DEPARTMENT OF TECHNOLOGY
SECOND YEAR B.TECH
Scheme of Teaching and Examination
Semester – III (Mechanical Engineering)

To be implemented from Academic Year 2017-18

Sr. No	Subject	Teaching Scheme (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credits	Scheme	Max. marks	Min. Passing	Scheme	Max. marks	Min. Passing
1.	Numerical Methods	04	01	-	05	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
2.	Electrical Technology and Computer Programming C++	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
3.	Engineering Thermodynamics	03	-	-	03	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
4.	Manufacturing Engineering. – I	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
5.	Fluid Mechanics	03	-	-	03	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	---------
6.	Engineering Thermodynamics Laboratory	-	-	02	01	------	-------	--------	IPE	50	20
						------	-------	-------	EPE	50	20
7.	Electrical Technology and Computer Programming C++	-	-	02	01	------	-------	--------	IOE	50	20
8.	Machine Drawing	01	-	02	02	------	-------	--------	EPE	50	20
9.	Fluid Mechanics Laboratory	-	-	02	01	------	-------	--------	EPE	50	20
10	Workshop Practice - I			02	01				IPE	50	20
	Total	**19**	**01**	**10**	**25**	------	**500**	--------	--------	**300**	--------

11.	Environmental Studies	2	-	-	-	Project Theory	30 70	40	--------	-------	--------
Audit Course I											
12.	Introduction to Performing Arts	2	-	-	-	Institute Level	--------	-------	--------	-------	--------

Total Credits: 25

Total Contact Hours/Week: 30 hrs

Note:

#: Minimum 40% marks must be secured in SEE to pass that head.

• Tutorials and practical shall be conducted in batches with batch strength not exceeding 18 students.

• The duration of examination for paper shall be 3 hours.

CIE – Continuous Internal Evaluation, SEE – Semester End Examination,

IPE – Internal Practical Evaluation, EPE–External Practical Examination,

IOE– Internal Oral Evaluation, EOE–External Oral Examination

DEPARTMENT OF TECHNOLOGY

SECOND YEAR B.TECH

Scheme of Teaching and Examination

Semester – IV (Mechanical Engineering)

To be implemented from Academic Year 2017-18

Sr. No	Subject	Teaching Scheme (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credits	Scheme	Max. marks	Min. Passing	Scheme	Max. marks	Min. Passing
1.	Applied Mathematics	04	01	-	05	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
2.	Mechanics of Material	04	01	-	05	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
3.	Theory of Machine – I*	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
4.	Fluid and Turbo Machinery	03	-	-	03	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
5.	Material Science and Metallurgy	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	---------
6.	Fluid and Turbo machinery Laboratory	-	-	02	01	-------	-------	--------	IPE	50	20
						-------	-------	--------	EPE	50	20
7.	Material Science and Metallurgy Laboratory	-	-	02	01	-------	-------	--------	IPE	50	20
						-------	-------	--------	EOE	50	20
8.	Workshop Practice - II	-	-	02	01	-------	-------	--------	------	------	------
						-------	-------	--------	EPE	50	20
9.	Theory of Machine – I Laboratory	-	-	02	01	----	-----	-------	EOE	50	20
	Total	**19**	**02**	**08**	**25**	-------	**500**	--------	--------	**300**	--------

10.	Environmental Studies	2	-	-	-	Project	30	40	--------	-------	--------
						Theory	70				
Audit Course II											
11.	Soft skill development	-	-	02	-----	Institute Level	-----	-------	-------	------	-------

Total Credits: 25

Total Contact Hours/Week: 29 hrs

Note: #: Minimum 40% marks must be secured in SEE to pass that head.

• Tutorials and practical shall be conducted in batches with batch strength not exceeding 18 students.

• The duration of examination for paper shall be 3 hours.

*Theory of Machine – I: The duration of this paper shall be of 4 Hours and shall include drawing velocity and acceleration problems on separate drawing sheet.

CIE – Continuous Internal Evaluation, SEE – Semester End Examination,

IPE – Internal Practical Evaluation, EPE–External Practical Examination,

IOE– Internal Oral Evaluation, EOE–External Oral Examination

Equivalence of Pre Revised and Revised Structure

Second Year B. Tech (Mechanical Engineering) Semester III

The above detailed syllabus is a revised version of the Second Year B. Tech (Mechanical Engineering) Program being conducted by the Shivaji University at the Technology Department of the University. This syllabus is to be implemented from June 2017, (Academic year 2017-18). The prime feature of this revision is the transformation of the existing curriculum into the Outcome based curriculum as specified in NBA rules and regulations.

The Equivalence for the subjects/courses of Mechanical Engineering at Second Year B. Tech. Semester III pre-revised and Revised Program under the faculty of Engineering and Technology is as follows.

Second Year B. Tech Semester III (Mechanical Engineering)

Sr. No	**Second Year B. Tech (Mechanical Engineering) Semester III Pre-revised syllabus**	**Second Year B. Tech (Mechanical Engineering) Semester III Revised syllabus**	**Remark**
1.	Credits = 25	Credits = 25	No change in credits
2.	Numerical Methods	Numerical Methods	Slight modification in the content
3.	Electrical Technology and Computer Programming C++	Electrical Technology and Computer Programming C++	Slight modification in the content
4.	Engineering Thermodynamics	Engineering Thermodynamics	Slight modification in the content
5.	Manufacturing Engineering – I	Manufacturing Engineering – I	Slight modification in the content
6.	Fluid Mechanics	Fluid Mechanics	Slight modification in the content
7.	Power Lab.	Engineering Thermodynamics Laboratory	Slight modification in the content
8.	Electrical Technology and	Electrical Technology and	Slight modification in the

	Computer Programming C++	Computer Programming C++	content
9.	Machine Drawing	Machine Drawing	Slight modification in the content
10.	Fluid Mechanics Lab	Fluid Mechanics Laboratory	Slight modification in the content
11.	Workshop Practice - I	Workshop Practice - I	Slight modification in the content
12.	Environmental Studies	Environmental Studies	Slight modification in the content
13.	Audit Course: No Audit Course at Semester III	Introduction to Performing Arts	New Audit Course Added

Audit course have not been assigned any credits. The students will be evaluated for these courses by the concerned course in charge. There will be grade conferred to the student. The grade will be based on conversion of marks obtained out of 50. (Obtaining passing grade is essential). Please refer to chart in the detail examination scheme. The chart shows the marks range and the respective grade.

Equivalence of Pre Revised and Revised Structure
Second Year B. Tech (Mechanical Engineering) Semester IV

The above detailed syllabus is a revised version of the Second Year B. Tech (Mechanical Engineering) Program being conducted by the Shivaji University at the Technology Department of the University. This syllabus is to be implemented from June 2017, (Academic year 2017-18). The prime feature of this revision is the transformation of the existing curriculum into the Outcome based curriculum as specified in NBA rules and regulations.

The Equivalence for the subjects/courses of Mechanical Engineering at Second Year B. Tech. Semester IV pre-revised and Revised Program under the faculty of Engineering and Technology is as follows.

Second Year B. Tech Semester IV (Mechanical Engineering)

Sr. No	**Second Year B. Tech (Mechanical Engineering) Semester IV Pre-revised syllabus**	**Second Year B. Tech (Mechanical Engineering) Semester IV Revised syllabus**	**Remark**
1.	Credits = 25	Credits = 25	No change in credits
2.	Applied Mathematics	Applied Mathematics	Slight modification in the content
3.	Mechanics of Material	Mechanics of Material	Slight modification in the content
4.	Theory of Machine – I (Paper duration = 3 Hrs)	Theory of Machine – I (Paper duration = 4 Hrs)	• Slight modification in the content • Paper duration changed to 4 Hours.
5.	Fluid and Turbo Machinery	Fluid and Turbo Machinery	Slight modification in the content
6.	Material Science and Metallurgy	Material Science and Metallurgy	Slight modification in the content
7.	Fluid and Turbo machinery Lab.	Fluid and Turbo machinery Laboratory	Slight modification in the content
8.	Material Science and Metallurgy Lab.	Material Science and Metallurgy Laboratory	Slight modification in the content
9.	Workshop Practice - II	Workshop Practice - II	Slight modification in the content
10.	Theory of Machine – I Lab.	Theory of Machine – I Laboratory	Slight modification in the content
11.	Environmental Studies	Environmental Studies	Slight modification in the content

12.	Introduction to Foreign Language	Introduction to Foreign Language	Moved to T. Y. B. Tech, Semester VI
13.	Soft skill development	Soft skill development	Introduced new audit course at S. Y. B. Tech. Semester IV

Audit course have not been assigned any credits. The students will be evaluated for these courses by the concerned course in charge. There will be grade conferred to the student. The grade will be based on conversion of marks obtained out of 50. (Obtaining passing grade is essential). Please refer to chart in the detail examination scheme. The chart shows the marks range and the respective grade.

DEPARTMENT OF TECHNOLOGY
THIRD YEAR B.TECH
Scheme of Teaching and Examination
Semester – V (Mechanical Engineering)

To be implemented from Academic Year 2018-19

Sr. No	Subject	Teaching Scheme (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credits	Scheme	Max. marks	Min. Passing	Scheme	Max. marks	Min. Passing
1.	Machine Design – I	03	01	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
2.	Theory of Machine – II*	03	-	-	03	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
3.	Energy Engineering	03	-	-	03	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
4.	Manufacturing Engineering. – II**	03	-	-	03	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
5.	Heat and Mass Transfer	03	-		03	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	---------
6.	Theory Of Machine – II Lab.	-	-	02	01	------ --	-------	--------	-------	--------	-------
7.	CAD – Lab - I	-	-	02	01	------ --	-------	--------	IOE	-	-
						------ --	-------	--------	EPE	50	20
8.	Workshop Practice - III	-	-	02	01	------ --	-------	--------	IOE	50	20
9.	Heat and Mass Transfer	-	-	02	01	------ --	-------	--------	IPE	50	20
						------ --	-------	--------	EPE	50	20
10.	Mini project and Seminar.	-	-	04	04	------ --	-------	--------	IOE	50	20
11.	Manufacturing Engineering - II Lab.	-	-	02	01	------ --	--------	--------	IPE	-	-
						------ --	--------	--------	EPE	50	20
	Total	**15**	**01**	**14**	**25**	------ --	**500**	--------	--------	**300**	--------
	Research Methodology (Audit Course)	01	-	02	--	------	-------	--------	-----	----	---

Total Credits: 25 Total Contact Hours/Week: 30 hrs

Note:

#: Minimum 40% marks must be secured in SEE to pass that head.

