Course and Examination Scheme
of NEP 2020 Curriculum

Bachelor of Technology in Mechanical Engineering
(Faculty of Science and Technology)

GONDWANA UNIVERSITY, Gadchiroli
MIDC Road Complex, Gadchiroli
PIN-442 605, (M.S.)

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Key Features of Curriculum

1. Multiple exit options after every year.
2. Provision for Open Electives (OE), Vocational and Skill Enhancement Courses (VSEC), Ability Enhancement Courses (AEC), Indian Knowledge System (IKS), Value Education Courses (VEC), Co-Curricular Courses (CC) in addition to program core courses.
3. Mandatory internship of one semester.
4. Credits for Value education courses, Ability Enhancement Courses, Co-Curricular Curricular Activities.
5. Interdisciplinary and multidisciplinary education through minors and open electives.
6. Skill based courses.
7. Provision for learning in online mode through Swayam/NPTEL etc. courses
8. Opportunity for learner to choose courses of their interest in all disciplines.
9. Provision of Skill Based Courses and internship/Field project/mini projects for exit options at each level.
10. Flexibility for all types of learners i.e. Good, Normal and Exit

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Credit Distribution for each year and Exit Option

NCrF Level	Year/ Semester	Exit Option	Credits	Additional Credits for exit students	Total Credits
4.5	Semester I & II	One Year U.G. Certificate in Engg./Tech.	44	04	48
5.0	Semester III & IV	Two Year U.G. Diploma in Engg./Tech.	88	08	96
5.5	Semester V & VI	Three Years Bachelor's Degree in Vocation (B. Voc.) Or B.Sc. (Engg./Tech.)	132	08	140
6.0	Semester VII & VIII	B. Tech. Major with Multidisciplinary Minor	174	--	174

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Course Category-wise Credit Distribution

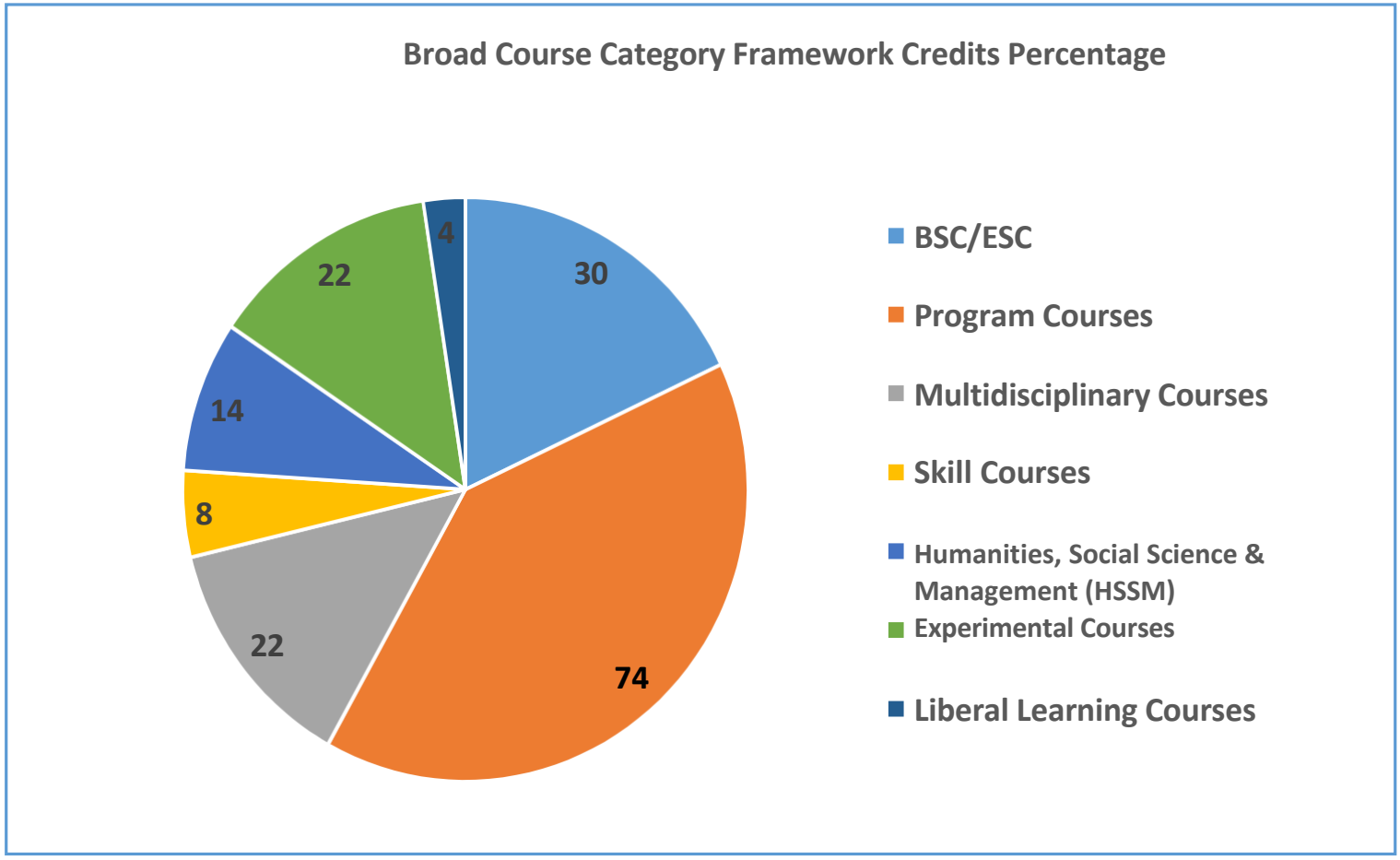
Course Category	As per NEP GR	University Credits	CC	As per NEP GR	University Credits
BSC/ESC	30	30	BSC	14-18	17
			ESC	16-12	13
Program Courses	64 -76	74	PCC	44-56	54
			PEC	20	20
Multidisciplinary Courses	22	22	MDM	14	14
			OE	8	8
Skill Courses	8	8	VSEC	8	8
Humanities, Social Science & Management (HSSM)	14	14	AEC	4	4
			EM	4	4
			IKS	2	2
			VEC	4	4
Experiential Courses	22	22	RM	4	4
			CEP	2	2
			PR	4	4
			IN/OJT	12	12
Liberal Learning Courses	4	4	CC	4	4
Total Credits	**164 - 176**	**174**		**164-176**	**174**

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Semester-wise Credit Distribution:

Sr. No.	SEM	I	II	III	IV	V	VI	VII	VIII	Total Credits	NEP Requirement
1	Basic Science Course (BSC)	8	9							17	14-18
2	Engineering Science Course (ESC)	6	7							13	16-12
3	Program Core Course (PCC)	2		10	10	13	9		10	54	44-56
4	Program Elective Course (PEC)					4	8	6	2	20	20
5	Multidisciplinary Minor Course (MDM)			2	2	3	3	2	2	14	14
6	Open /School Elective Course (OE)			4	2	2				8	8
7	Vocational & Skill Enhancement Course (VSEC)	2	2		2		2			8	8
8	Ability Enhancement Course (AEC)	2			2					4	4
9	Entrepreneurship/ Management Courses (EMC)			2	2					4	4
10	Indian Knowledge System (IKS)		2							2	2
11	Value Education Course (VEC)			2	2					4	4
12	Research Methodology (RM)								4	4	4
13	Community Engagement Activity/Field Project (CEP)			2						2	2
14	Project (PR)								4	4	4
15	Internship (IN)							12		12	12
16	Co-Curricular Course (CC)	2	2							4	4
	Total Credits	**22**	**22**	**22**	**22**	**22**	**22**	**20**	**22**	**174**	**164 - 176**

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General Instructions:

1. **Multi-Disciplinary Minor (MDM) track:**

   i. The Multi-Disciplinary Minor (MDM) course offered under the NEP curriculum is introduced to encourage students to gain knowledge and skills in areas beyond their major discipline. This approach promotes learning across multiple disciplines.

   ii. Minor subject title will be reflected in the student's **degree certificate** (e.g., B.Tech. in Mechanical Engineering with Minor in Data Science).

   iii. In the third semester, students must select one track from the MDM basket, that is outside the scope of their parent discipline. For example, a Computer Science and Engineering student should choose an MDM track offered by departments like Instrumentation Engineering, Mechanical Engineering, or Civil Engineering etc., but not permitted to select a track provided by the Computer Science and Engineering department itself.

   iv. Once a track is selected, it cannot be changed throughout the duration of the course.

   v. The offering of any Multi-Disciplinary Minor (MDM) course track shall be subject to a minimum enrollment of fifteen (15) students.

2. **Open Electives:**

   i. In the third, fourth, and fifth semesters, students must choose an open elective subject from the open elective basket.

   ii. Students from any discipline are allowed to opt for any open elective subject offered in the open elective basket.

   iii. The offering of any Open Elective (OE) course shall be subject to a minimum enrollment of fifteen (15) students.

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3. **The online course is to be completed through SWAYAM/ NPTEL/ equivalent portal. The Evaluation mechanism will be decided by the Board of Studies (BoS) Mechanical Engineering. In this case –**

   i. It is mandatory for students to register for and complete online courses in the respective semester as per the curriculum. Students must successfully complete the course and submit the certificate within the stipulated period.

   ii. If a student fails in the online course examination, the student has to appear for the examination as decided by the Board of Studies (BoS), Mechanical Engineering.

4. In Seventh semester, the students have to complete mandatory internship of one semester in the company/organization approved by the Departmental Faculty Board (DFB).

5. In addition to program specific courses, the students have to complete vocational skill courses, internship, field projects connected to major degree.

6. **Exit Option:** The exit option at the end of each year will be available to students after even semester, i.e. 2nd semester, 4th semester & 6th semester and will be awarded from AY 2024-25 for UG Certificate, AY 2025-26 for UG Diploma, AY 2026-27 for B. Voc./B. Sc. Engineering degree. Students opting for exit at any level will have to earn additional four/eight credits before exit in skill based vocational courses and internship/apprenticeship/mini-project to make them eligible to get UG certificate/UG Diploma or B.Voc./B. Sc. (Engg./Tech) degree as per eligibility.

7. **Regarding Practical Examination:** To pass the practical course, a student must appear for the university practical examination. Absence from this examination will result in failure, irrespective of the marks obtained in the college assessment.

