parameters, Heat balance, Testing of the engine.

Stages of combustion in SI engine, Flame propagation, Rate of pressure rise, Abnormal combustion, Theory of detonation, Effect of engine operating variables on knock, Stages of combustion in CI engines, Delay period - Factors affecting delay period, Knock in CI engines - methods of controlling diesel knock, Combustion chambers for SI and CI engines.

UNIT III – Gas Turbine

Open cycle and closed cycle arrangements, applications, assumptions in ideal cycle analysis, simple gas turbine cycle, heat exchange cycle, intercooled cycle, various combinations of reheat, heat exchange and intercooling, comparison of various cycles, Combined Brayton and Rankine Cycle and GT-ST plants; Advantages of Combined Cycle

UNIT IV – Steam Turbines

Classification of steam turbine, Impulse and reaction turbines, Staging, Stage and overall efficiency, Reheat factor, Utilization factor, Blading, Velocity diagram & work calculations, Impulse Reaction Turbines, Losses in steam turbines, Governing of turbines.

Unit V Nozzles and Diffusers

Introduction, SFEE and continuity equation for nozzles & diffusers, momentum equation for the steam nozzle, entropy change due to friction in the nozzle, nozzle efficiency, critical pressure, stagnation enthalpy & pressure, Relation between area, velocity & pressure in nozzle, the effect of friction on critical pressure ratio, supersaturated flow in nozzles, the effect of variation of back pressure

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

CO1: analyze the performance of steam power plant

CO2: describe the working principles of internal combustion engines and combustion phenomena
CO3: analyze the performance of gas turbine power plant

CO4: describe the working of various types of steam turbine
CO5: solve analytical problems of nozzles and diffusers

Text Books:

1. P K Nag, "Power Plant Engineering", Latest Edition, Tata McGraw Hill Publishing Company Limited,
2. Ganesan V, "Internal combustion engines", Latest Edition, Tata McGraw Hill Education Private Limited,
3. Ganesan V, "Gas Turbines", Latest edition, Latest Edition, Tata McGraw Hill Education Private Limited,
4. P. L. Ballaney, "Thermal Engineering", Latest Edition, Khanna Publishers

References Books:

1. John. B, Heywood, "Internal Combustion Engine Fundamentals", Latest edition, McGraw Hill Publishing Co., New York,
2. Sharma S. P, Chandramohan, "Fuels and Combustion", Latest edition, Tata McGraw Hill Publishing Co.
3. Mathur and Sharma, "A course on Internal combustion Engines", Latest edition, Dhanpat Rai& Co.
4. Rajput R. K, "A textbook of Thermal Engineering", Latest edition, Laxmi Publications
5. B.K. Venkanna, "Fundamentals of Turbomachinery", PHI Learning Private Limited

List of Experiments:

1. Introduction to Computational Fluid Dynamics and its methodology.
2. Perform CFD analysis on flow through pipe with varying Reynolds Number.
3. Performance test of two stoke diesel engine and four stroke diesel engines.
4. Study of compounding of Steam turbine.
5. Study of combined steam and gas turbine plant.

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

CO1: Describe the process involved and advantages in solving a fluid problem using computational fluid dynamics
CO2: Solve the Fluid flow problem using CFD technique.
CO3: Estimate energy distribution by conducting heat balance test on IC engines.
CO4: Determine performance parameters of impulse steam turbine
CO5: Evaluate the performance of steam turbine with compounding.

For batch admitted in Academic Session 2020-21

120515: Machine Design

Category	Title	Code	Credit -4			Theory Paper
Departmental Core-	Machine Design	120515/120505	L	T	P	Max.Marks-50

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DC			2	1	2	Min.Marks-16 Duration-2hrs.

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

Course Pre-Requisites:
1. Mechanics of Materials
2. Design of Machine Elements

Course Objectives: To make students:
1. Develop an ability 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
Stress concentration & fatigue: Stress Concentration-causes, effect in tension, bending and torsion, mitigation, **Fatigue**- cyclic loading, endurance limit, S-N curve, concentration factor, notch sensitivity, design consideration, Goodman and modified Goodman's diagram, Soderberg's equation, Gerber's parabola, design for finite life, cumulative fatigue damage factor.

UNIT-II
Spring: Function, classification, Rate, curvature of coil, scale, resilience, material, Stresses and deflection equations of helical springs, design of compression and tension springs, torsion springs, fatigue loading on springs, surge in spring, critical load, spiral springs, design of leaf spring.