- Tutorials and practical shall be conducted in batches with batch strength not exceeding 18 students.
- Unless not specifically mentioned, the duration of examination for paper shall be 3 hours.

*- Theory of Machine – II: The duration of this paper shall be of 4 Hours and shall include drawing of Cam-Follower on separate drawing sheet.

**- Manufacturing Engineering – II: The duration of this paper shall be of 4 Hours and shall include drawing of jigs and fixture problem on separate drawing sheet.

CIE – Continuous Internal Evaluation, SEE – Semester End Examination,
IPE – Internal Practical Evaluation, EPE–External Practical Examination,
IOE– Internal Oral Evaluation, EOE–External Oral Examination

Note: There will be an industrial tour in the first week of the semester VI. This tour will cover at least two visits to reputed **Mechanical Industries**. The report of the visits during the tour is required to be submitted by the students. This particular activity is for 50 marks as an Internal Oral Evaluation (IOE) which is included in Semester VI.

DEPARTMENT OF TECHNOLOGY
THIRD YEAR B.TECH
Scheme of Teaching and Examination
Semester – VI (Mechanical Engineering)

To be implemented from Academic Year 2018-19

Sr. No	Subject	Teaching Scheme (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credits	Scheme	Max. marks	Min. Passing	Scheme	Max. marks	Min. Passing
1.	Machine Design – II	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
2.	Control Engineering	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
3.	Internal Combustion Engines	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
4.	Metrology and Quality Control	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
5.	Industrial Engineering and Management	03	-	-	03	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	---------
6.	Metrology and Quality Control	-	-	02	01	--------	-------	--------	IOE	50	10
7.	Internal Combustion Engines	-	-	02	01	--------	-------	--------	IPE	--	--
						--------	-------	--------	EPE	50	10
8.	CAM Lab.	-	-	02	01	--------	-------	--------	IOE	--	--
						--------	-------	--------	EPE	50	10
9.	Machine Design - II	-	-	02	01	--------	-------	--------	IOE	50	10
						--------	-------	--------	EOE	50	10
10.	Report and presentation of Industrial Tour	-	-	-	02	--------	-------	--------	IOE (seminar &oral)	50	10
AUDIT COURSE											
11.	Introduction to Foreign Language (Audit Course)	01	-	02	--	--------	-------	--------	-----	----	---
	Total	**19**	**--**	**08**	**25**	--------	**500**	--------	--------	**300**	--------

Total Credits: 25 Total Contact Hours/Week: 30 hrs

Note:

#: Minimum 40% marks must be secured in SEE to pass that head.

• Tutorials and practical shall be conducted in batches with batch strength not exceeding 18 students.

• Unless not specifically mentioned, the duration of examination for paper shall be 3 hours.

CIE – Continuous Internal Evaluation, SEE – Semester End Examination,
IPE – Internal Practical Evaluation, EPE–External Practical Examination,
IOE– Internal Oral Evaluation, EOE–External Oral Examination

Equivalence of Pre Revised and Revised Structure
Third Year B. Tech. (Mechanical Engineering) Semester V

The above detailed syllabus is a revised version of the Third Year B. Tech (Mechanical Engineering) Program being conducted by the Shivaji University at the Technology Department of the University. This syllabus is to be implemented from June 2018, (Academic year 2018-19). The prime feature of this revision is the transformation of the existing curriculum into the Outcome based curriculum as specified in NBA rules and regulations.

The Equivalence for the subjects/courses of Mechanical Engineering at Third Year B. Tech. Semester V pre-revised and Revised Program under the faculty of Engineering and Technology is as follows.

Third Year B. Tech. Semester V (Mechanical Engineering)

Sr. No	Third Year B. Tech. (Mechanical Engineering) Semester V Pre-revised syllabus	Third Year B. Tech. (Mechanical Engineering) Semester V Revised syllabus	Remark
1.	Credits = 25	Credits = 25	Slight modification in the content
2.	Machine Design – I	Machine Design – I	Slight modification in the content
3.	Theory of Machine – II	Theory of Machine – II	• Slight modification in the content • Paper duration changed to 4 Hours.
4.	Energy Engineering	Energy Engineering	Slight modification in the content
5.	Manufacturing Engineering – II	Manufacturing Engineering – II	• Slight modification in the content • Paper duration changed to 4 Hours.
6.	Heat and Mass Transfer	Heat and Mass Transfer	Slight modification in the content
7.	Theory Of Machine – II Lab.	Theory Of Machine – II Laboratory	Slight modification in the content
8.	CAD – Lab - I	CAD Laboratory	Change in name
9.	Workshop Practice - III	Workshop Practice - III	No change
10.	Heat and Mass Transfer	Heat and Mass Transfer	Slight modification in the content
11.	Seminar	Seminar	Slight modification in the content
12.	Manufacturing Engineering - II Lab.	Manufacturing Engineering - II Lab.	No Change
13.	Presentation and Communication Techniques (Audit Course)	Soft skill development	Shifted this audit course at S. Y. B. Tech. Semester IV
14.	Introduction to Foreign Language (Audit Course)	Introduction to Foreign Language (Audit Course)	Introduced new audit course at T. Y. B. Tech. Semester VI.

Audit course have not been assigned any credits. The students will be evaluated for these courses by the concerned course in charge. There will be grade conferred to the student. The grade will be based on conversion of marks obtained out of 50. (Obtaining passing grade is essential). Please refer to chart in the detail examination scheme. The chart shows the marks range and the respective grade.

Equivalence of Pre Revised and Revised Structure
Third Year B. Tech. (Mechanical Engineering) Semester VI

The above detailed syllabus is a revised version of the Third Year B. Tech (Mechanical Engineering) Program being conducted by the Shivaji University at the Technology Department of the University. This syllabus is to be implemented from June 2018, (Academic year 2018-19). The prime feature of this revision is the transformation of the existing curriculum into the Outcome based curriculum as specified in NBA rules and regulations.

The Equivalence for the subjects/courses of Mechanical Engineering at Third Year B. Tech. Semester VI pre-revised and Revised Program under the faculty of Engineering and Technology is as follows.

Third Year B. Tech. Semester V (Mechanical Engineering)

Sr. No	Third Year B. Tech. (Mechanical Engineering) Semester VI Pre-revised syllabus	Third Year B. Tech. (Mechanical Engineering) Semester VI Revised syllabus	Remark
1.	Credits = 25	Credits = 25	No change in credits
2.	Machine Design – II	Machine Design – II	No Change
3.	Control Engineering	Control Engineering	No Change
4.	Internal Combustion Engines	Internal Combustion Engines	Slight modification in the content
5.	Metrology and Quality Control	Metrology and Quality Control	Slight modification in the content
6.	Industrial Engineering and Management	Industrial Engineering	• Name of the subject changed • Slight modification in the content
7.	Metrology and Quality Control	Metrology and Quality Control Laboratory	Slight modification in the content
8.	Internal Combustion Engines	Internal Combustion Engines Laboratory	No Change
9.	CAM Lab.	CAM Laboratory	Slight modification in the content
10.	Machine Design - II	Machine Design – II Laboratory	Slight modification in the content
11.	Research Methodology (Audit Course)		Slight modification in the content
12.	Mini Project and Report of Industrial Tour		No Change
13.			New Audit Course Added
14.			
15.			

Audit course have not been assigned any credits. The students will be evaluated for these courses by the concerned course in charge. There will be grade conferred to the student. The grade will be based on conversion of marks obtained out of 50. (Obtaining passing grade is

essential). Please refer to chart in the detail examination scheme. The chart shows the marks range and the respective grade.

DEPARTMENT OF TECHNOLOGY
FINAL YEAR B.TECH
Scheme of Teaching and Examination
Semester – VII (Mechanical Engineering)

To be implemented from Academic Year 2019-20

Sr. No	Subject	Teaching Scheme (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credit	Scheme	Max. marks	Min. Passing	Scheme	Max. marks	Min. Passing
1.	Refrigeration and Air-conditioning	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
2.	Hydraulics and Pneumatics	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
3.	Machine Design – III	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
4.	Manufacturing Engineering III	03	-	-	03	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
5.	Elective – I	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	--------	---------
6.	Refrigeration and Air-conditioning	- -	- -	02	01	--------	-------	-------	IPE	50	20
						--------	-------	-------	EOE	50	20
7.	Manufacturing Engineering – III	- -	- -	02	01	--------	-------	-------	IOE	--------	--------
						--------	-------	-------	EOE	50	20
8.	Hydraulics and Pneumatics	- -	- -	02	01	--------	--------	--------	EPE	50	20
9.	Major Project(Phase I)*	-	-	02	03*	--------	-------	-------	IOE (Project Based Seminar)	50	20
10.	Report of Industrial Training	-	-	-	-	--------	-------	-------	IOE	50	20
	Total	**19**	**--**	**08**	**25**	--------	**500**	-------	--------	**300**	--------
11.	Human Values and Professional Ethics (Audit Course)	02	-	-	-	--------	--------	--------	--------	--------	--------

Total Credits: 25
Total Contact Hours/Week: 29 Hrs
Note:
#: Minimum 40% marks must be secured in SEE to pass that head.
* Students are expected to do self study for two hours as per the guidance given by the project guide hence contact hours to be taken as two for the calculation of contact hours.

• Tutorials and practical shall be conducted in batches with batch strength not exceeding 18 students.

•Unless not specifically mentioned, the duration of examination for paper shall be 3 hours.

CIE – Continuous Internal Evaluation, SEE – Semester End Examination,
IPE – Internal Practical Evaluation, EPE–External Practical Examination,
IOE– Internal Oral Evaluation, EOE–External Oral Examination

Elective – I:

1. Finite Element Analysis
2. Cryogenics
3. Operations Research
4. Tribology
5. Nano- Technology
6. Open Elective

Note on Electives:
A particular elective will be offered when at least 20 students opt for it.

Note on Open Elective:
In order to promote interdisciplinary study department can offer open electives to students. This elective will be offered from the electives of other branches, particularly available in Sem. VII only. Students shall attend the theory lectures as per schedule of respective branch.