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Multiple exits: Following options are available for multiple exists:

Option	NCrF Level	Qualification Title	Additional credit requirement	Bridge courses
Exit-1	4.5	One-year UG certificate in Engineering/Technology	4	Exit offline courses offered by department **OR** 2 Month Internship **OR** Two online skill courses (ITI level) from NSQF / ESSC / ANY Other agency which provides certification. **OR** Technical Project
Exit-2	5.0	Two-year UG Diploma in Engineering/Technology	8	Exit offline courses offered by department **OR** 2 Month Internship **OR** Two online skill courses (diploma level) from NSQF / ESSC / ANY Other agency which provides certification. **OR** Technical Project
Exit-3	5.5	Three-year Bachelor Degree in Vocation (B.Voc) or B.Sc. (Engineering/Technology)	8	Exit offline courses offered by department **OR** 2 Month Internship **OR** Two online skill courses (diploma level) from NSQF / ESSC / ANY Other agency which provides certification. **OR** Technical Project

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SEMESTER–III																		
Course Category	**Board of Studies**	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Examination Scheme**										**Credit**
				Hours per week				**Theory Marks**						**Practical Marks**				
				L	**T**	**P**	**T**	**Duration in hrs.**	**MSE (CA)**	**IE (CA)**	**ESE (UA)**	**Total**	**Min (CA+UA)**	**CA**	**UA**	**Total**	**Min (CA+UA)**	
MDM	Mechanical Engineering	STMDMMEC301	Multi-disciplinary Minor-I	2	--	--	2	2	5	5	40	50	20	--	--	--	--	2
OE	Science and Humanities	STOESHC302A	Open Elective- I	4	--	--	4	3	10	10	80	100	40	--	--	--	--	4
HSSM (VEC)	Science and Humanities	STVECSHC303	Introduction to Constitution of India	2	--	--	2	--	30	20	--	50	20	--	--	--	--	2
PCC	Mechanical Engineering	STPCCMEC304	Material Engineering	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Mechanical Engineering	STPCCMEC305	Fluid Mechanics and Machines	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
HSSM (EMC)	Mechanical Engineering	STEMCMEC306	Industrial Economics and Entrepreneurship Development	2	--	--	2	2	5	5	40	50	20	--	--	--	--	2
PCC	Mechanical Engineering	STPCCMEC307	Material Engineering Lab	--	--	2	2	--	--	--	--	--	--	25	25	50	25	1
PCC	Mechanical Engineering	STPCCMEC308	Fluid Mechanics and Machines Lab	--	--	2	2	--	--	--	--	--	--	25	25	50	25	1
PCC	Mechanical Engineering	STPCCMEC309	Machine Drawing and Computer Aided Drafting Lab	--	1	2	3	--	--	--	--	--	--	50	50	100	50	2
CEP	Mechanical Engineering	STCEPMEC310	Mini Project/ Field Project	--	--	4	4	--	--	--	--	--	--	50	--	50	25	2
Total				**16**	**1**	**10**	**27**	**--**	**70**	**60**	**320**	**450**	**--**	**150**	**100**	**250**	**--**	**22**
Marks Grand Total				**700**														

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SEMESTER–III		
LIST OF OPEN ELECTIVES - I COURSE		
Sr.	**Course Code**	**Name of the course**
A	STOESHC302A	Mathematical Transform and Statistical Methods
B	STOESHC302B	Transform Methods in Engineering Mathematics
C	STOESHC302C	Probability and Statistics
D	STOEINS302	Signals and Systems
E	STOECEC302	Building Constructions and Materials
F	STOEELE302	Modelling and Design of EV

Note: The offering of any open elective course shall be subject to a minimum enrollment of fifteen (15) students.

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SEMESTER–IV																	
Course Category	Board of Studies	Course Code	Name of the Course	Teaching Scheme				Examination Scheme									Credit
				Hours per week				Theory Marks						Practical Marks			
				L	T	P	T	Duration in hrs.	MSE (CA)	IE (CA)	ESE (UA)	Total	Min (CA+UA)	CA	UA	Total	Min (CA+UA)	
MDM	Mechanical Engineering	STMDMMEC401	Multi-disciplinary Minor-II	2	--	--	2	2	5	5	40	50	20	--	--	--	--	2
OE	Mechanical Engineering	STOEMEC402	Open Elective- II	2	--	--	2	2	5	5	40	50	20	--	--	--	--	2
PCC	Mechanical Engineering	STPCCMEC403	Engineering Thermodynamics	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Mechanical Engineering	STPCCMEC404	Strength of Materials	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Mechanical Engineering	STPCCMEC405	Manufacturing Processes	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
HSSM (EMC)	Mechanical Engineering	STEMCMEC406	Human Resource Management	2	--	--	2	--	30	20	--	50	20	--	--	--	--	2
PCC	Mechanical Engineering	STPCCMEC407	Strength of Materials Lab	--	--	2	2	--	--	--	--	--	--	25	25	50	25	1
VSEC	Mechanical Engineering	STVSECMEC408	Workshop Practice - III	--	1	2	3	--	--	--	--	--	--	50	50	100	50	2
HSSM (AEC)	Mechanical Engineering	STAECMEC409	Modern Indian/ Foreign Language	--	1	2	3	--	--	--	--	--	--	50	--	50	25	2
HSSM (VEC)	Mechanical Engineering	STVECMEC410	Human Values and Ethics	--	1	2	3	--	--	--	--	--	--	50	--	50	25	2
Total				**15**	**3**	**8**	**26**	**--**	**70**	**60**	**320**	**450**	**--**	**175**	**75**	**250**	**--**	**22**
Marks Grand Total				**700**														

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SEMESTER–IV		
LIST OF OPEN ELECTIVES - II COURSE		
Sr.	**Course Code**	**Name of the course**
A	STOEMEC402	Industrial Management
B	STOEETC402	Digital System Design
C	STOECSE402	Design Thinking
D	STOEINS402	Chemical and Analytical Instrumentation
E	STOECEC402	Building Automation
F	STOEELE402	EV Design Analysis and Control

Note: The offering of any open elective course shall be subject to a minimum enrollment of fifteen (15) students.

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EXIT CRITERIA FOR U. G. DIPLOMA (AFTER SECOND YEAR)																		
Course Category	Board of Studies	Course Code	Name of the Course	Teaching Scheme				Examination Scheme										Credit
				Hours per week				Theory Marks						Practical Marks				
				L	T	P	T	Duration in hrs.	MSE (CA)	IE (CA)	ESE (UA)	Total	Min (CA+UA)	CA	UA	Total	Min (CA+UA)	
Exit offline courses offered by department (Student may choose and enroll in any one of these courses)																		
EX2	Mechanical Engineering	STEXMEC421	Mechatronics and Internet of Things	--	2	12	14	--	--	--	--	--	--	100	100	200	100	8
EX2	Mechanical Engineering	STEXMEC422	Advanced Manufacturing Engineering	--	2	12	14	--	--	--	--	--	--	100	100	200	100	8
EX2	Mechanical Engineering	STEXMEC423	Digital Manufacturing	--	2	12	14	--	--	--	--	--	--	100	100	200	100	8
OR																		
EX2	Mechanical Engineering	STEXMEC431	Internship / Technical Project											100@	100	200	100	8
OR																		
EX2	Mechanical Engineering	STEXMEC441	Two online skill courses (diploma level) from NSQF / ESSC / ANY Other agency which provides certification.											100@	100	200	100	8
Total														100	100	200		8
Marks Grand Total				200														

@ Evaluation based on seminar, internship report, technical project report, skill courses certification.

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SEMESTER– V																		
Course Category	Board of Studies	Course Code	Name of the Course	Teaching Scheme				Examination Scheme										Credit
				Hours per week				Theory Marks						Practical Marks				
				L	T	P	T	Duration in hrs.	MSE (CA)	IE (CA)	ESE (UA)	Total	Min (CA+UA)	CA	UA	Total	Min (CA+UA)	
MDM	Mechanical Engineering	STMDMMEC501	Multi-disciplinary Minor-III	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
OE	Mechanical Engineering	STOEMEC502	Open Elective- III	2	--	--	2	2	5	5	40	50	20	--	--	--	--	2
PCC	Mechanical Engineering	STPCCMEC503	Heat Transfer	3	1	--	4	3	10	10	80	100	40	--	--	--	--	4
PCC	Mechanical Engineering	STPCCMEC504	Kinematics of Machines	3	1	--	4	3	10	10	80	100	40	--	--	--	--	4
PCC	Mechanical Engineering	STPCCMEC505	Design of Machine Elements	3	1	--	4	3	10	10	80	100	40	--	--	--	--	4
PEC	Mechanical Engineering	STPECMEC506A/B/C	Program Elective - I	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Mechanical Engineering	STPCCMEC507	Heat Transfer Lab	--	--	2	2	--	--	--	--	--	--	25	25	50	25	1
PEC	Mechanical Engineering	STPECMEC508A/B/C	Program Elective – I Lab.	--	--	2	2	--	--	--	--	--	--	25	25	50	25	1
Total				**17**	**3**	**4**	**24**	**--**	**55**	**55**	**440**	**550**	**--**	**50**	**50**	**100**	**--**	**22**
Marks Grand Total				**650**														

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SEMESTER–V						
LIST OF OPEN ELECTIVES - III COURSE			LIST OF PROGRAM ELECTIVES - I		LIST OF PROGRAM ELECTIVES – I LAB	
Sr.	Course Code	Name of the course	Course Code	Name of the course	Course Code	Name of the course
A	STOEMEC502	Operations Research Techniques	STPECMEC506A	Internal Combustion Engines and Gas Turbines	STPECMEC508A	Internal Combustion Engines and Gas Turbines Lab
B	STOEETC502	Automotive Electronics	STPECMEC506B	Production Technology	STPECMEC508B	Production Technology Lab
C	STOECSE502	Software Project Management	STPECMEC506C	Computer Aided Design	STPECMEC508C	Computer Aided Design Lab
D	STOEINS502	Power Plant Instrumentation				
E	STOECEC502	Remote Sensing and GIS				
F	STOEELE502	Introduction to Smart Grid				

Note:

1. Note: The offering of any open elective or Program elective course shall be subject to a minimum enrollment of fifteen (15) students.
2. If a student opts for Program Elective – I (Serial No. A), they will be eligible only for the corresponding Program Elective – I Lab (Serial No. A); the same applies for serial no. B