UNIT-III
Gears: Design of Spur, Helical, worm and Bevel Gears: Force analysis, Selection of material, Beam and wear strength, Form or Lewis factor, Dynamic load-Barth equation and Buckingham equation, consideration for maximum power transmitting capacity, Gear lubrication.

UNIT-IV
Sliding contact bearings:
Classification, Selection, Viscosity of Lubricants, Materials, Types, Petroff's relation, loads on bearing, Design, Advantages, Disadvantages, Limitations, Heat Dissipation.

UNIT-V
Rolling contact bearings:
Designation, Types, Friction effect, loads, Fatigue, Deflection & deformation, Selection, bearing life.

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

CO1:Describe the design procedure used in automotive industry to design the engine parts
CO2:Classify the different types of spring, bearing and Gears
CO3:Choose the right strategy for designing the machine components based on material and methods
CO4:Apply the design procedure for solving and drafting the different design of machine elements
CO5:Compare the various curves and design procedure used
CO6:Selection of machine elements under various loading and environmental conditions.

Text Books

1. Shigley, J.E., and CharlesMechanical Engineering Design; TMH
2. Bhandari VB, Design of Machine elements; Tata McGraw Hill Book Co.

Reference Books

1. John KC,Text Book of Machine Drawing; PHI Learning.
2. Machine Design by Mubeen, Pearson.
3. Engineering design by George Dieter; McGraw Hill.
4. Bhatt, ND,Machine Drawing; Charotar.
5. Kulkarni, S.G., Machine Design, McGraw Hill.
6. Narayana and Reddy,Machine Drawing; New age publication.
7. Design data book, PSG College of Technology, Coimbatore
8. Luzzader, WJ, Duff, JM,Fundamental of Engineering Drawing Interactive Graphics; PHI.
9. Mahadevan, Reddy's,Mechanical design data book;CBS Publisher.

NPTEL Link for Design of Machine Elements

https://nptel.ac.in/syllabus/112106137/

https://nptel.ac.in/downloads/112105125/

List of Experiments

1. Design and drawing of helical spring.
2. Design and drawing of Spur gear.
3. Design and drawing of Helical gear.
4. Design and drawing of Worm gear.
5. Design and drawing of bevel gear.
6. Modelling and simulation of Gear box.
7. Study of Sliding Contact Bearings and Ball bearing and its selection
8. Design and drawing of Antifriction Bearing.
9. Design and drawing of Journal Bearing.
10. Assembly drawing of the Foot step bearing.

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

1. **Design** and analysis the different part of an I.C Engine like Gear, Spring and Bearing
2. **Compare** the materials used in designing the automobile engine parts.
3. **Use** the software like AUTO CAD, CATIA and ANSYS for modelling and analysis
4. **Select** the spring for a proper application also can select the proper material of spring.
5. **Design** the different types of gear and spring also able to know their practical applications
6. **Create** a gear box for modern Automotive vehicles and can use this for the benefits of society.

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120615: Mechanical Vibrations

Category	Title	Code	Credit - 4			Theory Paper
Departmental Core - DC	Mechanical Vibrations	120615	L	T	P	Max.Marks-50 Duration-2 hrs.
			2	1	2	

Prerequisite: Engineering Mathematics, Engineering Mechanics

Course Objectives:

1. To impart basic knowledge and importance on Mechanical Vibration in Engineering Fields among the students.
2. To create the awareness on Mechanical Vibration in Research and Application area

Syllabus

Unit-I:

Introduction: Importance and scope of vibrations, Definitions, Types of vibrations, Simple Harmonic Motion (S.H.M.), Work done by harmonic force, Principle of super position applied to SHM, Beats, Fourier transform and problems.

Undamped (Single Degree of Freedom) Free Vibrations: Derivations for spring mass systems, Methods of analysis, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and Problems.

Unit-II:

Damped free vibrations (1DOF): Types of damping, Analysis with viscous damping - Derivations for over, critical and under damped systems, Logarithmic decrement and Problems.

Whirling of shafts: Whirling of shafts with and without damping, discussion of speeds above and below critical speeds and Problems.

Unit-III Forced Vibrations (1DOF)

Introduction, Analysis of forced vibration with constant harmonic excitation - magnification factor, rotating and reciprocating unbalances, excitation of support (relative and absolute amplitudes), force and motion transmissibility, Energy dissipated due to damping and Problems.