DEPARTMENT OF TECHNOLOGY
FINAL YEAR B.TECH
Scheme of Teaching and Examination
Semester – VIII (Mechanical Engineering)

To be implemented from Academic Year 2019-20

Sr. No	Subject	Teaching Scheme (Hours / Week)				Examination Scheme (Marks)					
		L	T	P	Credits	Theory			Practical		
						Scheme	Max. marks	Min. Passing	Scheme	Max. marks	Min. Passing
1.	Automobile Engineering	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
2.	Total Quality Management	03	-	-	03	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
3.	Mechatronics and Robotics	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
4.	Power Plant Engineering	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
5.	Elective – II	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
6.	Automobile Engineering	-	-	02	01	--------	-------	--------	IPE	-------	-------
						--------	-------	--------	EOE	50	20
7.	Mechatronics and Robotics	-	-	02	01	--------	-------	--------	IPE	--	--
						--------	-------	--------	EOE	50	20
8.	Power Plant Engineering	- -	- -	02	01	--------	--------	--------	EOE	50	20
9.	Major Project(Phase II)*	-	-	02	03*	--------	-------	--------	IPE	50	20
						--------	-------	--------	EPE	100	40
	Total	**18**	**-**	**08**	**25**	--------	**500**	--------	--------	**300**	--------
10.	Constitution of India (Audit Course)	02	-	-	-	--------	--------	--------	--------	--------	--------

Total Credits: 25
Total Contact Hours/Week: 29 hrs
Note:
#: Minimum 40% marks must be secured in SEE to pass that head.

* Students are expected to do self study for two hours as per the guidance given by the project guide hence contact hours to be taken as two for the calculation of contact hours.

• Tutorials and practical shall be conducted in batches with batch strength not exceeding 18 students.
•Unless not specifically mentioned, the duration of examination for paper shall be 3 hours.

CIE – Continuous Internal Evaluation, SEE – Semester End Examination,
IPE – Internal Practical Evaluation, EPE–External Practical Examination,

IOE– Internal Oral Evaluation, EOE–External Oral Examination

Elective – II:

1. Computational Fluid Dynamics
2. Vibration and Noise
3. Machine Tool Design
4. Flexible Manufacturing Systems
5. Production Management
6. Open Elective

Note on Electives:
A particular elective will be offered when at least 20 students opt for it.

Note on Open Elective:
In order to promote interdisciplinary study department can offer open electives to students. This elective will be offered from the electives of other branches, particularly available in Sem. VIII only. Students shall attend the theory lectures as per schedule of respective branch.

DEPARTMENT OF TECHNOLOGY
SHIVAJI UNIVERSITY, KOLHAPUR

STRUCTURE AND SYLLABUS
OF
SECOND YEAR B. TECH.
(MECHANICAL ENGINEERING)

TO BE EFFECTIVE FROM
ACADEMIC YEAR 2017-18

B. Tech. Programme in Mechanical Engineering

1. Program Educational Objectives (PEO)

Graduate should:

1. Demonstrate successful professional careers with strong fundamental knowledge in Science, Mathematics, English and Engineering Sciences so as to enable them to analyze the Mechanical Engineering related problems leading to leadership, entrepreneurship or pursuing higher education
2. Acquire technical knowledge in specialized areas of Mechanical Engineering such as Materials, Design, Manufacturing and Thermal Engineering with a focus on research and innovation and gaining the technical skills in advanced software packages
3. Work with multidisciplinary field of engineering and technology to enlarge the ability among the students to understand the different industrial environments.
4. Continuously learn research and develop with strong professional, moral and ethical values and with a zeal for life-long learning.

2. Program Outcomes (PO)

An engineering graduate of Mechanical Engineering Programme at Department of Technology by the time of graduation will achieve and demonstrate:

a) An ability to apply basic knowledge of science, mathematics and engineering fundamentals in the field of Mechanical Engineering.

b) An ability to identify, formulates, review research literature and analyze mechanical engineering problems using basics principles of science, mathematics and engineering.

c) An ability to design for complex mechanical engineering problems using basic design concepts, analyze and process to meet the desired needs with in realistic constraints such as manufacturability , durability, sustainability and economy with appropriate consideration for the public health, safety, cultural, societal, and environmental considerations.

d) An ability to design and conduct experiments using research-based knowledge and methods including design of experiments, analyze, interpret the data and results with valid conclusion.

e) An ability to apply the modern tools and apply appropriate techniques to synthesize, model, design, analyze, verify and optimize to solve complex mechanical engineering problems within defined specification by using suitable modern tools to satisfy the needs of the society within realistic constraints such as social, economical, political, ethical, health, safety and manufacturing.

f) An ability to understand the impact of mechanical engineering solutions globally, in terms economic, societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g) An ability to understand the principles, commitment and practice to improve product sustainable development globally in mechanical engineering with minimal environmental effect.

h) An ability to understand and apply ethical principles and commitment to address professional ethical responsibilities of an engineer.

i) An ability to function efficiently as an individual and as a group member in a team in multidisciplinary activities

j) An ability to communicate, comprehend and present effectively with engineering community and the society at large on complex engineering activities by receiving clear instructions for preparing effective reports and design documentation.

k) An ability to acquire and demonstrate the knowledge of contemporary issues related to finance and managerial skills to bring up entrepreneurs and entrepreneurship.

l) An ability to recognize and adapt to emerging field of application in engineering and technology by developing self-confidence for continuing education and lifelong learning process.

3. Programme Specific Outcomes (PSO)

The Mechanical Engineering Graduates will be

m) able to function in various domains of Mechanical Engineering related with production engineering, thermal engineering and design engineering and do the analysis and design of basic mechanical system using relevant tools and techniques for applying the knowledge of mechanical engineering for the solution of industry problem.

n) able to model, simulate, analyze and optimize mechanical systems / processes through application of softwares.

o) acquainted with the platforms, tools, research and development in mechanical engineering.

DEPARTMENT OF TECHNOLOGY
SECOND YEAR B.TECH
Scheme of Teaching and Examination
Semester – III (Mechanical Engineering)

To be implemented from Academic Year 2017-18

Sr. No	Subject	Teaching Scheme (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credits	Scheme	Max. marks	Min. Passing	Scheme	Max. marks	Min. Passing
1.	Numerical Methods	04	01	-	05	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
2.	Electrical Technology and Computer Programming C++	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
3.	Engineering Thermodynamics	03	-	-	03	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
4.	Manufacturing Engineering. – I	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
5.	Fluid Mechanics	03	-	-	03	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	---------
6.	Engineering Thermodynamics Laboratory	-	-	02	01	------	-------	--------	IPE	50	20
						------	-------	-------	EPE	50	20
7.	Electrical Technology and Computer Programming C++	-	-	02	01	------	-------	--------	IOE	50	20
8.	Machine Drawing	01	-	02	02	------	-------	--------	EPE	50	20
9.	Fluid Mechanics Laboratory	-	-	02	01	------	-------	--------	EPE	50	20
10	Workshop Practice - I			02	01				IPE	50	20
	Total	**19**	**01**	**10**	**25**	------	**500**	--------	--------	**300**	--------

11.	Environmental Studies	2	-	-	-	Project Theory	30 70	40	--------	-------	--------
Audit Course I											
12.	Introduction to Performing Arts	2	-	-	-	Institute Level	--------	-------	--------	-------	--------

Total Credits: 25

Total Contact Hours/Week: 30 hrs

Note:

#: Minimum 40% marks must be secured in SEE to pass that head.

• Tutorials and practical shall be conducted in batches with batch strength not exceeding 18 students.

• The duration of examination for paper shall be 3 hours.

CIE – Continuous Internal Evaluation, SEE – Semester End Examination,

IPE – Internal Practical Evaluation, EPE–External Practical Examination,

IOE– Internal Oral Evaluation, EOE–External Oral Examination

DEPARTMENT OF TECHNOLOGY
SECOND YEAR B.TECH
Scheme of Teaching and Examination
Semester – IV (Mechanical Engineering)
To be implemented from Academic Year 2017-18

Sr. No	Subject	Teaching Scheme (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credits	Scheme	Max. marks	Min. Passing	Scheme	Max. marks	Min. Passing
1.	Applied Mathematics	04	01	-	05	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
2.	Mechanics of Material	04	01	-	05	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
3.	Theory of Machine – I*	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
4.	Fluid and Turbo Machinery	03	-	-	03	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
5.	Material Science and Metallurgy	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	---------
6.	Fluid and Turbo machinery Laboratory	-	-	02	01	-------	-------	--------	IPE	50	20
						-------	-------	--------	EPE	50	20
7.	Material Science and Metallurgy Laboratory	-	-	02	01	-------	-------	--------	IPE	50	20
						-------	-------	--------	EOE	50	20
8.	Workshop Practice - II	-	-	02	01	-------	-------	--------	------	------	------
						-------	-------	--------	EPE	50	20
9.	Theory of Machine – I Laboratory	-	-	02	01	----	-----	-------	EOE	50	20
	Total	**19**	**02**	**08**	**25**	-------	**500**	--------	--------	**300**	--------

10.	Environmental Studies	2	-	-	-	Project	30	40	--------	-------	--------
						Theory	70				
Audit Course II											
11.	Soft skill development	-	-	02	-----	Institute Level	-----	-------	-------	------	-------

Total Credits: 25

Total Contact Hours/Week: 29 hrs

Note: #: Minimum 40% marks must be secured in SEE to pass that head.

• Tutorials and practical shall be conducted in batches with batch strength not exceeding 18 students.

• The duration of examination for paper shall be 3 hours.

*Theory of Machine – I: The duration of this paper shall be of 4 Hours and shall include drawing velocity and acceleration problems on separate drawing sheet.

CIE – Continuous Internal Evaluation, SEE – Semester End Examination,

IPE – Internal Practical Evaluation, EPE–External Practical Examination,

IOE– Internal Oral Evaluation, EOE–External Oral Examination

Detailed Evaluation and Examination Scheme

1. Out of total 100 theory marks, 50 marks are assigned for Continuous Internal Evaluation (CIE). In CIE, obtaining minimum 20 marks is essential. It is similar to term work, the completion of which is mandatory to become eligible to appear for the Semester End Examination (SEE). Failing to complete the term in a particular course i.e. not obtaining 20 marks in CIE out of 50 shall be treated as term not granted in that course and it is on the part of the course teacher to officially inform the particular case through the respective Program Coordinator and the Director to the University Examination Section. The section will take a kind note of the same and it will not issue the hall ticket of the particular students for the SEE in the particular course/s.
2. CIE (50 marks) includes :

    - Internal Test - I, of 20 marks in 5^{th} week on 1^{st} & 2^{nd} unit
    - Internal Test - II, of 20 marks in 10^{th} week on 3^{rd} & 4^{th} unit
    - Activities for the students: 10 marks. It is at the course owners' discretion to get the assignments of varied nature completed by the students. However, the course teacher will plan to cover those course objectives that suit course learning outcomes and program outcomes that may not be covered in the internal tests.