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SEMESTER– VI																	
Course Category	Board of Studies	Course Code	Name of the Course	Teaching Scheme				Examination Scheme									Credit
				Hours per week				Theory Marks						Practical Marks			
				L	T	P	T	Duration in hrs.	MSE (CA)	IE (CA)	ESE (UA)	Total	Min (CA+UA)	CA	UA	Total	Min (CA+UA)	
MDM	Mechanical Engineering	STMDMMEC601	Multi-disciplinary Minor-IV	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Mechanical Engineering	STPCCMEC602	Thermal Engineering	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Mechanical Engineering	STPCCMEC603	Mechanical Measurement	2	--	--	2	2	5	5	40	50	20	--	--	--	--	2
PCC	Mechanical Engineering	STPCCMEC604	Dynamics of Machine	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PEC	Mechanical Engineering	STPECMEC605A/B/C	Program Elective - II	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PEC	Mechanical Engineering	STPECMEC606A/B/C	Program Elective – III	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Mechanical Engineering	STPCCMEC607	Mechanical Engineering Lab	--	--	2	2	--	--	--	--	--	--	25	25	50	25	1
PEC	Mechanical Engineering	STPECMEC608A/B/C	Program Elective – II Lab.	--	--	2	2	--	--	--	--	--	--	25	25	50	25	1
PEC	Mechanical Engineering	STPECMEC609A/B/C	Program Elective – III Lab.	--	--	2	2	--	--	--	--	--	--	25	25	50	25	1
VSEC	Mechanical Engineering	STVSECMEC610	Soft Skills	--	1	2	3	--	--	--	--	--	--	50	--	50	25	2
Total				**17**	**1**	**8**	**26**	**--**	**55**	**55**	**440**	**550**	**--**	**125**	**75**	**200**	**--**	**22**
Marks Grand Total				**750**														

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SEMESTER–VI			
LIST OF PROGRAM ELECTIVES - II		**LIST OF PROGRAM ELECTIVES – II LAB**	
Course Code	**Name of the course**	**Course Code**	**Name of the course**
STPECMEC605A	Automation in Manufacturing	**STPECMEC608A**	Automation in Manufacturing Lab
STPECMEC605B	Metrology and Quality Control	**STPECMEC608B**	Metrology and Quality Control Lab
STPECMEC605C	Rapid Prototyping and Additive Manufacturing	**STPECMEC608C**	Rapid Prototyping and Additive Manufacturing Lab

LIST OF PROGRAM ELECTIVES - III		**LIST OF PROGRAM ELECTIVES – III LAB**	
Course Code	**Name of the course**	**Course Code**	**Name of the course**
STPECMEC606A	Automobile Engineering	**STPECMEC609A**	Automobile Engineering Lab
STPECMEC606B	Product Life Cycle Management	**STPECMEC609B**	Product Life Cycle Management Lab
STPECMEC606C	Finite Element Methods	**STPECMEC609C**	Finite Element Methods Lab

Note:

1. Note: The offering of any Program elective course shall be subject to a minimum enrollment of fifteen (15) students.
2. If a student opts for Program Elective – II or III (Serial No. A), they will be eligible only for the corresponding Program Elective – II or III Lab (Serial No. A); the same applies for serial no. B

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EXIT CRITERIA FOR BACHELOR DEGREE IN VOCATION (AFTER THIRD YEAR)																		
Course Category	Board of Studies	Course Code	Name of the Course	Teaching Scheme				Examination Scheme										Credit
				Hours per week				Theory Marks						Practical Marks				
				L	T	P	T	Duration in hrs.	MSE (CA)	IE (CA)	ESE (UA)	Total	Min (CA+UA)	CA	UA	Total	Min (CA+UA)	
Exit offline courses offered by department (Student may choose and enroll in any one of these courses)																		
EX3	Mechanical Engineering	STEXMEC621	Design Process Management (PLM)	--	2	12	14	--	--	--	--	--	--	100	100	200	100	8
EX3	Mechanical Engineering	STEXMEC622	Autonomous, Connected, Electric Vehicles (ACE)	--	2	12	14	--	--	--	--	--	--	100	100	200	100	8
EX3	Mechanical Engineering	STEXMEC623	Automotive Systems	--	2	12	14	--	--	--	--	--	--	100	100	200	100	8
OR																		
EX3	Mechanical Engineering	STEXMEC631	Internship / Technical Project											100@	100	200	100	8
OR																		
EX3	Mechanical Engineering	STEXMEC641	Two online skill courses (diploma level) from NSQF / ESSC / ANY Other agency which provides certification.											100@	100	200	100	8
Total														**100**	**100**	**200**		**8**
Marks Grand Total				200														

@ Evaluation based on seminar, internship report, technical project report, skill courses certification.

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SEMESTER– VII																		
Course Category	Board of Studies	Course Code	Name of the Course	Teaching Scheme				Examination Scheme										Credit
				Hours per week				Theory Marks						Practical Marks				
				L	T	P	T	Duration in hrs.	MSE (CA)	IE (CA)	ESE (UA)	Total	Min (CA+UA)	CA	UA	Total	Min (CA+UA)	
MDM	Mechanical Engineering	STMDMMEC701	Multi-disciplinary Minor-V	*2	--	--	2	--	--	50	--	50	20	--	--	--	--	2
PEC	Mechanical Engineering	STPECMEC702	Program Elective - IV	*3	--	--	3	--	--	100	--	100	40	--	--	--	--	3
PEC	Mechanical Engineering	STPECMEC703	Program Elective - V	*3	--	--	3	--	--	100	--	100	40	--	--	--	--	3
IN	Mechanical Engineering	STINMEC704	Internship / OJT	--	--	24	24	--	--	--	--	--	--	100	200	300	150	12
Total				**8**	**--**	**24**	**32**	**--**	**--**	**250**	**--**	**250**	**--**	**100**	**200**	**300**	**--**	**20**
Marks Grand Total				**550**														

Note:

Program Elective-IV and V is 12-week online certificate courses conducted by NPTEL / SWAYAM / MOOC / OTHERS in the area approved by DFB
Internship Guide Teaching load: 4 hrs/week

***Courses to be mentored and assessed by faculty members**

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SEMESTER– VIII																		
Course Category	**Board of Studies**	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Examination Scheme**										**Credit**
				Hours per week				**Theory Marks**						**Practical Marks**				
				L	**T**	**P**	**T**	**Duration in hrs.**	**MSE (CA)**	**IE (CA)**	**ESE (UA)**	**Total**	**Min (CA+UA)**	**CA**	**UA**	**Total**	**Min (CA+UA)**	
MDM	Mechanical Engineering	STMDMMEC801	Multi-disciplinary Minor-VI	2	--	--	2	2	5	5	40	50	20	--	--	--	--	2
PCC	Mechanical Engineering	STPCCMEC802	Refrigeration and Air Conditioning	3	1	--	4	3	10	10	80	100	40	---	---	---	---	4
PCC	Mechanical Engineering	STPCCMEC803	Design of Mechanical Drives	3	1	--	4	3	10	10	80	100	40	---	---	---	---	4
PEC	Mechanical Engineering	STPECMEC804A/B/C	Program Elective - VI	2	--	--	2	2	5	5	40	50	20	---	---	---	---	2
RM	Mechanical Engineering	STRMMEC805	Research Methodology and IPR	3	1	---	4	3	10	10	80	100	40	---	---	---	---	4
PCC	Mechanical Engineering	STPCCMEC806	Refrigeration and Air Conditioning Lab.	---	---	2	2	---	---	---	---	---	---	25	25	50	25	1
PCC	Mechanical Engineering	STPCCMEC807	Design of Mechanical Drives Lab	---	---	2	2	---	---	---	---	---	---	25	25	50	25	1
PR	Mechanical Engineering	STPRMEC808	Major Project	---	---	8	8	---	---	---	---	---	---	75	75	150	75	4
Total				**13**	**3**	**12**	**28**	**--**	**40**	**40**	**320**	**400**	**--**	**125**	**125**	**250**	**--**	**22**
Marks Grand Total				**650**														

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Semester - VIII	
LIST OF PROGRAM ELECTIVES - VI	
Course Code	**Name of the course**
STPECMEC804A	Stress Analysis
STPECMEC804B	Power Plant Engineering
STPECMEC804C	Control System Engineering

Note: The offering of any Program elective course shall be subject to a minimum enrollment of fifteen (15) students.

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LIST OF OPEN ELECTIVE COURSE (BASKET OF OPEN ELECTIVE)			
	OPEN ELECTIVE-I	**OPEN ELECTIVE -II**	**OPEN ELECTIVE -III**
A	STOESHC302A Mathematical Transform and Statistical Methods	STOEMEC402 Industrial Management	STOEMEC502 Operations Research Techniques
B	STOESHC302B Transform Methods in Engineering Mathematics	STOEETC402 Digital System Design	STOEETC502 Automotive Electronics
C	STOESHC302C Probability and Statistics	STOECSE402 Design Thinking	STOECSE502 Software Project Management
D	STOEINS302 Signals and Systems	STOEINS402 Chemical and Analytical Instrumentation	STOEINS502 Power Plant Instrumentation
E	STOECEC302 Building Constructions and Materials	STOECEC402 Building Automation	STOECEC502 Remote Sensing and GIS
F	STOEELE302 Modelling and Design of EV	STOEELE402 EV Design Analysis and Control	STOEELE502 Introduction to Smart Grid

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LIST OF PROGRAM ELECTIVES						
Name of course	**Program Elective - I**	**Program Elective - II**	**Program Elective - III**	**Program Elective - IV**	**Program Elective - V**	**Program Elective - VI**
Code	**STPECMEC506**	**STPECMEC605**	**STPECMEC606**	**STPECMEC702**	**STPECMEC703**	**STPECMEC804**
A	Internal Combustion Engines and Gas Turbines	Automation in Manufacturing	Automobile Engineering	NPTEL / SWAYAM / MOOC / OTHERS	NPTEL / SWAYAM / MOOC / OTHERS	Stress Analysis
B	Production Technology	Metrology and Quality Control	Product Life Cycle Management	NPTEL / SWAYAM / MOOC / OTHERS	NPTEL / SWAYAM / MOOC / OTHERS	Power Plant Engineering
C	Computer Aided Design	Rapid Prototyping and Additive Manufacturing	Finite Element Methods	NPTEL / SWAYAM / MOOC / OTHERS	NPTEL / SWAYAM / MOOC / OTHERS	Control System Engineering

SWAYAM/NPTEL etc. portal Courses should be approved by DFB and **at least of 12 weeks** including tutorials.