Unit-IV

Systems with two degrees of Freedom:

Principle modes of vibrations, Normal mode and natural frequencies of systems (without damping), Torsional system, Semidefinite system

Multi Degree Freedom System: Free Vibration equation of motion. Stiffness influence coefficients, , flexibility influence coefficient, inertia influence coefficient

Unit V

Numerical Methods: Dunkerley's Methods, Rayleigh`s Method, Holzer`s Method, Methods of Matrix iterations, Jacobi's method

Vibration Control: Transducers and vibration pickup, Vibrometer, accelerometer, velometer, frequency measuring instrument, FFT analyser, vibration exciters.

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Course Outcomes: After completing this course students are able to:
CO1: Able to **understand** basics concept of mechanical vibration.
CO2: Able to **define** the physical systems in to spring-mass-damper systems.
CO3: Able to **use** different methods and principles applicable to dynamic systems.
CO4: Able to **determine** responses of vibrating systems.
CO5: Able to **analyse** the behaviours of physical systems.
CO6: Able to **design** the mechanical systems by considering vibration.

Text Books:

1. Grover, G.K., " Mechanical Vibrations", 7th Ed., Nem Chand & Bros.
2. Rao, S.S., " Mechanical Vibrations", 5th Ed., Addison-Wesley Longman, Incorporated.

References Books:

1. Theory of Vibrations with Applications: W T Thomson CBS Publishers Delhi
2. Fundamentals of Vibration: Leonard Meirovitch , McGraw Hill International Edison.
3. Principles of Vibration Control: Asok Kumar Mallik, Affiliated East-West Press.
4. Mechanical Vibrations A H Church ,John Wiley & Sons Inc
5. Mechanical Vibrations J P Den Hartog ,McGraw Hill.
6. Mechanical Vibration Analysis: Srinivasan ,McGraw Hill.

List of Experiments

1. To verify the relation of simple pendulum.
2. To determine the radius of gyration of given compound pendulum.
3. To study undamped free vibration of equivalent spring mass system.
4. To study the torsional vibration of single rotor system
5. To study damped free vibration of equivalent spring mass system.
6. To study the damped torsional oscillation.
7. To study the forced vibration of spring mass system
8. To study the free vibration of Two rotor system.
9. To determine the whirling of shaft.
10. To verify the Dunkerley's rule.

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Academic session 2020-21 admitted

120616/190616: Refrigeration and Air-conditioning

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core -DC	Refrigeration and Air-conditioning	120616/190616	2	1	2	Max.Marks-50 Duration-2 hrs

Course Objectives: To make the students to understand
1. The fundamental principles and different methods of refrigeration and air conditioning.

2. Different refrigerants with respect to properties, applications and environmental issues.

3. The various equipment, operating principles, operating and safety controls employed in refrigeration air conditioning systems.

Pre-requisite: Engineering Thermodynamics

Syllabus

Unit I: Introduction to Refrigeration: –Basic Definition, ASHRAE Nomenclature, Air Refrigeration: Air Refrigeration Cycles-reversed Carnot cycle, Bell-Coleman cycle analysis, Air Refrigeration systems-merits and demerits, analysis.

Unit II: Vapour Compression Refrigeration System (VCRS): Carnot Vapour compression refrigeration cycle, Working and analysis, Limitations, Standard Vapour Compression Refrigeration system, Working and analysis, Effects of sub cooling and super heating, Multi-Pressure or Compound Vapour Compression Refrigeration Systems, Flash Gas removal, Flash inter cooling and water inter cooling.
Refrigerants: Classification, Selection of Refrigerants and Nomenclature of refrigerants, Desirable Properties of an ideal refrigerant, A discussion on Ozone layer Depletion and Global Warming.

Unit III: Vapour Absorption Systems: Absorbent – Refrigerant combinations, Water-Ammonia Systems, Water Lithium Bromide System, Contrast between the two systems, Modified Version of Aqua-Ammonia Brief Discussion on (i) Steam-Jet refrigeration system and (ii) Thermoelectric refrigeration system
Refrigeration System Equipment – Compressors, Condensers, Expansion Devices and Evaporators, System with Rectifier and Analyser Assembly

Unit IV: Psychrometry: Introduction to Air-Conditioning, Basic Definition, Classification, ASHRAE Nomenclature pertaining to Air-Conditioning, Applications of Air-Conditioning, Psychrometry –Air-water vapour mixtures, Psychrometric Properties, Psychrometric or Air-Conditioning processes, Psychrometric Chart.