3. For the Semester End Examination (SEE), 100 marks (3 hours) paper will be set and finally it will be converted to 50 marks. The students must secure minimum 40 % i.e. 20 marks in SEE as the University examination passing head.
4. Final theory marks (out of 100) will be the addition of CIE (out of 50 marks) and SEE (out of 50 marks).
5. Internal Practical/Oral Evaluation (IPE/IOE) will be on the basis of Internal Oral/ Practical/Tutorials/Seminar in which students must secure minimum 40% i.e. 20 marks. It is similar to the term work the completion of which is mandatory to be eligible to appear for the Semester End Examination (SEE).

6. External Practical/Oral Evaluation (EPE/EOE) will be conducted under the supervision by some external course expert. The minimum score 40% i.e. 20 marks is required to be secured as the University's passing head in EPE/EOE.
7. *Semester End Examination duration will be 4 hrs.
8. Equivalence for the Course: As elaborated at the end of this whole curriculum document.

Academic Autonomy:

1. Flexibility in deciding Structure and Contents of Curriculum with reasonable frequency for changes in the same.
2. Continuous Assessment of Students performance with newly adopted - Credit System based on award of grade.
3. Credits are simply a means of attaching relative values to courses of different components. These are a currency of learning and in general regarded as a measure of the time typically required to achieve a given curricular outcome.
4. All courses (Courses) under each Program/Discipline are unitized.

Credit system:

Education at the Institute is organized around the semester-based credit system of study. The prominent features of the credit system are a process of continuous evaluation of a student's performance/progress and flexibility to allow him/her to progress at an optimum pace suited to his/her ability or convenience. Each course by every student needs to fulfill minimum requirements of credits for continuation.

A student's performance/progress is measured by the number of credits that he/she has earned, i.e. completed satisfactorily. Based on the course credits and grades obtained by the student, grade point average is calculated. A minimum grade point average is required to be maintained for satisfactory progress and continuation in the Program. Also a minimum number of earned credits and a minimum grade point average should be acquired in order to qualify for the degree. All Programs are defined by the total credit requirement and a pattern of credit distribution over courses of different categories.

Course credits assignment:

Each course, except a few special courses, has a certain number of credits assigned to it depending upon its lecture, tutorial and laboratory contact hours in a week. This weightage is also indicative of the academic expectation that includes in-class contact and self-study outside of class hours.

Lectures and Tutorials: One lecture or tutorial hour per week per semester is assigned one credit.

Practical/Laboratory: One laboratory hour per week per semester is assigned half credit.

Example: Course: Chemistry-I: 5 credits (4-0-2)

The credits indicated for this course are computed as follows:

4 hours/week lectures = 4 credits

0 hours/week tutorial = 0 credit

2 hours/week practical = 2 *x* 0.5 = 1 credit

The contact hours in this case of **5** credits course is 6 hours per week. (**4** h Lectures + **0** h Tutorial + **2** h Practical=6 hours per week.)

For each lecture or tutorial credit, the self study component is 1 hour/week and 2 hours/week. In the above example, the student is expected to devote 3 + 1 = 4 hours per week on self study for this course, in addition to class contact of 5 hours per week.

Earning credits:

At the end of every course, a letter grade is awarded in each course for which a student had registered. On obtaining a pass grade, the student accumulates the course credits as earned credits. A student's performance is measured by the number of credits that he/she has earned and by the weighted grade point average.

The credit system enables continuous evaluation of a student's performance and allows the students to progress at an optimum pace suited to individual ability and convenience.

Features of Credit System at Shivaji University, Kolhapur:

Every course is allotted credits based on its academic importance/weightage.

1. All Courses may not have same credits.
2. There will be 23 to 28 Credits / Semester.
3. Absolute Grading System with 7 Passing Grades viz. AA, AB, BB, BC, CC, CD, DD and FF for failure.
4. Getting FF grade in 4 heads in one academic year, he/she is considered as failed.
5. Continuous Evaluation: Unit Test I i.e. T_1 [20 marks], and Unit Test II i.e. T_2 [20 marks]. Activities will be for 10 marks and the course owner/in charge will have discretion to decide the nature of activities.
6. Standardization of courses: Each course is unitized in 6 numbers. Unit Test I on units I and II while Unit Test II on units III & IV, SEE will be based on all the units of the course curriculum.

7. Unit Test I & Unit Test II will be supervised and evaluated by internal course teachers while SEE will be evaluated mostly by external and internal teachers as joint examiner ships.
8. Any request for re-test will not be entertained after internal test.
9. For both the semesters' failure courses, re-examination will be only after the even Semester End Examination. No re-examination will be conducted for odd semester courses in even semester or vice-versa.

Attendance rule:

All students must attend every lecture, tutorial and practical class. However, to account for late registration, sickness or other such conditions, the attendance requirement will be a minimum of 75 % of the classes actually held. A student with less than 75 % attendance in a course during the semester, in lectures, tutorials and practical taken together (as applicable), will be awarded the 'F' grade in that course irrespective of his/her performance in the tests.

Taking into account the consolidated attendance record for the whole semester, the course in charge in consultation with the Program Coordinator will award 'XX' grade to the student who is deficient in attendance. For the purpose of attendance calculation, every scheduled practical class will be counted as one unit irrespective of the number of contact hours.

Attendance record will be maintained based upon roll calls (or any equivalent operation) in every scheduled lecture, tutorial and practical class. The course owner will maintain and consolidate attendance record for the course (lectures, tutorials and practical together, as applicable).

Evaluation system:

1. Semester Grade Point Average (SGPA) =

$$\frac{\sum (\text{course credits in passed courses X earned grade points})}{\sum (\text{Course credits in registered courses})}$$

2. Cumulative Grade Point Average (CGPA) =

$$\frac{\sum (\text{course credits in passed courses X earned grade points) of all Semesters}}{\sum (\text{Course credits in registered courses) of all Semesters}}$$

3. At the end of B. Tech Program, student will be placed in any one of the divisions as detailed below:

   Ist Division with distinction: CGPA $\geq$ 8.25 and above

Ist Division : CGPA $\geq$ 6.75 and < 8.25

IInd Division : CGPA $\geq$ 6.25 and < 6.75

As per AICTE Handbook (2011-12), gradation is as follows:

Grade Points	Equivalent Percentage Range
6.25	55
6.75	60
7.25	65
7.75	70
8.25	75

Conversion of CGPA to corresponding equivalent percentage marks for CGPA>5.0 may be obtained using the following equation:

Equivalent Percentage marks = (Respective CGPA x 10) – 7.5

An example of these calculations is given below:

Typical academic performance calculations - I semester

Course no.	**Course credits**	**Grade awarded**	**Earned credits**	**Grade points**	**Points Secured**
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6 (Col 4* Col 5)
MALXXX	5	CC	5	6	30
CSLXXX	4	CD	4	5	20
PHLXXX	4	AA	4	10	40
PHPXXX	2	BB	2	8	16
MELXXX	4	FF	0	0	0
TTNXXX	2	AB	2	9	18
Total	21		17	38	124

1. Semester Grade Point Average (SGPA) =

$$\frac{(124)}{(21)} = 5.90$$

2. Cumulative Grade Point Average (CGPA) =

Cumulative points earned in all passed courses = 124 (past semesters) + 124 (this sem.) = 248 Cumulative earned credits = 23 (past semesters) + 21 (this sem.) = 44

$$\frac{\sum (124 + 124)}{\sum (23 + 21)} = 5.63$$

Chart for marks range and its corresponding grade and grade points

Marks Range	Grade Points	Grade	Description of Performance
91-100	10	AA	Outstanding
86-90	09	AB	Excellent
76-85	08	BB	Very Good
66-75	07	BC	Good
56-65	06	CC	Fair
46-55	05	CD	Average
40-45	04	DD	Poor
Below 40	00	FF	Fail
--	--	$	Passed in first attempt
--	--	PP	Passed (Audit Course)
--	--	NP	Not Passed (Audit Course)
--	--	** 2^{nd} *** 3^{rd} **** 4^{th}	One grade punishment for 2^{nd} ,3^{rd}, 4^{th}, …attempt,

Audit Courses:

Additional courses shall be included as audit courses from the third semester onwards. While the performance of the student in audited courses shall be included in the Grade Card, these grades do not contribute to SGPA or CGPA of the concerned student.

Award of Degree:

Following rules prevail for the award of degree:

1. A Student has registered and passed all the prescribed courses under the general institutional and departmental requirements.

2. A student has obtained CGPA≥ 4.5.

3. A student has paid all the institute dues and satisfied all the requirements prescribed.

4. A student has no case of indiscipline pending against him/her.

5. Institute authorities shall recommend the award of B.Tech degree to a student who is declared to be eligible and qualified for above norms.

CGPA Improvement Policy for award of degree:

An opportunity shall be given to a student who has earned all the credits required by the respective program with CGPA greater than or equal to 4.00 but less than 4.50, to improve his/her grade by allowing him/her to appear for 100% examinations of maximum two theory courses of seventh and eighth semester. However, CGPA shall be limited to 4.5 even though the performance of a student as calculated through modified CGPA becomes greater than 4.5.

Equivalence of Pre Revised and Revised Structure
Second Year B. Tech (Mechanical Engineering) Semester III

The above detailed syllabus is a revised version of the Second Year B. Tech (Mechanical Engineering) Program being conducted by the Shivaji University at the Technology Department of the University. This syllabus is to be implemented from June 2017, (Academic year 2017-18). The prime feature of this revision is the transformation of the existing curriculum into the Outcome based curriculum as specified in NBA rules and regulations.

The Equivalence for the subjects/courses of Mechanical Engineering at Second Year B. Tech. Semester III pre-revised and Revised Program under the faculty of Engineering and Technology is as follows.