LIST OF PROGRAM ELECTIVES LABS			
Name of course	**Program Elective – I Lab**	**Program Elective – II Lab**	**Program Elective – III Lab**
Code	**STPECMEC508**	**STPECMEC608**	**STPECMEC609**
A	Internal Combustion Engines and Gas Turbines Lab	Automation in Manufacturing Lab	Automobile Engineering Lab
B	Production Technology Lab	Metrology and Quality Control Lab	Product Life Cycle Management Lab
C	Computer Aided Design Lab	Rapid Prototyping and Additive Manufacturing Lab	Finite Element Methods Lab

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LIST OF MULTI DICIPLINARY MINOR COURSE TRACK (MDM BASKET)

Sr. No.	Offering Department	Name of Minor Course (Track)	Students from Department Who can register
1	Mechanical Engineering (MEC)	Industrial IoT and Smart Manufacturing	All branches except Mechanical Engineering
2	Instrumentation Engineering (INS)	Industrial Automation	All branches except Instrumentation Engineering
3	Electronics and Telecommunication Engg.(ETC)	IoT and Drone Technology	All branches except Electronics and Telecommunication Engineering
4	Electrical Engineering (ELE)	Power System Engineering	All branches except Electrical Engineering
5	Computer Science & Engineering (CSE)	Data Science	All branches except Computer Science & Engineering
6	Civil Engineering (CEC)	Environmental Engineering	All branches except Civil Engineering


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LIST OF MULTI DICIPLINARY MINOR COURSES (MDM BASKET)

Name of Minor Course	Mechanical Engineering	Instrumentation Engineering	Electronics & Telecommunication Engineering	Electrical Engineering	Computer Science and Engineering	Civil Engineering
	TRACK-I **Industrial IoT and Smart Manufacturing**	**TRACK-I** **Industrial Automation**	**TRACK-I** **IoT and Drone Technology**	**TRACK-I** Power System Engineering	**TRACK-I** Data Science	**TRACK-I** Environmental Engineering
Multi-disciplinary Minor -I	STMDMMEC301 Additive Manufacturing	STMDMINS301 Industrial Measurements	STMDMETC301 IoT Sensors and Actuators	STMDMELE301 DC Machines and Transformer	STMDMCSE301 Introduction to Data Science	STMDMCEC301 Basics of Environmental Engineering
Multi-disciplinary Minor -II	STMDMMEC401 Mechatronics Systems	STMDMINS401 Control System Components	STMDMETC401 Basics of Drone Technology	STMDMELE401 AC Machines	STMDMCSE401 Tools for Data Science	STMDMCEC401 Drinking Water Quality and Water Pollution
Multi-disciplinary Minor -III	STMDMMEC501 PLC and Automation	STMDMINS501 Control System Engineering	STMDMETC501 IoT Architecture and Protocol	STMDMELE501 Electrical Drives	STMDMCSE501 Data Visualization and Data Analytics	STMDMCEC501 Air Pollution
Multi-disciplinary Minor -IV	STMDMMEC601 Industrial Robotics	STMDMINS601 Process Automation	STMDMETC601 Interfacing Programming of IoT and Drone	STMDMELE601 Power System Protection	STMDMCSE601 Machine Learning	STMDMCEC601 Soil, Sound and Solid Waste Pollution
Multi-disciplinary Minor -V	STMDMMEC701 NPTEL / SWAYAM / MOOC 8 Week online course related to track	STMDMINS701 NPTEL / SWAYAM / MOOC 8 Week online course related to track	STMDMETC701 NPTEL / SWAYAM / MOOC 8 Week online course related to track	STMDMELE701 NPTEL / SWAYAM / MOOC 8 Week online course related to track	STMDCSEC701 NPTEL / SWAYAM / MOOC 8 Week online course related to track	STMDMCEC701 NPTEL / SWAYAM / MOOC 8 Week online course related to track
Multi-disciplinary Minor -VI	STMDMMEC801 IoT in Automotive Engineering	STMDMINS801 Process Control	STMDMETC801 IoT and Drones Application	STMDMELE801 Digital Signal Processing	STMDMCSE801 Data Science in Practice	STMDMCEC801 Advance Air Pollution and Solid waste Management



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III Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STMDMMEC301

Title of Course: **Multi-Disciplinary Minor - I (MDM)**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
2	--	--	2	2	2	5	5	40	50

The Detail Syllabus for the Multidisciplinary Minor (MDM) course is provided separately under Multi-disciplinary Minors (MDM) Basket.

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III Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STOESHC302A

Title of Course: **Open Elective - I**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
4	--	--	4	4	3	10	10	80	100

The Detail Syllabus for the Open Elective - I course (OE) is provided separately under "Open Electives" Basket.

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III Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STVECSHC303

Title of Course: **Introduction to Constitution of India**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
2	--	--	2	2	--	30	20	--	50

Course outcomes:

After completing the course, the students will be able to;

CO1 Explain the value of the fundamental rights and duties for becoming a responsible citizen of India.

CO2 Analyze the functioning of the three wings of the government i.e., legislative, executive and judiciary.

CO3 Discuss the decentralization of power between the central, state and local self-government.

CO4 Describe the functioning of urban and rural administration in India.

Unit	Content	Hours
I	**Constitution: Meaning and Importance** Introduction to the Constitution of India, history, social, political, economic, and spiritual influences in the development of the constitution, Nature and special features: Equality and social justice- various kinds of freedoms-social control, Citizenship, Preamble, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy (Article 41 to 47)	8
II	**The Central Government of India** The levels of government, Indian Federation, Center-state relationship: Legislative, Administrative and Financial, Roles and positions of President, PM, Council of union ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.	8
III	**The State Government** Roles and positions of Governor, CM, and Council of ministers of states: Legislative, and Executive Control, Secretariat and Directorates: organization, structure, and functions, District Administration and the role of District Collector: Legislative, and Executive Control. The Supreme Court and High Court: Powers and Functions.	7
IV	**Urban and Rural Administration** Role and importance of District's administrative head, the role of Mayor and elected representative, Role and functioning of the Municipal Corporation and Municipalities, Zila Panchayat, Gram Panchayat, Block level governance, democracy at the grass root level, The Election Commission of India: Introduction to the role and functioning of the Election Commission of India, Overview of the electoral procedure.	7

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Reference Books:

1. Introduction to the Constitution of India by Durga Das Basu, Prentice Hall of India Pvt. Ltd., New Delhi
2. Indian Constitution by Subash Kashyap, National Book Trust
3. Constitution of India by Dr. P. K. Agrawal and Dr. K. N. Chaturvedi, Prabhat Prakashan 2017
4. Constitution of India by V. N. Shukla, Eastern Book Company

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III Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STPCCMEC304

Title of Course: **Material Engineering**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able to;

CO1 Summarize properties of engineering materials.
CO2 Apply various test methods for characterizing properties of materials
CO3 Identify the phases present in different alloy system by analyzing phase diagrams
CO4 Understanding the properties of different types of polymers and ceramics
CO5 Appreciate the properties of composite material for different engineering application

Unit	Content	Hours
I	**Classification and Structure of Materials** Classification of materials: metals, Non-metals, ceramics, polymers and composites. Nature of bonding in materials: metallic, ionic, covalent and mixed bonding, fundamentals of crystallography, symmetry operations, crystal systems, Bravais lattices, unit cells, crystallographic planes and directions, structures of metals, ceramics, polymers, amorphous materials and glasses. Defects in crystalline materials, Frenkel and Schottky defects; dislocations; grain boundaries, twins, stacking faults; surfaces and interfaces.	8
II	**Characterization of Materials** Characteristics of crystal structures for steel and metallic, ceramic, and polymeric structures. Uses and limitations of elemental analysis (i.e., EDS, XPS, XRD) and standard materials characterization techniques, i.e., optical and electron microscopy (SEM) and thermal analysis (i.e., DTA, DSC, TGA) to determine or analyze crystal structure, microstructure, and surface morphology. Destructive and Non-destructive testing of Metals.	8
III	**Phase Transformations and Thermal Treatment** Fe-Fe3C phase diagram, Binary phase diagrams. Solid Solutions. Steel and Cast Iron. Annealing and heat treatment techniques for stress relief, recovery, recrystallization, grain growth, and precipitation hardening. Crystallization kinetics, diffusion, and nucleation and growth phenomena in metals. Amorphous materials, glass transition temperature, Tg, Time-temperature-transformation (TTT) diagrams. Hardenability of steels. Introduction to Aluminum and copper alloys.	8

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IV	**Polymer and ceramic materials** Polymer materials, polymer structure, various properties of polymers, Polymer processing techniques like molding, extrusion, etc., specific processing techniques like injection moulding and blow moulding, Types and application of polymers-Thermoplastics, thermosets, elastomers. Ceramic materials, various properties of ceramics, traditional ceramic processing, advanced ceramics processing techniques, application of ceramics – abrasives, biomedical, electronics and refractories.	8
V	**Composites and Nano-Materials** Polymer matrix composite, ceramics matrix composite, metal matrix composite. Fabrication techniques considering particle and fiber reinforcement. Iso-stress and Iso-strain loading. Continuous, random, aligned, critical length, orientation of fillers. Thermal, mechanical, electrical, high-temperature application of ceramics. Traditional micro fabrication processes: lithography, etching, physical deposition (sputtering), chemical deposition (CVD), electrodeposition, oxidation, diffusion, ion implantation.	8

Text Books:

1. W. D. Callister, 2006, “Materials Science and Engineering-An Introduction”, 6th Edition, Wiley India.
2. Kenneth G. Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
3. V. Raghavan, “Material Science and Engineering’, Prentice Hall of India Private Limited, 1999. 4. U. C. Jindal, “Engineering Materials and Metallurgy”, Pearson, 2011.
4. Aver S.H, Introduction to Physical Metallurgy, McGraw Hill,Tokyo.

Reference Books:

1. Jastrezebski Z.D., The nature and properties of engineering Materials, Wiley Newyork.

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III Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STPCCMEC305

Title of Course: **Fluid Mechanics and Machines**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able to;

CO1 Acquaint with fluid properties and evaluate pressure distributions in a static fluid, taking account of hydrostatic pressure

CO2 Acquaint with Kinematics and Dynamics of fluid flow.

CO3 Analyze the head loss in pipes for both minor and major losses.

CO4 Evaluate the performance of turbine

CO5 Understand the working of centrifugal pump.

Unit	Content	Hours
I	Introduction to Fluid Mechanics, Properties of fluids, Types of fluids, Newton's law of viscosity & its applications, Surface tension & capillarity. Pascal's law, Hydrostatic law, Fluid pressure & its measurements (simple & Differential Manometers) Forces on submerged plane surfaces.	8
II	Buoyancy, centre of Buoyancy, Metacentre, Metacentric height, Stability of floating and submerged bodies. Kinematics of fluid flow: Types of flow, Path-line, stream line, stream tube streak line, Continuity equation, Dynamics of fluid flow: - Euler's equation of motion, Derivation of Bernoulli's equation for incompressible flow and its applications.	8
III	Turbulent flow: Reynold's experiment, frictional loss in pipe flow. Flow through pipes: Equations of pipe flow, Losses in pipes & fittings, Hydraulic Gradient Line & Total energy Line, Flow through pipe in series and parallel, Flow through branched pipes. Reciprocating Pumps: Types, Main Components, Slip, Work done, Theoretical and Actual Indicator Diagrams.	8
IV	Impulse Momentum Principle, Dynamic Action of Jets on Fixed and Moving Flat Plates and Curved Vanes. Pelton Turbines: Principle, Constructional Features, Velocity Diagrams and Analysis, Working Proportions, Design Parameters, Cavitations in Turbines, Governing. Introduction to reaction turbine.	8

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V	Centrifugal Pumps: Classification and their applications, Operation, Priming, Fundamental Equation, Various Heads, Velocity Triangles and Analysis, slip Factor, Vane Shape, Losses and Efficiencies, Multi staging of Pumps, Design Consideration, Working Principle, N.P.S.H., Cavitations, Performance Characteristics.	8

Text Books:

1. Fluid Mechanics & hydraulic Machines - Dr. V. M. Domkundwar
2. Fluid Mechanics & Fluid Power Engineering -D. S. Kumar (Kataria Publications.)
3. Fluid Mechanics & hydraulic Machines - R. K. Bansal (Laxmi Publications.)
4. Theory & Design of Hydraulic Machines, - V. P. Vasandani (Khanna Publications.)
5. Fluid Mechanics, - A. K. Jain (Khanna Publications.)
6. Fluid Mechanics & Machines, - Banga & Sharma (Khanna Publications.)
7. Fluid Mechanics & Machines, - R. K. Rajput (S. Chand Publications.)