Unit V: Air-Conditioning: Mathematical Analysis of Air-Conditioning Loads, Related Aspects, Numerical Problems, Different Air-Conditioning Systems-Central – Station Air-Conditioning System, Unitary Air-Conditioning System, Window Air-Conditioner and Packaged Air-Conditioner, Components related to Air-Conditioning Systems

Course outcomes: After the successful completion of this course, the student will be able to:

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1. **Understand** vapour compression refrigeration system.
2. **Describe** the working principles of air, vapour absorption, thermoelectric and steam-jet refrigeration systems.
3. **Obtain** cooling capacity and coefficient of performance by conducting test on vapor compression refrigeration systems.
4. **Analyze** the basic air conditioning processes on psychometric charts, calculate cooling load for its applications in comfort and industrial air conditioning.
5. **Develop** thermal comfort conditions with respect to temperature and humidity
6. **Estimate** cooling and heating loads in an air-conditioning system.

List of Experiments (Expandable):

1. Demonstration of fundamental study of Absorption Refrigeration System.
2. To study Performance of Ice-Candy unit.
3. Demonstration of C.O.P. and Performance of Air-Conditioner.
4. Demonstration of fundamental study of Vapour Compression cycle (Ice candy Unit)
5. Determination of C.O.P. in Vapour compression Refrigeration system.
6. Demonstration of Electrolux Refrigerator.
7. Equipment and controls of Refrigeration Systems.
8. Equipment and controls of Air Conditioning Systems
9. To study duct and induct type AC
10. To study refrigeration and fault simulator
11. Demonstration of C.O.P. and other performance parameters for Mech. Heat Pump.
12. Demonstration of C.O.P. and other performance parameters for Mech. Heat Pump.

Text Books:

1. Arora C.P., Refrigeration and Air-conditioning, Tata McGraw –Hill Latest Edition, New Delhi

References Books :

1. Roy J. Dossat, Principles of Refrigeration, Wiley Limited
2. Stoecker W.F., and Jones J.W., Refrigeration and Air-conditioning, McGraw - Hill, New Delhi

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120661: Fundamental of Welding Science and Technology

Category	**Title**	**Code**	**Credit - 3**			**Theory Paper**
Departmental Elective-DE 2	Fundamental of Welding Science and Technology	120661	L	T	P	As per SWAYAM/NPTEL norms
			3	-	-	

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc23_me20/preview
The details of the course are mentioned below:-

Course Start Date	**Course End Date**	**Exam date**	**Duration**
23 Jan 2023	17 Mar 2023	26 Mar 2023	8 Weeks

Course layout

Week 1 : Introduction and classification of welding
Week 2 : Nomenclature and symbol of welding joints
Week 3 : Power source of welding
Week 4 : Physics and principle of arc welding
Week 5 : Different type of welding methods and their details
Week 6 : Different type of welding methods their details
Week 7 : Different type of welding methods their details
Week 8 : Welding defects and inspection

Books and references

1. V. M. Radhakrishnan, Welding Technology and Design, New age. 2002.
2. Dr. O. P. Khanna, Welding Technology, Reprint: 2002.
3. J. A. Goldak, Computational Welding Mechanics, Springer 2005.
4. O. Grong, Metallurgical Modelling of Welding,2nd Ed. IOM publication , 1997.
5. L-E Lindgren, Computational Welding Mechanics, Woodhead Publishing Limited,2007.
6. J. F. Lancaster (Ed), The Physics of welding, Pergamon, 1986.
7. R.W. Messler, Principles of Welding, John Wiley and Sons,1999.

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190662/120662: Viscous Fluid Flow

Category	**Title**	**Code**	**Credit - 3**			**Theory Paper**
Departmental Elective-DE 2	Viscous Fluid Flow	190661/120662	L	T	P	As per SWAYAM/NPTEL norms
			3	-	-	

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc23_me57/preview
The details of the course are mentioned below:-

Course Start Date	**Course End Date**	**Exam date**	**Duration**
23 Jan 2023	14 Apr 2023	30 Apr 2023	12 Weeks

Course layout

Week 1: Introduction
Week 2: Steady One-dimensional Rectilinear Flows
Week 3: Steady Axisymmetric Flows
Week 4: Transient One-dimensional Unidirectional Flows
Week 5: Steady, Two-dimensional Rectilinear Flows
Week 6: Lubrication Theory
Week 7: Laminar Boundary Layers - I
Week 8: Laminar Boundary Layers - II
Week 9: Laminar Free Shear Flows
Week 10: Stability Theory
Week 11: Turbulent Flows - I
Week 12: Turbulent Flows - II