Second Year B. Tech Semester III (Mechanical Engineering)

Sr. No	Second Year B. Tech (Mechanical Engineering) Semester III Pre-revised syllabus	Second Year B. Tech (Mechanical Engineering) Semester III Revised syllabus	Remark
1.	Credits = 25	Credits = 25	No change in credits
2.	Numerical Methods	Numerical Methods	Slight modification in the content
3.	Electrical Technology and Computer Programming C++	Electrical Technology and Computer Programming C++	Slight modification in the content
4.	Engineering Thermodynamics	Engineering Thermodynamics	Slight modification in the content
5.	Manufacturing Engineering – I	Manufacturing Engineering – I	Slight modification in the content
6.	Fluid Mechanics	Fluid Mechanics	Slight modification in the content
7.	Power Lab.	Engineering Thermodynamics	Slight modification in the

		Laboratory	content
8.	Electrical Technology and Computer Programming C++	Electrical Technology and Computer Programming C++	Slight modification in the content
9.	Machine Drawing	Machine Drawing	Slight modification in the content
10.	Fluid Mechanics Lab	Fluid Mechanics Laboratory	Slight modification in the content
11.	Workshop Practice – I	Workshop Practice - I	Slight modification in the content
12.	Environmental Studies	Environmental Studies	Slight modification in the content
13.	Audit Course: No Audit Course at Semester III	Introduction to Performing Arts	New Audit Course Added

Audit course have not been assigned any credits. The students will be evaluated for these courses by the concerned course in charge. There will be grade conferred to the student. The grade will be based on conversion of marks obtained out of 50. (Obtaining passing grade is essential). Please refer to chart in the detail examination scheme. The chart shows the marks range and the respective grade.

Equivalence of Pre Revised and Revised Structure
Second Year B. Tech (Mechanical Engineering) Semester IV

The above detailed syllabus is a revised version of the Second Year B. Tech (Mechanical Engineering) Program being conducted by the Shivaji University at the Technology Department of the University. This syllabus is to be implemented from June 2017, (Academic year 2017-18). The prime feature of this revision is the transformation of the existing curriculum into the Outcome based curriculum as specified in NBA rules and regulations.

The Equivalence for the subjects/courses of Mechanical Engineering at Second Year B. Tech. Semester IV pre-revised and Revised Program under the faculty of Engineering and Technology is as follows.

Second Year B. Tech Semester IV (Mechanical Engineering)

Sr. No	Second Year B. Tech (Mechanical Engineering) Semester IV Pre-revised syllabus	Second Year B. Tech (Mechanical Engineering) Semester IV Revised syllabus	Remark
1.	Credits = 25	Credits = 25	No change in credits
2.	Applied Mathematics	Applied Mathematics	Slight modification in the content
3.	Mechanics of Material	Mechanics of Material	Slight modification in the content
4.	Theory of Machine – I (Paper duration = 3 Hrs)	Theory of Machine – I (Paper duration = 4 Hrs)	• Slight modification in the content • Paper duration changed to 4 Hours.
5.	Fluid and Turbo Machinery	Fluid and Turbo Machinery	Slight modification in the content
6.	Material Science and Metallurgy	Material Science and Metallurgy	Slight modification in the content
7.	Fluid and Turbo machinery Lab.	Fluid and Turbo machinery Laboratory	Slight modification in the content
8.	Material Science and Metallurgy Lab.	Material Science and Metallurgy Laboratory	Slight modification in the content
9.	Workshop Practice - II	Workshop Practice - II	Slight modification in the

			content
10.	Theory of Machine – I Lab.	Theory of Machine – I Laboratory	Slight modification in the content
11.	Environmental Studies	Environmental Studies	Slight modification in the content
12.	Introduction to Foreign Language	Introduction to Foreign Language	Moved to T. Y. B. Tech, Semester VI
13.	Soft skill development	Soft skill development	Introduced new audit course at S. Y. B. Tech. Semester IV

Audit course have not been assigned any credits. The students will be evaluated for these courses by the concerned course in charge. There will be grade conferred to the student. The grade will be based on conversion of marks obtained out of 50. (Obtaining passing grade is essential). Please refer to chart in the detail examination scheme. The chart shows the marks range and the respective grade.

Class & Semester	:	**S. Y. B. Tech. (Mechanical Engineering) Part II, Semester III**				
Course Title	:	**NUMERICAL METHODS**		*Course Code*:	:	**ME211**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks = 52 hours minimum Tutorial= 01 hour/week Practical= -- hours/week**		*Total Credits*	:	**04+01 =05**
Evaluation Scheme (Marks)	:	**CIE = 50 SEE = 50**	**IPE=Nil : IOE=Nil : EPE= Nil : EOE = Nil**	**Grand Total=100**	*Duration of SEE*	: **3 hours**
Revision:	:	**First**			*Month*	: **May 2017**

Pre-requisites **:** Engineering Mathematics-I and Engineering Mathematics-II

Type of Course **:** Theory

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate
Affective : Awareness, Respond, Value, Organize
Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination (SEE)

Course Objectives:

1. To introduce various numerical methods for solving algebraic and transcendental equations.
2. To introduce numerical methods for solving partial differential equations.
3. To introduce numerical methods for evaluation of derivatives and definite integrals.
4. To study fundamental tools of statistics

Course Outcomes:

At the end of this course, student will be able to

1. To understand need of numerical methods in mechanical engineering
2. Apply numerical methods for solving problems in different areas of engineering.
3. Deploy skills effectively in the numerical solutions of problem, principally in the area of mechanical engineering.
4. Apply interpolation and approximation for mechanical engineering problems.
5. Use of statistics in Mechanical Engineering.

Curriculum Content	Hours
Unit I: Numerical solution of algebraic and transcendental equations Bisection Method, iterative methods, False Position Method, Rate of convergence, Muller's Method, Newton-Raphson method for solution of system of non-linear Equations, Secant Method.	**08**
Unit II: Numerical solution of partial differential equations Elliptical Equations- Laplace's equation Liebmann's Method, Secondary Variables, Boundary condition. Parabolic Equations- Heat equation, Explicit Method, Implicit Method, Crank Nicolson Method. Hyperbolic equations- Wave equation, Explicit Method.	**08**
Unit III: Interpolation and Approximation Lagrange's interpolation formula, forward and backward difference interpolation formula, Newton's divided difference interpolation formula, Hermite interpolation formula, Cubic Spline interpolation.	**09**
Unit IV: Numerical differentiation and Integration Numerical differentiation, methods based on interpolation, numerical integration, Error analysis, methods based on interpolation, Newton cotes methods, Error estimates for trapezoidal and Simpson's rule.	**08**
Unit V: Statistics Mean and standard deviation. Probability**,** addition and multiplication laws of probabilities. Random variable, Probability mass function and probability density function, Binomial, Poisson and Normal distributions.	**09**
Unit VI: Mathematical Programming	**10**

Linear Optimization problems, Standard and Canonical forms, Basic solutions and feasible solutions, Optimal solutions by simplex method, Artificial Variables, Big M-method, Dual simplex method.

Suggested list of Tutorials/Assignments-

1. Solution of algebraic and transcendental equations.
2. Solution of Wave equation, Heat Equation and Laplace Equation
3. Interpolation
4. Approximation
5. Numerical differentiation
6. Numerical Integration
7. Statistical Distributions
8. Simplex method
9. Big M-method

General Instructions:

1. Batch wise tutorials are to be conducted. The number of students per batch should be as per the practical batches.
2. Students must be encouraged to solve engineering mathematics problems using different software's in tutorial class only.
3. Each Student has to write at least 6 assignments on entire syllabus.

Text Books

1. Numerical methods for scientific and Engineering Computation, M. K. Jain, S. R. K. Iyengar, R. K. Jain, New Age International Limited Publishers.
2. Fundamental of Statistics by S. C. Gupta.

Reference Books

1. A text book of Applied Mathematics: Vol. I, II and III, Wartikar J. N. & Wartikar P. N. , Vidyarthi *Griha Prakashan, Pune*
2. Numerical methods for scientific and Engineering Computation, M. K. Jain, S. R. K. Iyengar, R. K. Jain, New Age International Limited Publishers.
3. Numerical method for Engineers - S.C. Chapra, R.P. Canale (Tata McGraw Hill Publications)
4. Numerical Methods – Dr. B.S. Grewal (Khanna Publications)
5. Numerical methods – E Balguruswamy (Tata McGraw Hill Publications)
6. Numerical Heat transfer and Fluid flow - S.U. Patankar (McGraw Hill Publications)
7. Introductory Methods of Numerical Analysis- S.S.Sastry (Prentice Hall Publication)
8. Fundamental of Statistics by S. C. Gupta.
9. Operations Research by S. D. Sharma

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO-1	✓	✓	✓		✓				✓		✓	✓	✓		✓
CO-2	✓	✓	✓		✓				✓		✓	✓	✓		
CO-3	✓	✓	✓		✓				✓		✓	✓	✓		
CO-4			✓	✓		✓	✓					✓	✓	✓	✓

Assessment Pattern

Knowledge Level	UT-1	UT-2	ESE
1. Remember	05	--	10
2. Understand	05	05	10
3. Apply	10	10	40
4. Analyze	05	05	20
5. Evaluate	--	05	10
6. Create	--		10
Total	**25**	**25**	**100**

Class and Semester	:	**S. Y. B. Tech. (Mechanical Engineering) Part II, Semester III**			
Course Title	:	**ELECTRICAL TECHNOLOGY AND COMPUTER PROGRAMMING C++**	*Course Code*:	:	**ME212**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks = 52 hours minimum Tutorial= -- hour/week Practical= 02 hours/week**	*Total Credits*	:	**04+01 =05**
Evaluation Scheme (Marks)	:	**CIE = 50 SEE = 50** : **IPE=Nil IOE=50 EPE= Nil EOE = Nil** : **Grand Total=100**	*Duration of SEE*	:	**3 hours**
Revision:	:	**First**	*Month*	:	**May 2017**

Pre-requisites **:** In order to complete the course studies successfully, it is important to have a good command of English. Other Pre-requisites include engineering physics and basic electrical engineering.

Type of Course **:** Theory

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate
Affective : Awareness, Respond, Value, Organize
Psychomotor: Imitation, manipulation, articulation, naturalization

$ Practicals to be conducted alternate weeks. For Electrical Technology And computer Programming C++ Term work assessment consist of 25 marks for each Electrical Technology And computer Programming C++ separately. And combined marks out of 50 obtained by each student should be forwarded to Shivaji University, Kolhapur

* Question paper should consist of Two sections of 50 marks each for Electrical Technology And computer Programming C++ And A separate answer book must be supplied for theory Examination for each section Electrical Technology And computer Programming C++

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I and Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination (SEE)

Course Objectives:

1. To study speed control methods and starters for DC and AC machine
2. To Study of different power factor correction techniques with their practical importance
3. To introduce the concept of object oriented programming, various elements used and their application in program development
4. To learn and apply concepts of inheritance and overloading with application in program development

Course Outcomes:

At the end of course, student will able

1. To explain different types of electrical motors, their classification and control
2. To measure power factor and correct the power factor
3. To explain the concept of object oriented programming with the use of various elements
4. To write and execute the programs for variety of cases using the concepts of elements, inheritance and overloading.