Reference Books:

1. Fluid Mechanics with Engineering Applications, - Daugherty & Franizini (McGraw Hill Publications.)
2. Theory of Turbo – Machines, - A. T. Sayers, (McGraw Hill (India) Pvt. Ltd.)
3. Fundamentals of Turbomachines, - B. K. Vekanna
4. Fluid Mechanics & Hydraulic Machines, - Som & Biswas (TMH Publications.)

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III Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STEMCMEC306

Title of Course: Industrial Economics and Entrepreneurship Development

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
2	--	--	2	2	2	5	5	40	50

Course outcomes:

After completing the course, the students will be able to;

CO1 Recognize the concept of demand & demand forecasting methods and various cost involved in the production.

CO2 Acquaint with price determination for different situations and impact of globalization on Indian economy.

CO3 Outline the characteristics and functions of entrepreneur.

CO4 Identify the factors governing the selection of product and site.

Unit	Content	Hours
I	Industrial Economics: Basic concepts, demand analysis, types of demand, methods of demand forecasting, types of Business structures, top and bottom line of the organization, economics of operations. Production system, factors of production, production function, laws of return, cost concepts, fix variable, average, marginal and total cost, break even analysis, depreciation cost.	8
II	Optimum size of unit, optimum firm, industrial combinations, causes for the growth of combinations, forms of combinations in India, various competitive situations, perfect, monopoly, monopolistic, oligopoly. Price determination under these situations, Impact of globalization on Indian economy.	8
III	Concept of entrepreneurship, definition, competencies of entrepreneurs, entrepreneurial functions, achievement, motivation, types of enterprises. Procedure to set up small scale industrial unit, advantages and limitation of SSI. Market survey and factors governing product selection. Project formulation, financial & marketing analysis of project.	7
IV	Factors governing the selection of site, plant and machinery. Role of consultancy organizations, role of District Industries Centre, State Industrial Development Corporations, Banks and Financial Institutions, latest SSI intensive schemes (To be confirmed from DIC time to time), determination of sources of funds.	7

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Text Books:

1. Industrial Economics, Ranjana Seth, Ane Book Pvt Ltd.
2. Modern Economic Theory, K. K. Dewett. S. Chand.
3. Industrial Economics, Jagdish Sheth, Pearson Publication.
4. Entrepreneurial Development, S. S. Khanka S. Chand& Co. Ltd. Ram Nagar New Delhi.
5. Entrepreneurship, Hisrich R D and Peters M P, Tata McGraw-Hill.
6. Management of Entrepreneurship. By, N.V.R. Naidu, I.K. International Pvt Ltd.
7. Entrepreneurial Development, S. Anil Kumar, New Age International.
8. Dynamics of Entrepreneurial, Vasant Desai
9. Indian Industrial Economy, K. V. Sivaya, V. B. M. Das
10. Managerial Economics, V. N. Gupta.
11. Managerial Economics, G. S. Gupta.

Reference Books:

1. Business Economics, K. Rajgopalchar, Atlantic Publishers.
2. Microeconomics, Robert Pindyck, Pearson Publication
3. Business Economics, H. L. Ahuja, S. Chand.
4. Entrepreneurship and innovation Rabindra N. Kanungo, Sage Publications, New Delhi.
5. Financing Small Scale Industries in India, K. C. Reddy, Himalaya Publication.

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III Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STPCCMEC307

Title of Course: Material Engineering Lab

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	25	25	50

Course outcomes:

After completing the course, the students will be able to;

CO1	Construct phase diagrams based on the given data on binary alloy systems
CO2	Discuss the microstructural aspects of metals and alloys
CO3	Prepare metallic samples for microstructural observation
CO4	Conduct microstructure-property correlation of heat-treated samples
CO5	Practice industrial heat treatment processes for ferrous and nonferrous alloys

Lab Activities: A minimum of eight practicals should be performed from the topics listed below.

List of practicals:

1. To study different crystal systems in metals
2. To study cooling curve of a binary alloy
3. Determination of the elastic modulus and ultimate strength of a given Materials
4. Determination of Brinell/Rockwell hardness number for given metallic specimen
5. Study of metallurgical microscope
6. To study specimen preparation for metallography
7. To measure grain size and study the effect of grain size on hardness of the given metallic specimens.
8. To study & draw the microstructure of plain carbon steel
9. To study the effect of annealing & normalizing on microstructure & hardness of steel
10. To study metallography of cast iron and non-ferrous metals

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III Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STPCCMEC308

Title of Course: **Fluid Mechanics and Machines Lab**

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	25	25	50

Course outcomes:

After completing the course, the students will be able to;

CO1 Examine the stability of floating bodies.
CO2 Identify the type of flow using Reynold's apparatus.
CO3 Verify Bernoulli's theorem.
CO4 Determine coefficient of discharge for flow measuring devices.
CO5 Evaluate the performance of turbines and pumps

Lab Activities: A minimum of eight practicals should be performed from the topics listed below.

List of practicals:

1. To run the centrifugal pump under various loading conditions and to draw the performance characteristic curves.
2. To conduct a test on turbine wheel & plot the performance characteristic curves for constant load and head.
3. To study the performance of reciprocating pump and draw the characteristic curves.
4. Determination of the metacentric height of a floating body.
5. To study type of flow using Reynolds apparatus (Laminar and Turbulent).
6. To verify Bernoulli's theorem.
7. Determination of the coefficient of discharge for a given Venturi meter.
8. Determination of the coefficient of discharge for a given Orifice meter.
9. To study the performance of Francis turbine at constant head.

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III Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STPCCMEC309

Title of Course: **Machine Drawing and Computer Aided Drafting Lab**

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	1	2	3	2	--	50	50	100

Course outcomes:

After completing the course, the students will be able to;

CO1 Interpret and draft mechanical part and assembly drawings.

CO2 Apply standard drawing practices for dimensions, fits, and tolerances.

CO3 Use CAD software for creating, editing and assembling machine parts.

CO4 Translate design intent into manufacturing-ready drawings

Unit	Content
I	**Introduction to Machine Drawing Standards and Practices:** Drawing conventions: Types of lines, dimensioning styles, material representation, welding symbols, surface roughness, heat treatment symbols, limits, fits and tolerances, hole basis & shaft basis systems. Orthographic projections: Conversion of pictorial view of machine parts. Sectional views: Full, half, offset sections of machine parts.
II	**Assembly and Part Drawing (Manual):** Parts and assembly drawing concepts of standard machine elements- Shafts, keys, couplings, bearings, pulleys, brackets etc. Exploded views and bill of materials (BOM).
III	**Computer-Aided Drafting (2D & 3D Modelling):** Introduction to CAD interface: Coordinates, drawing tools, modification tools. 2D Drafting - Line, circle, arc, trim, offset, dimensioning etc. 3D Modelling basics- Extrude, revolve, sweep, loft, fillet, chamfer etc. Orthographic projection from 3D models.
IV	**Assembly Modelling and Drafting (CAD-Based):** Parametric modelling techniques and constraints. Assembling components using mating features. Generation of assembly drawings, BOM, and exploded views. Printing layouts and drawing annotations.

Lab Activities: A minimum of eight sheets should be prepared, using both manual drafting and CAD, from the topics listed below.

Manual Drawing on full imperial size Sheets (A1)

1. Representation of drawing conventions and symbols.
2. Conversion of pictorial views of machine parts.
3. Sectional views of machine components.
4. Preparation of part drawings from assembly.
5. Assembly drawing from part drawings.

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Computer Aided Drawing

1. Introduction to a CAD software (e.g., AutoCAD, SolidWorks, CATIA, or Fusion 360)
2. Practice of 2D component drawings.
3. Generating 3D models of simple machine parts.
4. Creating isometric and exploded views.
5. Assembling standard machine elements in CAD (e.g. screw jack, stuffing box, tool post, etc.).
6. Drawing, modelling and assembling a mechanical system (e.g. screw jack clamp, vice, gear box, etc.).

Text Books:

1. Production Drawing, Narayana K. L. Kannaiah R., Venkata Reddy K., New Age Int. Pub.
2. Machine Drawing, N. D. Bhatt, Charotar Publishing House, New Delhi.
3. Fundamentals of Machine Drawing, Sadhu Singh, P. L. Sah, PHI Learning Pvt. Ltd.
4. Mastering CAD/CAM, Ibrahim Zeid**,** McGraw-Hill publication.

Reference Books

1. Engineering Drawing Practice for School & Colleges, Bureau of Indian Standards.
2. AutoCAD workbook for Engineers and Designers, Sham Tickoo.
3. IS Standards to refer, IS: 696 (Code of practice for general engineering drawing), IS: 10714 (Machine Drawing Conventions), IS: 11669 (Assembly Drawings).

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III Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STCEPMEC310

Title of Course: **Mini Project / Field Project**

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	4	4	2	--	50	--	50

Course outcomes:

After completing the course, the students will be able to;

CO1 Identify industry / Centre for training / possible mini project on Mechanical engineering system through survey / participate in community activities

CO2 Recognized the area expected to undergo training/carryout literature survey for selected mini project

CO3 Analyze literature and develop/fabricate mini project using mechanical design procedure

CO4 Prepare and present industrial training /case study /mini project/ community activities report based on work experience

Students are expected to fulfil any one of the following (A or B or C or D)

(A) Students are expected to undergo the training (before commencement of semester or during the semester as per schedule) at CIIIT centers in the Institute/ Industry/ Organization for minimum two weeks duration.

(B) Students are expected to carry a mini project (Training centers of CIIIT, Departmental laboratories/workshop in the Institute or recognized training Institutes/centers) under the guidance of concerned resource person.

(C) Students are expected to participate in any National or International technical event/ competition organized by reputed institutes or organizations to demonstrate the developed innovative machine or product.