Books and references

- White, F. M., Viscous Fluid Flow, McGraw-Hill, 2011.
- Papanastasiou, T. C., Georgiou, G. C., and Alexandrou, A. N., Viscous Fluid Flow, CRC Press, 2000.
- Sherman F. S., Viscous Flow, McGraw-Hill College, 1990.
- Ockendon H., and Ockendon J.R., Viscous Flow, Cambridge University Press, 1995.
- Schlichting, H., and Gersten, K., Boundary Layer Theory, Springer- Verlag, 2000.

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Department of Mechanical Engineering

120663: Properties of Materials (Nature and Properties of Material: III)

Category	**Title**	**Code**	**Credit - 3**			**Theory Paper**
Departmental Elective-DE 2	Properties of Materials (Nature and Properties of Material: III)	120663	L	T	P	As per SWAYAM/NPTEL norms
			3	-	-	

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc23_mm08/preview
The details of the course are mentioned below:-

Course Start Date	**Course End Date**	**Exam date**	**Duration**
20 Feb 2023	14 Apr 2023	29 Apr 2023	8 Weeks

Course layout

Week 1 : Introduction and Basic Elasticity
Week 2 : Mechanical testing and plastic deformation
Week 3 : Plastic deformation mechanisms
Week 4 : Strengthening mechanisms
Week 5 : Electrical properties of metals
Week 6 : Quantum mechanics and band theory
Week 7 : Semiconductor properties
Week 8 : Thermal properties

Books and references

1. V. Raghavan, Materials Science and Engineering
2. W.D. Callister, Materials Science and Engineering
3. H.W. Hayden, W.G. Moffatt and J.W. Wulff, Mechanical Behaviour (Volume III: Structure and Properties of Materials)
4. L.F. Pease, R.M. Rose and J. Wulff, Electronic Properties (Volume IV: Structure and Properties of Materials)
5. A. Guinier and R. Julien, The Solid State

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Academic session 2020-21 admitted

910108 (OC-1): Product Design

Category	Title	Code	Credit - 3			Theory Paper
Open Course-OC	Product Design	910108	L	T	P	Max.Marks-50 Duration-2 hrs.
			2	1	-	

Course Objectives: To make the students to understand:
1. The multidisciplinary aspects of product development and innovation.
2. The basic methodology and tools that can be used in product development projects.

SYLLABUS

Unit 1: Basic: Significance of product design, product characteristics, product design and development process, the challenges of product development, design morphology, sequential engineering design method**.**
Product Planning: Identifying opportunities evaluate and prioritize projects, allocation of resources.

Unit 2: Identifying Customer Needs: Interpret raw data in terms of customers need, organize needs in hierarchy and establish the relative importance of needs, Translating customer needs
Product Specifications: Establish target specifications, setting final specifications, product costing.

Unit 3: Concept Generation: Activities of concept generation, clarifying problem, search both internally and externally, explore the output.
Industrial Design: Assessing need for industrial design, industrial design process, management, assessing quality of industrial design, design for manufacturing, design for assembly, and design for maintenance, design for environment.

Unit 4: Concept Selection: Overview, concept screening and concept scoring, methods of selection, Creativity techniques.
Theory of inventive problem solving (TRIZ): Fundamentals, methods and techniques, general theory of innovation and TRIZ, Value engineering applications in product development and design, Model-based technology for generating innovative ideas.

Unit 5: Concept Testing: Elements of testing: qualitative and quantitative methods including survey, measurement of customer's response.
Intellectual Property: Elements and outline, patenting procedures, claim procedure.

Course Outcome: - After the completion of the course the student will be able to
CO1. Analyze the demands and needs of customers to conceptualize product.

CO2. Describe the different steps involved in the product design.

CO3. Analyze the shortcoming in the product development.

CO4. Identify the opportunities to develop the product.

CO5. Utilize the recourses available in efficient manner for maximum productivity.

CO6. Forecast the impact of product on the surrounding environment.