Curriculum Content	Hours
ELECTRICAL TECHNOLOGY:	
Unit I: DC Machine	
DC Generator: Construction features, emf equation of dc generator, methods of excitation, losses condition for maximum efficiency, armature reaction, commutation, methods of improving commutation, characteristics of separately excited and self excited dc generator.	**10**
DC Motor: Working principle, voltage equation, condition for maximum power, characteristics, operating characteristics of dc motor, torque developed, starting, speed control methods, swinburn's and break test of dc shunt motor.	
Unit II : AC Machine and Electrical Drives	**07**
Induction Motor – Three Phase Induction Motors Rotating magnetic field, construction and principle of operation, slip, rotor frequency, development of equivalent circuit, torque equation, maximum torque, torque – speed characteristics, speed control. Starting methods, motor ratings.	

Induction motor as generalized transformer (Numerical treatment).

Electric Drives - Comparison between Group drive and Individual drive. Selection of motors for lathe, milling machine, planning machine, shaping machine, rolling mills, traction, conveyors and lifts, CNC machines etc.

Unit III: **07**

Power factor Measurement and correction

Significance of power factor Causes of low power factor, Disadvantages of low power factor, power factor correction methods.

(Note: The chapter includes numerical treatment on the appropriate topics.)

Electrical Measuring Instruments and electrical Heating

Principle construction and application of PMMC, Electronic energy meter, Types of electric heating- Introduction, resistance ovens, and High frequency eddy current heating.

COMPUTER PROGRAMMING USING C++:

Unit IV: **10**

Object-Oriented programming: Introduction, Basic concepts, Benefits, object oriented languages, Applications. Classes and Objects: Introduction, structures and classes, Declaration of class, Member functions; defining the object of a class; accessing a member of a class; Array of class objects. Use of Pointers with Arrays and Function.

Unit V: **07**

Inheritance: Introduction, single inheritance; Types of base classes: Direct, Indirect; Types of derivation: Public, Private, Protected.

Unit VI: **07**

Overloading: Function overloading with various data types, arguments; operator overloading: assignment operator; arithmetic and comparison operators. Polymorphism: Virtual functions; Abstract Base Classes, Constructor under Inheritance, Destructor under inheritance.

Text Books

1. Object Oriented Programming, E. Balguruswami, Tata McGraw Hill Publication.
2. Let us C++ ,Yashwant Kanitkar ,BPB Publication.
3. C++ Programming,Alstevanswiely India,7 th Edition. 4
4. Object oriented Programming with C++, Sourav Sahay, Oxford University Press.
5. Object-Oriented Programming in C++, Rajesh K Shukla, Wiley India

Reference Books

1. Object Oriented Programming - E. Balguruswami (Tata McGraw hill Publication)
2. Let us C++ - Yashwant Kanitkar (BPB Publication).
3. C++ Programming 7ed Alstevans wiely India
4. C++/CLI Sivkumar wiely India
5. Professional C++ Solter Wiely India

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO-1	✓				✓				✓			✓	✓		✓
CO-2	✓	✓	✓		✓				✓			✓			
CO-3	✓			✓	✓				✓			✓	✓	✓	✓
CO-4	✓			✓	✓				✓			✓		✓	

Assessment Pattern

Knowledge Level	UT-1	UT-2	ESE
1. Remember	5	--	10
2. Understand	5	5	10
3. Apply	7	7	40
4. Analyze	8	8	20
5. Evaluate	--	5	10
6. Create	--	--	10
Total	**25**	**25**	**100**

Class and Semester	:	**S. Y. B. Tech. (Mechanical Engineering) Part II, Semester III**				
Course Title	:	**ENGINEERING THERMODYNAMICS**			*Course Code*:	: **ME213**
Teaching Scheme (Hours)	:	**Lectures 3 hours/weeks=3 x 13 weeks = 39 hours minimum** **Tutorial= -- hour/week** **Practical= 02 hours/week**			*Total Credits*	: **03+01 =04**
Evaluation Scheme (Marks)	:	**CIE = 50** **SEE = 50**	**IPE=50** : **IOE=Nil** : **EPE= 50** : **EOE = Nil**	**Grand Total=100**	*Duration of SEE*	: **3 hours**
Revision:	:	**First**			*Month*	: **May 2017**

Pre-requisites **:** In order to complete the course studies successfully, it is important to have a good command of English. Other Pre-requisites include engineering physics and basic mechanical engineering.

Type of Course **:** Theory

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate
Affective : Awareness, Respond, Value, Organize
Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I and Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination (SEE)

Course Objectives:

1. To state the First and Second Laws of Thermodynamics to understand the factors affecting the

efficiency of thermal system.

2. To explain the thermodynamic properties of pure substances using tables, charts, and ideal gas law and apply them to thermodynamic analysis of a system
3. To learn fundamental concepts of classical thermodynamics and how to use them for solving real-world thermal systems and engineering problems.
4. To learn various important vapour power cycles such as Rankine and Carnot cycle.

.

Course Outcomes:

At the end of this course, students will be able to

1. Conceive and relate thermodynamic problems based on their fundamental knowledge and express them in mathematical terms.
2. Analyse a thermodynamic steam cycles and understand them in the working of boilers and condensers
3. Apply knowledge of thermodynamics concepts to understand the working heat pumps, refrigerator, entropy etc.
4. Apply knowledge of thermodynamics concepts to solve numerical problems using steam tables.

Curriculum Content	Hours
Unit I: Basics concepts and First law **Fundamental Concepts and Definitions:** Introduction- Basic Concepts: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle Reversibility Quasi – static Process, Irreversible Process, Causes of Irreversibility Energy and its forms, Work and heat (sign convention), Gas laws, Ideal gas, Real gas, Law of corresponding states, Dalton's law, Amagat's law, Property of mixture of gases. **Zeroth law of thermodynamics:** Concept of Temperature and its' measurement, Temperature scales. **First law of thermodynamics:** Thermodynamic definition of work, Displacement work and flow work, , Displacement work for various non flow processes, Joules' experiment, First law analysis for closed system (non flow processes), Internal energy and enthalpy. Limitations of first law of thermodynamics, PMM-I. **(Note: The chapter includes numerical treatment on the appropriate topics.)**	**10**
Unit II: **First law of thermodynamics applied to open systems :** Steady flow systems and their analysis, Steady flow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc. **Second law of thermodynamics:** Thermal reservoirs, Energy conversion, Heat engines,	**14**

Efficiency, Reversed heat engine, Heat pump, Refrigerator, Coefficient of Performance, Kelvin Planck and Clausius statement of second law of thermodynamics, Equivalence of the two statements. Reversible and irreversible processes, Carnot cycle and Carnot engine, Carnot theorem and it's corollaries, Thermodynamic Temperature Scale, PMM-II.

(Note: The chapter includes numerical treatment on the appropriate topics.)

Unit III: Properties of Pure Substances **07**

Pure substance, Phases of pure substances, Phase change phenomenon of pure substance, Terminology of pure substances, property diagrams for phase change processes, vapor pressure and phase equilibrium, property tables, ideal gas equation of states, Properties of gas mixture: Ideal and Real gases, compressibility factor.

(Note: The chapter includes numerical treatment on the appropriate topics.)

Unit IV: Entropy **07**

Entropy-concept and its applicability, Clausius' Theorem, Clausius Inequality, Entropy : A property of system, Property diagrams , Entropy Principle, Tds Relations: Entropy change for Ideal Gas, Entropy generation in a closed and open system, The Entropy Change of Solids and Liquids, Third law of thermodynamics

(Note: The chapter includes numerical treatment on the appropriate topics.)

Unit V: Availability and Irreversibility **07**

Sources of energy, Available and unavailable energy , Availability of energy entering a system, Availability of closed system, Availability in a steady flow processes, The Second –Law Efficiency

Unit VI: Vapor power cycles **07**

Steam Power Plant, Performance parameters of Vapour Power cycle, Carnot Vapour power Cycle , Analysis of Carnot Vapour Power Cycle, Work and Heat transfer, Rankine cycle, Analysis of Rankine Cycle, Comparison of Rankine and Carnot cycle, Work done and efficiency, Regeneration, Reheating, and Co-generation

(Note: The chapter includes numerical treatment on the appropriate topics.)

Text Books

1. P.K.Nag " Basic and Applied Thermodynamics", Tata McGraw Hill
2. Rayner Joel, "Basic Engineering Thermodynamics", Addison Wesley Longman
3. Yunus A. Cengel, " Thermodynamics – An Engineering Approach", Tata McGraw Hill.
4. Engineering Thermodynamics by C.P. Arora

Reference Books

1. Hawkins G. A., "Engineering Thermodynamics" John Wiley and Sons.
2. Van Wylen, Sonntag R. E., "Fundamentals of Classical Thermodynamics", John Wiley and Sons.

3. T.D. Eastop and A. McConkey, "Applied Thermodynamics", Addison Wesley Longman
4. Lynn D. Russell, " Engineering Thermodynamics" Oxford University Press

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO-1	✓								✓			✓	✓		
CO-2		✓	✓							✓		✓			
CO-3			✓					✓		✓				✓	✓
CO-4	✓	✓	✓											✓	

Assessment Pattern

Knowledge Level	UT-1	UT-2	ESE
1. Remember	5	--	10
2. Understand	5	5	10
3. Apply	7	7	40
4. Analyze	8	8	20
5. Evaluate	--	5	10
6. Create	--	--	10
Total	**25**	**25**	**100**

Class and Semester	:	**S. Y. B. Tech. (Mechanical Engineering) Part II, Semester III**			
Course Title	:	**MANUFACTURING ENGINEERING – I**	*Course Code*:	:	**ME214**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks = 52 hours minimum Tutorial= -- hour/week Practical= -- hours/week**	*Total Credits*	:	**04+0+0 =04**
Evaluation Scheme (Marks)	:	**CIE = 50 SEE = 50 IPE=Nil IOE=Nil EPE= Nil EOE = Nil Grand Total=100**	*Duration of SEE*	:	**3 hours**
Revision:	:	**First**	*Month*	:	**May 2017**

Pre-requisites **:** In order to complete the course studies successfully, it is important to have a good command of English. Other Pre-requisites include Engineering Physics, Chemistry-I, Chemical Engineering Thermodynamics-I and Fluid Flow Operations.