(D) Students are expected to participate in community activities like village technology awareness camp, rain water harvesting awareness, plastic waste to product campaign, energy conservation awareness drive and green campus movement drive etc.

Student should submit training report with certificate from concerned industry/organization and deliver presentation based on the training/ project undertaken.

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Contents of Industrial Training Report:

1. Details of Industry/Organisation (Name of Industry, address, ownership, organisation structure etc.)
2. Descriptions about Layout, Departments/Sections, Operations and Processes used in the plant

Contents of Mini Project / Community activity Report:

1. Details of laboratory/Training Centre/Community activity
2. Description about Layout, Departments/Sections/activity,
3. Brief description of the equipment's / software's handled, if any
4. Brief description about hands on project undertaken
5. Steps followed to fabricate mechanism / model/ activity solution
6. Display and submission of physical/virtual prototype/model

Evaluation Guidelines for A, B, C and D are as follows:

a. Industrial Training / Project Report - 25 Marks (Maximum).
b. Presentation - 15 Marks (Maximum).
c. Viva – Voce - 10 Marks (Maximum).

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IV Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STMDMMEC401

Title of Course: **Multi-Disciplinary Minor - II (MDM)**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
2	--	--	2	2	2	5	5	40	50

The Detail Syllabus for the Multi-disciplinary Minor (MDM) course is provided separately under Multi-disciplinary Minors (MDM) Basket.

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IV Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STOEMEC402

Title of Course: Open Elective - II

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
2	--	--	2	2	2	5	5	40	50

The Detail Syllabus for the Open Elective - I course (OE) is provided separately under "Open Electives" Basket.

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IV Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STPCCMEC403

Title of Course: **Engineering Thermodynamics**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

After completing the course, the students will be able to;

CO1 Apply the concepts of thermodynamic system, control volume, thermodynamic properties, thermodynamic equilibrium, work and heat for various applications

CO2 Apply the first law of thermodynamics to the closed systems, open systems and steady flow processes.

CO3 Analyze heat engines, refrigerators and heat pumps by applying the second law of thermodynamics.

CO4 Evaluate properties of wet, dry saturated and superheated steam in the thermodynamic process for various applications.

CO5 Analyze vapor and gas power cycles

Unit	Content	Hours
I	Introduction to thermodynamics**:** simple steam power plant, internal combustion engines, domestic refrigerator, room air conditioner, fuel cells, macroscopic vs microscopic viewpoint, thermodynamic system and control volume, thermodynamic properties, processes and cycles, homogeneous and heterogeneous systems, thermodynamic equilibrium, Quasi static process, pure substance, Zeroth law of thermodynamics. Work and heat transfer, the ideal gas.	8
II	First law of thermodynamics: first law for a closed system undergoing a cycle and change of state, energy, different forms of stored energy, specific heat, enthalpy, PMM-I. Application of first law to steady flow processes: the steady flow energy equation applied to nozzles & diffusers, throttling devices, turbine & compressor, heat exchanger, comparison of S.F.E.E with Euler and Bernoulli's equations.	8
III	Second Law of Thermodynamics: Cyclic heat engine, thermal energy reservoirs, Kelvin-Plank & Clausius statements, refrigerator and heat pump, reversible & irreversible processes, Carnot cycle, Carnot Theorem, reversed heat engine, Thermodynamic temperature scale. Entropy: - The Clausius theorem, property of entropy, inequality of Clausius, entropy changes in an irreversible process, entropy principle, applications of entropy principle, entropy transfer with heat flow, entropy generation in a closed, open and steady flow systems.	8
IV	Properties of Pure Substances: P-V, T-S diagram and H - S diagram for pure substance, dryness fraction and its determination using various calorimeters.	8

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V	Vapor cycles: -Simple steam power cycle, Rankine cycle, reheat Rankine cycle Air standard cycles: -Otto, diesel and dual cycles and their comparison.	8

Text Books:

1. Engineering Thermodynamics, P.K. Nag.
2. Thermodynamics - An engineering approach, Yunus Cengal, M. A. Boles, Tata Mc-Graw Hill Publication.
3. Thermal Engineering, Mahesh Rathod, Tata Mc-Graw Hill Publication.
4. Thermal Engineering, R. K. Rajput, Laxmi Publication.
5. Fundamentals of classical Thermodynamics, Gorden J.V. Wylen, Sonntag.
6. Basic Engineering Thermodynamics, Reiner Joel.

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IV Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STPCCMEC404

Title of Course: Strength of Materials

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

After completing the course, the students will be able to;

CO1 Demonstrate fundamental knowledge about various types of loading and stresses induced

CO2 Draw the SFD and BMD for different types of loads and support conditions

CO3 Estimate the strain energy in mechanical elements and analyze the deflection in beams

CO4 Design shaft for various loading conditions

CO5 Understand theory of failure of thin cylinders

Unit	Content	Hours
I	Concept of simple stresses and strains: Introduction, stress, strain, types of stresses, stress and strain diagram for brittle & ductile material, elastic limit, Hooks law, modulus of elasticity, modulus of rigidity, factor of safety, analysis of tapered rod, analysis of composite section, thermal stress and strain. Longitudinal strain & stress, lateral stresses and strains, Poisson's ratio, volumetric stresses and strain with uni-axial, bi-axial & tri-axial loading, bulk modulus, relation between Young's modulus and modulus of rigidity, Poisson's ratio and bulk modulus. Principal stresses and Principal planes: Definition of principal planes & principal stresses, analytical method of determining stresses on oblique section when member is subjected to direct stresses in one plane in mutually perpendicular two planes, when member is subjected to shear stress and direct stresses in two mutually perpendicular planes, Mohr's circle for representation of principal stresses.	8
II	Shear force and bending moment: Types of beams (cantilever beam, simply supported beam, overhung beam etc.), types of loads (concentrated and uniformly distributed loads (UDL), shear force and bending moment diagrams for different types of beams subjected to different types of loads, sign conventions for bending moment and shear force, shear force and bending moment diagrams for beams subjected to couple. Stresses in beams: Pure bending, theory of simple bending with assumptions & expressions for bending stress, derivation of bending equation, bending stresses in symmetrical sections, section modulus for various shapes of beam sections.	8

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	Shear stresses in beams: Concept and derivation of shear stress distribution formula, shear stress distribution diagram for common symmetrical sections, maximum and average shear stress.	
III	Slope & Deflection of beams: Deflection & slope of Cantilever, simply supported and Overhung beams subjected to concentrated load, UDL using double integration method and Macaulay's method, Relation between slope, deflection & radius o f curvature. Strain energy & Impact loading: - Definition of strain energy stored in a body when it is subjected to gradually applied load, suddenly applied loads & impact loads. Strain energy stored in bending & torsion.	8
IV	Torsion of circular shafts: Derivation of torsion equation with the assumptions, Strength and rigidity criterion for design of shaft, Torque transmitted by solid & hollow circular shaft, Equivalent twisting and bending moment in shaft when it is subjected to bending moment, torque & axial load.	8
V	Thin cylinder and spherical shells: Longitudinal stresses and circumferential or Hoop's stresses, Failure of thin cylinder shell due to an internal pressure, Design of thin cylinder shell, Deformation in thick and thin cylinders.	8

Text Books:

1. Strength of Materials, S. Ramamrutham and R. Narayanan, Dhanpat Rai Publishing
2. Strength of Materials, R. K. Bansal, Laxmi Publications, New Delhi.
3. Strength of Materials, S. S. Rattan, Mcgraw Hill Education.

Reference Books:

1. Mechanics of Materials, Beer, Johnston, Dewolf and Mazurek, Tata McGraw- Hill
2. Elements of Strength of Materials by Timoshenko, S. P. and Young, D.H., East West Press,

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IV Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STPCCMEC405

Title of Course: **Manufacturing Processes**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

After completing the course, the students will be able to;

CO1 Define different parameters associated with single point and multipoint cutting tool

CO2 Identify the different processes involved in casting and select the appropriate pattern for the work.

CO3 Recognize the rolling, forging, extrusion and drawing processes.

CO4 Identify various welding methods and defects.

CO5 Describe non-conventional machining processes.

Unit	Content	Hours
I	Theory of metal cutting: Single and multi-point cutting; orthogonal and oblique cutting, various force components, Merchant circle force diagram, mechanics of chip formation, cutting tool nomenclature, deformation zones, types of chips, tool wear and tool life, surface finish and integrity, machinability, cutting tool materials, cutting fluids.	8
II	Casting and moulding: Pattern, pattern materials, pattern making, allowances of pattern and pattern types, core prints. Moulding process: Types of moulding process, injection moulding, blow moulding. Moulding sand and its types, properties of moulding sand, meting furnaces, cupola. modernization and mechanization of foundry, gating design, aspiration effect, gating ratio, significance of directional solidification. Types of casting: sand casting, centrifugal casting, continuous casting, die casting, investment casting, shell casting, slush casting, CO_2 moulding, casting defects and its remedies.	8
III	Mechanical working of metals: Introduction, principle of hot and cold working processes, principle of rolling, hot and cold rolling, rolling parameters, types of rolling mills. Hot and cold forging processes: Direct and indirect extrusion, roll forging operation. Sheet metal operation: Spinning, formability, deep drawing operation, wire drawing operation, bending, blanking, piercing, swagging, hobbing, embossing. Introduction to press operations: Mechanical and Hydraulic presses.	8

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IV	Introduction to welding Processes: Welding, AC and DC welding, electrode classification and coding, physics of welding, brazing and soldering, types of weld joints, classification of welding processes. welding defects – causes and remedies, heat affected zones in welding. Types of welding processes: Gas welding, arc welding, electron beam welding, laser beam welding, ultrasonic welding, thermit welding, GTAW, GMAW, SMAW, resistance welding process, plasma welding.	8
V	Unconventional machining processes: Principles and process parameters, abrasive jet machining, abrasive water jet machining, ultrasonic machining, electrical discharge machining (EDM), electro-chemical machining (ECM), laser beam machining (LBM), plasma arc machining (PAM) and electron beam machining (EBM), MRR, surface finish, tool wear.	8

Text Books:

1. Elements of workshop technology, Hajra Choudhury Media Promoters and Publishers Pvt. Ltd.
2. A course in Workshop Technology-Vol-1, B.S. Raghuwanshi, Dhanpat Rai and Company
3. Production Engineering, P.C. Sharma, S. Chand
4. Manufacturing Science, Ghosh Mallik East- West Press
5. Manufacturing processes for engineering materials, Kalpakjian and Schmid, Pearson India,
6. Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, Mikell P. Groover

Reference Books:

1. Materials and Processes in Manufacturing, Degarmo, Black & Kohser.

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IV Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STEMCMEC406

Title of Course: Human Resource Management

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
2	--	--	2	2	--	30	20	--	50

After completing the course, the students will be able to;

CO1 Explain the importance of human resource (HR) management for an organization and also distinguish between personnel and HR management.