Text books and References:

1. Ulrich K. T, and Eppinger S.D, Product Design and Development, Tata McGraw Hill.
2. Otto K, and Wood K, Product Design, Pearson.
3. George Dieter, Engineering Design, MGH New York.
4. Engineering of creativity: introduction to TRIZ methodology of inventive Problem Solving, By Semyon D. Savransky, CRC Press.
5. Inventive thinking through TRIZ: a practical guide, By Michael A. Orloff, Springer**.**
6. Systematic innovation: an introduction to TRIZ ; (theory of inventive Problem Solving), By John Terninko, AllaZusman, CRC Press.

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Academic session 2020-21 admitted

910109 (OC-1): Robotics

Category	Title	Code	Credit - 3			Theory Paper
			L	T	P	
Open Course-OC	Robotics	910109	2	1	-	Max.Marks-50 Duration-2 hrs.

Course Objectives: To make the students to understand:

1. Study and understand the concepts of robotics and mechatronics.
2. Impart basic knowledge about the different sensors and their applications in robotics.
3. Learn the basic fundamentals of actuation Systems.
4. To impart knowledge on the basic concepts of measurement, static and dynamic characteristics of measurement systems.
5. To work professionally in the area of robot programming.

Syllabus

UNIT -I Robotics-Introduction-classification with respect to geometrical configuration (Anatomy), Controlled system, Chain type: Serial manipulator and Parallel Manipulator. Components of Industrial robotics-recession of movement-resolution, accuracy and repeatability
Kinematic and Dynamic characteristics- speed of motion, load carrying capacity & speed of response-Sensors-Internal sensors: Position sensors, Velocity sensors, External sensors: Proximity sensors, Tactile Sensors, Force or Torque sensors.

UNIT - II Grippers - Mechanical Gripper-Grasping force, Magnetic gripper, vaccume cup gripper-considerations in gripper selection and design, **Industrial robots** specifications. Selection based on the Application.

UNIT – III Kinematics-Manipulators Kinematics, Rotation Matrix, Homogenous Transformation Matrix. Direct and Inverse Kinematics for industrial robots. Differential Kinematics for planar serial robots. **Dynamics**: Equations of motion, State-Space equation,

UNIT - IV Trajectory planning: Joint space scheme- Cubic polynomial fit, Obstacle avoidance in operation space-cubic polynomial fit with via point, Introduction Cartesian space scheme. Control- Interaction control, Rigid Body mechanics, **Control architecture**- position, path velocity, and force control systems, computed torque control, adaptive control, and Servo system for robot control.

UNIT – V Basics of data acquisition systems, Programming of Robots - programming methods (Arduino MATLAB, Bond Graph, etc.), Vision System, Bioinspired robots and applications, Teach pendent-overview of various textual programming languages, Application of knowledge.

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

CO1. Understand importance of robotics and its impact on human safety, quality of life,economy, environment, etc.; basics of open-ended type of Robotic manipulators.

CO2. Discuss Kinematics and dynamics of open ended robotic mechanisms; Fixing frames

CO3. Ability to formulate, derive, analyse, design and synthesize kinematics and dynamics of open ended robotic mechanisms.

CO4. Apply detailed concepts relating to various actuators, sensors, and theirintegration with drives and signal conditioning for robotics

CO5. Impart knowledge on the basic concepts of measurement, static and dynamic characteristics of measurement systems. control theory and applying them to design and development of robots.

Text & References Books:

1. Introduction to Robotics: Mechanics and Control, **by** John J. Craig, Addison-Wesley.
2. Introduction to Robotics **by** S. K. Saha, Tata McGraw-Hill Publishing Company Ltd.
3. Introduction to Robotics Analysis Systems, Applications **by** S. B. Niku of Pearson Education.
4. Industrial Robotics-Technology Programming and Applications **by** M. P. Groover, M. Weiss, R. N. Nagel and N. G. Odrey of McGraw-Hill Book and Company
5. Robotics: Fundamental Concepts and Analysis **by** A. Ghosal of Oxford University Press.
6. Robot Dynamics and Control, **by**Spong M. W., and Vidyasagar M., John Wiley & Sons.
7. Mechatronic Systems: Fundamentals **by** R. Iserman ofSpringer.
8. Fundamentals of Mechatronics **by** Musa Jouaneh of Cengage Learning.
9. Mechatronics **by**W.Bolton, Pearson education.
10. Micromechatronics, Modeling, Analysis, and Design with MATLAB **by** V. Giurgiutiu and S. E. Lyshevski, CRC Press.
11. Bond Graph in Modeling, Amalendu**by** Mukherjee, RanjitKarmakar and Arun Kumar Samantaray, Simulation and Fault Identification, I. K. International Publishing House Pvt.