Type of Course **:** Theory

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate
Affective : Awareness, Respond, Value, Organize
Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I and Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination (SEE)

Course Objectives:

1. To study fundamental methods of manufacturing with reference to hot and cold forming.
2. To study various joining methods such as welding, adhesive joining.
3. To study foundry technology fundamentals with conventional and advanced casting methods.
4. To study construction, working and applications of various machine tools.

Course Outcomes:

Student will able to

1. Distinguish between hot and cold working processes on fundamental and application part.
2. Numerically solve the problems on the welding processes.
3. Classify various casting processes and design the gating system for simple objects.
4. Summaries and correlate various machine tool for their applications for manufacturing of any component.

Curriculum Content	Hours

Unit I: Hot and cold working of metals **10**

Hot and cold working, Principles of rolling, forging, drop, press, upset, roll forging, extrusion, drawing, spinning, effect of hot working. Cold working processes**,** Cold rolling, swaging, forging, extrusion forward, backward and impact roll forming, tube drawing, wire drawing, spinning, shot penning, high energy rate forming, sheet metal working, types of presses, drives, different operations and types of dies.

(Note: The chapter includes numerical treatment on the appropriate topics.)

Unit II: Joining processes **08**

1. Introduction, classification of joining processes
2. Arc welding- Theory, SMAW, GTAW, GMAW, FCAW, Submerged arc welding, Stud welding, Resistance welding- Theory, spot and seam projection welding processes , Gas welding Friction welding, Ultrasonic welding, Thermit welding, EBW and LASER welding ***(Note: Numerical treatment on arc and resistance welding process)***
3. Use of adhesive for joining, classification of adhesives, types of adhesive and their application, surface preparation and various joints
4. Welding defects and quality control in welding

Unit III: Foundry- Pattern making, moulding and casting **12**

1. Importance of casting as manufacturing process, advantages and disadvantages of casting processes, foundry layouts and mechanization
2. Introduction to patterns, core boxes and gating systems: types of patterns, pattern

materials, pattern making allowances, core boxes, core making, core prints, components of gating system, functions and importance of runners and risers, solidification control devices: chills, ceramics bricks, progressive and directional solidification, sand properties ***(Note: Numerical treatment of gating and risering system design)***

3. Hand and machine moulding
4. Melting and pouring - melting furnaces- Cupola, fuel fired, electric arc and induction furnaces. Cleaning, finishing of casting, casting defects.
5. Advanced casting methods: Lost wax processes, shell moulding and investment casting. Permanent mould dies casting- Die-casting, low-pressure permanent mould casting, hot and cold chamber processing, centrifugal casting, semi centrifugal casting and continuous casting.

Unit IV: Lathe and drilling machine **11**

1. Working principles, types, specifications, principal parts, accessories and attachments, lathe construction. Concept of speed, feed and depth of cut, thread cutting operation.
2. Introduction to boring Machines, Capstan and Turret lathe.
3. Fundamentals of drilling processes, hoist, drill geometry, tool holder, types of drilling machines, operations performed on drilling machines, type of drill.
4. Reaming processes and reamer types.

Unit V: Milling, shaping, planning and broaching **06**

1. Fundamental aspects, cutter types and geometry, Operations performed on milling machine, dividing head method of indexing.
2. Construction, working and operations performed on shaper, planer, and broaching machines

Unit VI: Grinding **05**

1. Classification, grinding wheels, wheel marking, wheel selection, wheel mounting, wheel balancing, Grinding wheels- Abrasives, bonds and bonding processes, grit, grade and structure of wheel, types of grinding machines.
2. Honing, lapping, super finishing, buffing and burnishing processes.

(Important Note: Numerical treatment on above machine tools from Unit IV, V and VI for calculating machining time)

Text Books

1. Chapman W.A.-"Workshop Technology, Vol. II, III,and I", Edward Arnold Pub. Ltd. London
2. Hajra Chaudhary S.K.- Elements of Workshop Technology, Vol. Iand II, Media Prom and Pub, Mumbai.
3. Manufacturing Processes for Engg. Materials -S..Klpakjim, S.R. Schmid Perason Education
4. Fundamentals Of Modern Manufacturing M.P.Groover Wiley India Pvt. Ltd.

5. P L Jain, Principles of foundry technology-, Tata McGraw-Hill, New Delhi
6. P. C. Sharma., Production technology, S. Chand and Company Ltd.,

Reference Books

1. HMT Hand book- Production Technology
2. Roy A. and Linberg- "Processes and materials of manufacturing", Prentice Hall of India Delhi.
3. Campbell J.S. : Principles of manufacturing Materials and Processes, McGraw-Hill, New York.
4. Begeman-"Manufacturing processes", Asia Publishing house Bombay.
5. Haine And Rosenthal, Principles of metal casting, Tata McGraw-Hill Book Company. New Delhi.
6. ASTM Volumes on Welding, casting, forming and material selection
7. Manufacturing Processes And System 9E P. Ostwald, J. Munoz, John Wiley & Sons (asia) Pvt.Ltd
8. Little, Welding technology, Tata McGraw-Hill Book Company. New Delhi.

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO-1	✓		✓	✓	✓		✓	✓		✓	✓		✓	✓	✓
CO-2	✓	✓	✓	✓			✓				✓		✓	✓	
CO-3	✓	✓	✓		✓		✓		✓	✓	✓		✓	✓	✓
CO-4	✓		✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	

Assessment Pattern

Knowledge Level	UT-1	UT-2	ESE
1. Remember	5	--	10
2. Understand	5	5	10
3. Apply	7	7	40
4. Analyze	8	8	20
5. Evaluate	--	5	10
6. Create	--	--	10
Total	**25**	**25**	**100**

Class and Semester	:	**S. Y. B. Tech. (Mechanical Engineering) Part II, Semester III**				
Course Title	:	**FLUID MECHANICS**		*Course Code*:	:	**ME215**
Teaching Scheme (Hours)	:	**Lectures 3 hours/weeks=3 x 13 weeks = 39 hours minimum Tutorial= -- hour/week Practical= 02 hours/week**		*Total Credits*	:	**03+01 =04**
Evaluation Scheme (Marks)	:	**CIE = 50 SEE = 50**	**IPE=Nil : IOE=Nil : EPE= 50 : EOE = Nil**	**Grand Total=100**	*Duration of SEE*	: **3 hours**
Revision:	:	**First**			*Month*	: **May 2017**

Pre-requisites **:** In order to complete the course studies successfully, it is important to have a good command of English. Other Pre-requisites include Engineering Physics, Chemistry-I, Chemical Engineering Thermodynamics-I and Fluid Flow Operations.

Type of Course **:** Theory

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate
Affective : Awareness, Respond, Value, Organize
Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I and Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination (SEE)

Course Objectives:

1. To identify various properties of fluids and Pascal's Law.
2. To state and illustrate fundamentals of Fluid Statics, Kinematics and Dynamics.
3. To demonstrate Bernoulli's Equation for various applications.
4. To understand the physics of fluid flow and conversant with Internal, External flows and its applications.

Course Outcomes:

At the end of course student will able to

1. Describe the significance of properties of fluid.
2. Apply the knowledge of fluid statics, kinematics and dynamics while addressing problems of mechanical engineering.
3. Estimate the discharge through a pipe or open channel.
4. Solve the practical problems in design of channels, openings.

Curriculum Content	Hours
Unit I: Basics of Fluid Mechanics Definition of fluid, fluid properties such as viscosity, vapour pressure, compressibility, surface tension, capillarity, Mach number etc, pressure at a point in the static mass of fluid, variation of pressure, Pascal's law, pressure measurement by simple and differential manometers using manometric expression **(Note: The chapter includes numerical treatment on the appropriate topics.)**	**10**
Unit II: Fluid Static Hydrostatic forces on the plane and curved surfaces, centre of pressure, Buoyancy, centre of buoyancy, stability of floating bodies, metacentre and metacentric height, its application in shipping. **(Note: The chapter includes numerical treatment on the appropriate topics.)**	**14**
Unit III: Fluid Kinematics velocity of fluid particle, types of fluid flow, description of flow, continuity equation, Coordinate free form, acceleration of fluid particle, rotational and irrotational flow, Laplace's equation in velocity potential and Poisson's equation in stream function. **(Note: The chapter includes numerical treatment on the appropriate topics.)**	**07**
	07

Unit IV: Fluid Dynamics

Momentum equation, development of Euler's equation, Introduction to Navier-Stokes equation, Integration of Euler's equation to obtain Bernoulli's equation, Bernoulli's theorem , Application of Bernoulli's theorem such as venture meter, orifice meter, rectangular and triangular notch, pitot tube etc.

(Note: The chapter includes numerical treatment on the appropriate topics.)

07

Unit V: Flow types

a) Laminar Flow: Flow through circular pipe, between parallel plates, Power absorbed in viscous flow in bearings, loss of head due to friction in viscous flow.

b) Turbulent Flow: Reynolds's experiment, frictional loss in pipe flow, major and minor losses, HGL and TEL, flow through series and parallel pipes.

(Note: The chapter includes numerical treatment on the appropriate topics.)

07

Unit VI: Advanced topics

a) Dimensional Analysis: Dimensional homogeneity, Raleigh's method, Buckingham's theorem, Model analysis, similarity laws and dimensionless numbers.

b) Introduction to boundary layer theory and its analysis.

c) Forces on Submerged bodies: Drag and lift.

(Note: The chapter includes numerical treatment on the appropriate topics.)

Text Books

1. Dr. P.N. Modi and Dr. S.M. Seth - Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House.
2. Dr. R.K. Bansal - Fluid Mechanics and Hydraulic Machines - l, Laxmi Publication Pvt. Ltd., New Delhi.
3. Streeter, Wylie, Bedford - Fluid Mechanics, McGraw Hill Publication.

Reference Books

1. White - Fluid Mechanics, McGraw Hill Publication
2. Irving Shames - Mechanics of Fluid, McGraw Hill Publication
3. Murlidhar - Advanced Fluid Engineering, Narosa Publication.
4. G.S.Sawhney-Fundamentals of fluid mechanics, I.K. International Publishing House Pvt. Limited, New-Delhi, 2008 New York.