CO2 Develop a job analysis and produce a job description & job specification.

CO3 Construct selection process and justify the applicability of various techniques of training

CO4 Outline the performance appraisal process and explain the utility of various modern and traditional methods of performance appraisal

Unit	Content	Hours
I	Introduction: Nature, scope, objectives, importance and functions of Human Resource Management (HRM), Difference between Personnel Management and Human Resource Management, Roles and Qualities of HR Manager, Introduction to strategic HRM.	8
II	Job analysis and job design: Meaning, uses, process and methods of collecting data for job analysis, job description, job specifications & role analysis, Concept of job design: Factors affecting job design, techniques of job design.	8
III	Human Resources Planning (HRP): Need, importance & objectives of HRP, factors affecting HRP, Recruitment and Selection - meaning, sources and process, Induction and placement, Objectives and importance of training, training process, training need identification, types and techniques of training and development	7
IV	Performance appraisal and career planning & development: Concept, objectives, importance, methods, self-appraisal, Potential appraisals compensation management - concept and components, Job evaluation, components of salary, incentives, bonus, employee stock ownership plan (ESOP), fringe benefits	7

Text Books:

1. Human Resource Management – Text and Cases, Dr. S S. Khanka, S. Chand Publication
2. Human Resource and Personnel Management – Text and cases, K. Aswathappa, McGraw- Hill Publishing co. ltd.
3. Essentials of Human Resource Management & Industrial Relations, P. Subba Rao, Himalaya Publication
4. Human Resource Management, Seema Sanghi, Vikas Publishing
5. Human Resource Management, L. M. Prasad, Sultan Chand & Sons publisher

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IV Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STPCCMEC407

Title of Course: Strength of Materials Lab

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	25	25	50

Course outcomes:

After completing the course, the students will be able to;

CO1 Study the stress-strain behavior of materials under different loading conditions.
CO2 Analyze the effect of tensile, shearing force for real life engineering problems
CO3 Perform impact test using Izod and Charpy method for materials
CO4 Estimate the strain energy in mechanical elements and analyze the deflection in beams
CO5 Measure torsional strength, hardness of material

Lab Activities: A minimum of eight practicals should be performed from the topics listed below.

List of Practicals:

1. Study of Universal Testing Machine (UTM)
2. Tension test on UTM
3. Compression test on materials
4. Shear test on metals
5. Impact test on metals
6. Torsion test on metals
7. Deflection of beam
8. Modulus of rupture test
9. Hardness test on metals
10. Deflection of beams

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IV Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STVSECMEC408

Title of Course: Workshop Practice - III

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	1	2	3	2	--	50	50	100

Course outcomes:

After completing the course, the students will be able to;

CO1 Demonstrate basic welding techniques and safety procedures for metal joining applications.

CO2 Create patterns and understand the principles of casting process.

CO3 Operate and perform basic machining operations on milling and lathe machines.

CO4 Understand the working mechanisms of machine tools such as shaper.

CO5 Identify different parameters associated with single point and multipoint cutting tool.

Lab Activities: A minimum of eight practicals should be Performed from the topics listed below.

List of Practicals:

1. Perform a job using Lathe,
2. Perform a job using Milling
3. Perform a job using Shaper
4. Demonstration job on casting
5. Perform a job on pattern making
6. Perform a job using welding machine (Gas /Arc)
7. Study and identification of various defects like blowholes, porosity etc in a weld joint
8. Study and comparison of single point and multipoint cutting tool
9. Study and demonstration of single point cutting tool nomenclature
10. Study and demonstration of multi-axle milling machine
11. Study and demonstration of Vertical milling machine

Reference and Text Books

1. Workshop Technology (Vol. 1 & 2), Hajra Choudhury S.K. and A.K., Media Promoters
2. Elements of Workshop Technology, Raghuwanshi B.S., Dhanpat Rai & Co.
3. A Textbook of Manufacturing Technology, P.N. Rao, McGraw-Hill Education
4. Production Technology, H.M.T., Tata McGraw-Hill
5. Workshop Practice Manual, K.C. John, PHI Learning Pvt. Ltd.
6. Manufacturing Processes, J.P. Kaushish, PHI Learning Pvt. Ltd.
7. Manufacturing Science, Amitabha Ghosh and A.K. Mallik, East-West Press
8. Workshop Practice, R.K. Jain and S.C. Gupta, Khanna Publishers
9. Technology of Machine Tools, Steve F. Krar, Tata McGraw-Hill (Indian edition)
10. Fundamentals of Metal Cutting and Machine Tools – B.L. Juneja, New Age International Publishers

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IV Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STAECMEC409

Title of Course: **Modern Indian / Foreign Language**

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	1	2	3	2	--	50	--	50

Course outcomes:

After completing the course, the students will be able to;

CO1 Recognize and pronounce the German alphabet, basic greetings, and introductions, demonstrating an understanding of fundamental language structures

CO2 Form basic sentences using present tense verb conjugations, applying correct sentence structure and grammar rule

CO3 Identify and use German nouns with their corresponding articles and cases, demonstrating an understanding of grammatical concepts

CO4 Engage in basic conversations, ask and respond to questions, and demonstrate an understanding of question words and sentence formation, phrases related to everyday situations

Unit	Content
I	**Introduction to German Language and Alphabet** German alphabet and pronunciation Basic greetings and introductions (e.g., Hallo, Guten Tag, Ich heiße...) Basic phrases (e.g., Wie geht es dir?, Danke, Bitte) Numbers 1-10
II	**Basic Sentence Structure and Verb Conjugation** Basic sentence structure (e.g., Ich bin, Ich habe) Verb conjugation in present tense (e.g., sein, haben, gehen) Common verbs and their conjugations (e.g., essen, trinken, sprechen) Basic sentence formation (e.g., Ich esse ein Sandwich)
III	**Nouns, Articles, and Cases** German nouns and their genders (masculine, feminine, neuter) Definite and indefinite articles (e.g., der, die, das, ein, eine) Nominative and accusative cases Basic sentence formation with articles and cases
IV	Basic conversations (e.g., asking for directions, ordering food) Question words (e.g., Wer?, Was?, Wo?, Wann?) Basic question formation (e.g., Wie heißt du?, Woher kommst du?)

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	Responding to basic questions Vocabulary related to everyday situations (e.g., family, food, transportation) Basic phrases for shopping, eating out, and traveling Using phrases like "Ich möchte..." and "Ich brauche..." Basic writing and reading comprehension exercises

Lab activities;
Based on the above, students are required to appear for internal written examinations or quizzes, oral examinations or role plays. Additionally, they must submit at least one assignment for each unit. The assessment and evaluation will be carried out as follows.

Written exams or quizzes (20 marks)
Oral exams or role-plays (20 marks)
Assignments or projects (10 marks)

Reference Books:

1. RAPIDEX Hindi-German language Course, Publisher: Pustak Mahal,
2. Get Ready Practice Book German Class X (part-2), Dr. Shruti Jain Parul Sharma
3. Goyal Basic German Vocabulary, Goyal Publishers
4. Goyal Collins Easy Learning German Grammar, Goyal Publishers
5. Netzwerk Neu A1: Textbook + Workbook + Glossar + Lösungen (Set Of 4 Books), Stefanie Dengler

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IV Semester B. Tech. Mechanical Engineering (NEP 2020)

Course Code: STVECMEC410

Title of Course: Human Values and Ethics

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	1	2	3	2	--	50	--	50

Course outcomes:

After completing the course, the students will be able to;

CO1 Demonstrate an understanding of basic human values and their role in shaping ethical behavior and personal well-being.

CO2 Demonstrate the ability to apply ethical principles and interpersonal skills such as empathy, trust, and respect to analyze and resolve real-life dilemmas in personal and social contexts through case studies and role plays.

CO3 Demonstrate the ability to evaluate and address real-life professional dilemmas using ethical frameworks through the analysis of case studies and participation in role plays.

CO4 Exhibit a sense of environmental responsibility and understand the importance of sustainable living for global peace and harmony.

Unit	Content	Hours
I	**Introduction to Human Values** **Tutorial:** Concept of values, value education, and need for value-based life. **Practical:** Group discussion on value conflicts; Case study on ethical dilemmas	
II	**Harmony in the Self, Family and Society:** **Tutorial:** Understanding self, needs, and happiness; Relationship and trust in the family and Humanistic society. **Practical:** Role-play on trust and respect in relationships; Reflective journal writing. Group debate on social ethics and justice; Local community interaction or survey.	
III	**Ethics in Professional Life:** **Tutorial:** Integrity, work ethics, professional responsibility. **Practical:** Case study analysis of ethical issues in professional environments.	
IV	**Environmental Ethics and Global Peace:** **Tutorial:** Environmental responsibility, sustainable development, peace and harmony. **Practical:** Field activity on local environmental issues; Poster presentation or awareness campaign	

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Reference Books:

1. R.R. Gaur, R. Sangal & G.P. Bagaria, A Foundation Course in Human Values and Professional Ethics, Excel Books, 2010.
2. Govindarajan M., Natarajan S., Senthil Kumar V. S., Professional Ethics and Human Values, PHI.
3. Bhatia, R. (2011), Values and Ethics in Business and Profession, PHI.

Online Reference:

1. https://www.uhv.org.in/uhve
2. https://fdp-si.aicte-india.org/UHVII.php

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Two-year UG Diploma in Engineering/Technology

Exit Course after Second Year of B.Tech. Mechanical Engineering

Course Code: STEXMEC421

Title of Course: **Mechatronics and Internet of Things**

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	2	12	14	8	--	100	100	200

Course Description: This course introduces basic concepts of Mechatronics and Internet of Things (IoT). Students will learn about mechanical and electronic components, sensors, microcontrollers, and how they are used in smart systems like automation and robotics.

Course outcomes:

After completing the course, the students will be able to;

CO1 Identify key mechanical, electronic components and explain their working.
CO2 Interface basic sensors and actuators with microcontrollers.
CO3 Develop basic Arduino codes to control and monitor devices.
CO4 Connect sensors to cloud/mobile apps using IoT concepts.
CO5 Build a mini project using Mechatronics + IoT integration.

Unit	Content	Hours
I	Basics of Mechatronics, Introduction to Mechatronics, Definition, importance, and real-life applications (washing machine, ATM, car automation). Mechanical Components: Gears, cams, levers, linkages, pulleys Sensors and Actuators Sensors: LDR (light), IR sensor, Ultrasonic (distance), Temperature sensor (LM35/DHT11). Actuators: DC motor, Servo motor, Relay, Buzzer, Solenoid. Control Systems: Open-loop vs closed-loop systems with simple examples like fan with thermostat or automatic streetlight. Feedback Concept: Basic idea of sensor feedback and system correction.	8
II	Microcontrollers: Introduction, Definition, Difference between microprocessor and microcontroller, Arduino Uno Board, Pin diagram, power supply, digital vs analog pins, coding software (Arduino IDE). Basic Arduino Programming: Blink LED, Push button switch, Delay and loop functions Interfacing Sensors and Actuators IR sensor to detect obstacle: LDR to measure light, Relay to control a fan/bulb, Servo to rotate door or camera, Troubleshooting Basics, Common wiring and coding errors and how to fix them.	8

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III	Introduction to IoT: Definition, daily applications: Smart home, smart irrigation, health monitoring. IoT Architecture, Basic concept: Wi-Fi Enabled Microcontrollers Node MCU / ESP8266 basics. How it differs from Arduino. IoT Platforms: Introduction of open-source cloud platform like Blynk App: To control devices via smartphone and Thing-Speak: For sending sensor data to cloud.	8
IV	Integration of Mechatronics with IoT Sensors and actuators used with microcontroller + Wi-Fi to build smart systems. Real-Time Monitoring and Control Controlling devices through mobile apps using Internet connectivity. Hands-On Examples Smart Home System: Light and fan control from mobile Automatic Irrigation System: Soil sensor + pump control IoT Fire Alert: Temperature sensor + buzzer + cloud alert Safety and Precautions: Safe voltage levels, wiring precautions, handling Wi-Fi modules properly. Fault Finding in IoT Systems: Detecting connectivity issues, serial monitor debugging, using LEDs for status.	8
V	Lab Work and Project Sensor Interfacing Experiments Connect LDR, IR sensor, and temperature sensor with Arduino. Use buzzer or LED as output indicator. Device Control Experiments DC Motor forward/reverse Servo Motor controlled by sensor Relay to turn on a fan or light IoT Integration Send data to mobile using Blynk Control fan from cloud dashboard Show temperature on graph using ThingSpeak Mini Project Ideas Smart Dustbin (IR sensor + servo) Fire Alert System (DHT + buzzer + cloud) Room Automation (Relay + mobile control) Weather Station (Display sensor data on mobile) Project Report and Presentation Document project objectives, components used, working explanation, and testing results.	8

Text Books:

1. Bradley D.A., Burd N.C., Dawson D., Loader A.J., Mechatronics: Electronics in Products and Processes, Routledge.
2. Sami S.H and Kisheen Rao G The Internet of Mechanical Things: The IoT Framework for Mechanical Engineers, CRC Press.

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Reference Books:

1. John Billingsley, Essentials of Mechatronics, Wiley.
2. David H., Gonzalo S., Patrick G., Rob B. and Jerome H., IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Pearson Education.
3. Nitin G and Sharad S, Internet of Things: Robotic and Drone Technology, CRC Press.
4. Newton C. Braga, Mechatronics for The Evil Genius, McGrawHill.
5. Bell C., Beginning Sensor Networks with Arduino and Raspberry Pi, Apress.

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Exit Course after Second Year of B.Tech. Mechanical Engineering

Course Code: STEXMEC422

Title of Course: **Advanced Manufacturing Engineering**

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	2	12	14	8	--	100	100	200

Course Description: This course provides in-depth knowledge of modern manufacturing technologies and advanced processes used in today's industrial environment. It covers the principles, techniques, and applications of non-traditional machining, additive manufacturing (3D printing), The course also explores the integration of computer-aided design and manufacturing (CAD/CAM). Emphasis is placed on process optimization, sustainability, and quality control in advanced manufacturing setups. Through lab learning and practical case studies, students will develop the competencies necessary to apply advanced manufacturing methods in solving real-world engineering problems.

Course outcomes:

After completing the course, the students will be able to;

CO1 Understand and differentiate various advanced manufacturing processes.
CO2 Explain the principles and applications of additive manufacturing.
CO3 Develop CNC programs for machining operations.
CO4 Analyze laser cutting and its applications in modern industries.
CO5 Build a mini project.

Unit	Content	Hours
I	Introduction to Advanced Manufacturing, Evolution of manufacturing processes, Conventional vs. non-conventional manufacturing, Role of computerization and automation, NC and CNC Machines, Smart Manufacturing & Industry 4.0, Pillars of Industry 4.0	8
II	Additive Manufacturing (AM) & 3D Printing, Introduction to Additive Manufacturing (AM) Principles and Process Flow of AM, Types of Additive Manufacturing Techniques: Fused Deposition Modelling (FDM), Stereolithography (SLA), Selective Laser Sintering (SLS) Materials for 3D Printing: Plastics, Metals, Composites. Applications, Advantages and limitations of AM 3D Printer Components and Setup, File Formats and Pre-processing (STL, G-code), Design considerations for 3D Printing, Case Studies of Prototypes and Functional Parts, Post-processing methods, Troubleshooting common issues	8

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III	Machines and Manufacturing, Introduction to CNC Machines, Types of CNC Machines (Turning, Milling), CNC Programming Basics: G-code and M-code, Tooling systems, Work holding and jaw setup, Process Planning and control plan, Applications and case studies in precision manufacturing.	8
IV	Laser Cutting and Advanced Machining, Fundamentals of Laser-Material Interaction, Types of Lasers used in Manufacturing, Laser CAD and Laser Cutting operations, Process parameters and their effect on quality, Comparison with other non-conventional processes (e.g. EDM, Abrasive water jet), Industrial Applications in Engraving, Sheet Metal and Electronics	8
V	Lab Work and Project Demonstration of additive manufacturing process using sample parts: Observation of various 3D printing techniques (FDM, SLA, SLS), 3D Printing Hands-On: CAD model creation using Creo, Slicing and preparing STL files for printing, Design and fabricate a small assembly, 3D print a simple mechanical component (e.g., gear, bracket) Laser Cutting Technology: Vector drawing for laser cut design., Execute a laser cutting job CNC Machine Setup, Manual G-code programming for simple turning/milling operations CNC milling or turning job Project Report and Presentation Document project objectives, components used, process parameters, working explanation, and inspecting results.	8

Textbooks:

1. Hans B. Kief, Helmut A. Roschiwal & Karsten Schwarz – CNC-Handbuch, 31st ed., Carl Hanser Verlag (München), 2020.
2. Gary Rohrbacher & Filson – Design for CNC: Furniture, Fixtures, and Casework for the ShopBot, Maker Media Inc, 2017.

Reference Books:

1. Yoram Koren, Computer control of Manufacturing Systems.
2. Joseph Pusztai and Michael Sava, Numerical Control of Machine Tools.
3. Richard Horne & Kalani Kirk Hausman, 3D Printing for Dummies.
4. Ben Redwood, Filemon Schöffer & Brian Garrett, The 3D Printing Handbook.

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Exit Course after Second Year of B.Tech. Mechanical Engineering

Course Code: STEXMEC423

Title of Course: **Digital Manufacturing**

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	2	12	14	8	--	100	100	200

Course Description: This course introduces basic concepts of Digital Manufacturing (Robotics) with Simulation software. Students will learn about Robot Operation, Robot Programming, Digital Manufacturing and Robotic Simulation.

Course outcomes:

After completing the course, the students will be able to;

CO1 Identify various types of industrial robots and perform their configuration.
CO2 Identify the robotic cell components & application tools with EOAT.
CO3 Run operations with teach pendant key functions & user interface for the teach pendant.
CO4 Identify Digital Technologies for designing, producing & optimizing processes.
CO5 Build a mini project using Robot with EOAT

Unit	Content	Hours
I	Introduction to Digital Manufacturing & Simulation Introduction to Industrial Evolution: Journey from Industry 1.0 to 4.0 with Industrial application. Emerging trends In Manufacturing: IOT - Internet of Things, SMAC (Social, Mobile, Analytics, Cloud), SMAC/IOT in PLM world, Digital Twin. Augmented Reality Virtual Reality in Manufacturing. Digital Manufacturing in Automotive Manufacturing Workflow, Perspective: Timeline of Automobile Launches, Reasons for Digital Transformation of Automotive Segment, Digital Transformation of Automotive Segment, Benefits of Digital Transformation. Introduction to Simulation: Manufacturing Simulations, Assembly process Simulation, Device Building and Kinematics, Robotics Simulation and OLP, Ergonomics Simulation, Machining Process Simulation	8
II	Robotics: introduction, industrial safe working practices and precautions, training guideline, safety signs & precaution for safety. First aid of electric and safety, use of fire extinguishers. Various types of robots, configuration of robots, work envelope concept robotics hardware. Identify the Robotic Cell Components & Application tools, safety measures and safety sensors, robot and other peripheral devices	8

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III	Robot Operations: Starting Up and Shutdown Steps, Robot model specifications & features, Programming Pendant, Coordinate systems, TCP. Robot Access System & Jogging, Co-ordinate selection, verifying coordinate Axis system, Jogging using programming pendant. Perform Robot axis movements, position variation, jogging robot with different coordinate systems, Create Box/ circle/ triangle work object.	8
IV	Robot Programming: Basic Program structure, Use of Move J(Joint)/ Move L(Linear)/ Move C(Circular)/ Move S(Spline), Servo ON/OFF process. Use of Teach mode, Play mode, Remote mode, user defined work objects. Start, end and main conditions in program structure. Motion Trajectory, Robot EOAT (End of Arm Tooling), Introduction to different types EOAT (grippers, welding torch, ultrasonic tool), pneumatic system & its connection to EOAT, Assembling of EOAT, Working with Welding Torch, Loop control instructions, Arithmetic and Logical instructions, Shift instructions, Timers. Basic programming using move commands. Programming with advance level instructions. Hands-On programming: Ultrasonic Welding: different Plastic (non-metal) joining. Gluing fixture: pouring of glue on different parts. MIG Welding: Metal parts welding. Pick & Place: use of gripper to pick & place a hot part Calculate the cycle time & reduce unwanted motions & time. PLC Input/Output signals with interlocks.	8
V	Lab Work and Project Identify Cell Components Robot with controller, PLC panels, Buzzers, Door switches Fixtures, Pedestal, Fence. Push Buttons, EOAT. Teach Pendant Working Different keys & enable switch working Servo enable ON/OFF Combination of Shift + Keys Create & Run Robot Programs Creating a New Program Add / Edit different Motion types, Instructions Run in Manual & Play mode Mini Project Ideas Soft Gripper Manufacturing & Integration (for Soft Part handling) Dissimilar Parts Joining (Plastic + Non-metal parts) Welding of metal part with Pick & Place (Foot Rest / Adjustable fixturing) 2D shapes Creations (Cutting & Gluing Applications) Project Report and Presentation Document project objectives, components used, materials selections, working explanation, and testing results.	8

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Textbooks:

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