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO-1	✓	✓			✓										

CO-2	✓	✓	✓		✓							✓	✓		
CO-3	✓	✓	✓		✓							✓		✓	✓
CO-4	✓	✓	✓		✓						✓				✓

Assessment Pattern

Knowledge Level	**UT-1**	**UT-2**	**ESE**
1. Remember	5	--	10
2. Understand	5	5	10
3. Apply	7	7	40
4. Analyze	8	8	20
5. Evaluate	--	5	10
6. Create	--	--	10
Total	**25**	**25**	**100**

Class and Semester	:	**S. Y. B.Tech. (Mechanical Engineering), Part II, Semester III**			
Course Title	:	**ENGINEERING THERMODYNAMICS LABORATORY**	*Course Code*:	:	**ME216**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**	*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE : 50 EPE : 50** **IOE : Nil EOE : Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**First**	*Month*	:	**May 2017**

Pre-requisites **:** Laboratory work in Engineering Physics, Chemistry-I and Fluid Flow Operations.

Type of Course **:** Practical

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment, Internal Practical Examination and External Practical Examination

Course Objectives:

1. To state the First and Second Laws of Thermodynamics to understand the factors affecting the efficiency of thermal system.
2. To explain the thermodynamic properties of pure substances using tables, charts, and ideal gas law and apply them to thermodynamic analysis of a system

3. To learn fundamental concepts of classical thermodynamics and how to use them for solving real-world thermal systems and engineering problems.

Course Outcomes:

At the end of course student will able to

1. Explain the methods to increase efficiency of thermal devices and analyse its impact on environment
2. Conduct experiment, analyse output data and verify it with the theoretical concepts
3. Calculate performance parameters of steam power plant and its allied components
4. Share and compile observations as a team.

Practical List **:**

Any Eight

1) Experiment on Redwoods Viscometer
2) Determination of Aniline point
3) Determination of Cloud and Pour Point
4) Calibration of pressure gauges using dead weight pressure gauge
5) Demonstration of applications of first law of thermodynamics
6) Demonstration and Study of water tube boiler (Babcock and Wilcox boiler)
7) Demonstration and Study of boiler mountings and accessories
8) Determination of dryness fraction of steam
9) Experiment on bomb calorimeter
10) Visit to a industry/sugar factory for study of cogeneration plant
11) Demonstration on heat exchangers

Lab Manual

- Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Reference Books

1"Fundamentals of Thermodynamics", Claus Borgnakke, Sonntag R. E., John Wiley and Sons.

2. "Thermodynamics",Holman, , McGraw Hill, London.

3. "Principles of Engineering Thermodynamics", Moran,Shapiro,Boetnner, Wiley, 8th Edition.

4. "Thermodynamics: an Engineering Approach",Cengel and Boles, Tata McGraw-Hill, New Delhi ,3 rd Edition,.

5. "Applied Themodynamics", Estop Mcconkey ,Pearson Education, 5th Edition

6. "Engineering Thermodynamics" G.Rogers Yon Mayhew, Pearson Education, 4th Edition.

7. "Fundamentals of Thermodynamics", R.E.Sonntag,C. Borgnakke, V. Wylen, Wiely India Pvt.Ltd, 6th Edition

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	K	l	m	n	o
CO-1	✓	✓	✓	✓			✓	✓			✓				
CO-2	✓	✓	✓					✓	✓		✓	✓		✓	
CO-3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO-4				✓			✓		✓	✓					

Assessment Pattern

Skill Level	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Ex. 7	Ex. 8	Ex. 9	Ex. 10	Ex. 11
1. Assembling	✓	✓	✓	✓	✓			✓			
2. Testing	✓	✓	✓	✓	✓			✓			
3. Observing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4. Analyzing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5. Interpreting	✓	✓	✓	✓	✓			✓	✓		
6. Designing											
7. Creating											
8. Deducing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9. Concluding	✓	✓	✓	✓	✓	✓	✓	✓	✓		
C.A.	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**

Class and Semester	:	**S. Y. B. Tech. (Mechanical Engineering), Part II, Semester III**					
Course Title	:	**Electrical Technology and Computer Programming C++ Laboratory**			*Course Code*:	:	**ME217**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**			*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE** : **Nil** **EPE** : **Nil** **IOE** : **50** **EOE** : **Nil**			*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**First**			*Month*	:	**May 2017**

Pre-requisites **:** Laboratory work in Engineering Physics and basic electrical engineering

Type of Course **:** Practical

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment and Internal Oral Examination

Course Objectives:

1. To identify suitable motors for various industrial application.
2. To gain knowledge of electrical measuring instruments.
3. The study of programming techniques developed in pre-requisite course, including use of object-oriented programming, debugging, testing, coding standards and practices, memory management, optimization and software design principles.

4. To gain the knowledge of various programming techniques.

Course Outcomes:

At the end of course student will able to

1. Apply the significance of and application of DC machines while addressing problems of mechanical engineering.
2. Apply the knowledge of electrical measuring instruments.
3. Apply C++ features to program design and implementation
4. Apply C++ to demonstrate practical experience in developing object-oriented solutions
5. Apply common software patterns in object-oriented design and recognise their applicability to other software development contexts.

Practical List **:**

ELECTRICAL TECHNOLOGY(SECTION)

Any SIX experiments from the following;

1) Case study of any one industrial application.
2) Speed control of D. C. Shunt motor by flux control method.
3) Speed control of D. C. Shunt motor by rheostatic control method
4) Load test on D. C. Shunt motor,
5) Efficiency calculation of resistance ovens.6) Calibration of single-phase energy meter
7) Power factor correction of thee phase load using static capacitors.
8) Study of PMMC, Moving iron, Electro-dynamic instruments.

COMPUTER PROGRAMMING USING C++ (SECTION)

1) Minimum 1 program on Input/output and arithmetic expressions, hierarchy of operators, branching and loop control statements
2) Minimum 1 program on pointers with Arrays and Function.
3) Minimum 1 program on structures.
4) Minimum 2 programs on Class and Objects
5) Minimum 2 programs on Inheritance
6) Minimum 2 programs on Overloading
7) Minimum 2 programs on Polymorphism

(*Practical and Oral: Compilation and execution of any one program on OOPS concept followed by oral)

Lab Manual **:**

- Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO-1	✓				✓				✓			✓			
CO-2	✓	✓	✓		✓				✓			✓	✓		
CO-3	✓			✓	✓				✓			✓		✓	
CO-4	✓	✓		✓	✓				✓			✓		✓	✓

Assessment Pattern for ELECTRICAL TECHNOLOGY (SECTION)

Skill Level	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Ex. 7	Ex. 8
1. Assembling	✓	✓	✓		✓	✓		✓
2. Testing	✓	✓	✓		✓	✓		✓
3. Observing	✓	✓	✓	✓	✓	✓	✓	✓
4. Analyzing	✓	✓	✓	✓	✓	✓	✓	✓
5. Interpreting	✓	✓	✓	✓	✓	✓	✓	✓
6. Designing	✓	✓	✓	✓	✓	✓	✓	✓
7. Creating	✓	✓	✓	✓	✓	✓	✓	✓
8. Deducing	✓	✓	✓	✓	✓	✓	✓	✓
9. Concluding	✓	✓	✓	✓	✓	✓	✓	✓
C.A.	10	10	10	10	10	10	10	10

Assessment Pattern for COMPUTER PROGRAMMING USING C++ (SECTION)

Skill Level	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Ex. 7
1. Assembling	✓	✓	✓		✓	✓	
2. Testing	✓	✓	✓		✓	✓	
3. Observing	✓	✓	✓	✓	✓	✓	✓
4. Analyzing	✓	✓	✓	✓	✓	✓	✓
5. Interpreting	✓	✓	✓	✓	✓	✓	✓
6. Designing	✓	✓	✓	✓	✓	✓	✓
7. Creating	✓	✓	✓	✓	✓	✓	✓
8. Deducing	✓	✓	✓	✓	✓	✓	✓
9. Concluding	✓	✓	✓	✓	✓	✓	✓

C.A.	10	10	10	10	10	10	10

Class and Semester	:	**S. Y. B. Tech. (Mechanical Engineering), Part II, Semester III**			
Course Title	:	**MACHINE DRAWING**	*Course Code*:	:	**ME218**
Teaching Scheme (Hours)	:	**L – 1 hr/week = 1 x13=13 hours** **2 hr /week= 2 x13= 26 hours**	*Credits*	:	**2**
Evaluation Scheme (Marks)	:	**IPE : Nil EPE : 50** **IOE : Nil EOE : Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**First**	*Month*	:	**May 2017**

Pre-requisites **:** Laboratory work in Engineering graphics

Type of Course **:** Practical

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment and External Practical Examination

Course Objectives:

1. To describe BIS conventions used in machine drawing
2. To find the line/curve of intersection between two solids
3. To describe the function of various machine components
4. To study assembly and detail drawings

Course Outcomes:

At the end of course student will able to

1. Use BIS conventions in machine drawings

2. Find lines/curves of intersection between two intersecting surfaces (or interpenetrating solids)
3. Sketch the various machine components
4. Read and interpret the given production drawings, understand significance of assembly and detail drawings

Practical List **:**

Unit 1 Introduction to Machine Drawing:

Dimensioning Techniques, Representation of standard components such as Screw Threads, Screw fasteners, keys, couplings, bearings, pulleys, brackets, gears, locking arrangements, Rivets and riveted joints, Welding symbols. Pipe Joints :- Expansion joints, stuffing box and glands, piping layouts, conventional representation of pipe fittings, valves, joints, etc.

Unit 2 Limits, Fits and Tolerances:

ISO system of tolerance, Tolerance charts, Hole - base and shaft -base system of tolerance, Types of fits, symbols and applications. Geometric Tolerances: Introduction, Nomenclature, Rules, Symbols, values obtained from various manufacturing processes.

Unit 3 Surface Roughness and Production Drawing :

Surface Textures, Roughness values and Roughness Grades, Machining symbols Conventional Representation on part drawings. Production Drawing: Assembly and part drawings, Blue print reading, study and preparation of bill of materials.

Four sheets based on above syllabus.

1. 1 sheet on Introduction to Machine Drawing
2. 1 sheet on Limits fits and Tolerances
3. 2 sheets on Assembly and details of Mechanical parts

Lab Manual **:**

- Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO-1	✓						✓		✓						
CO-2	✓														
CO-3	✓		✓		✓	✓	✓					✓	✓		✓
CO-4	✓		✓	✓	✓				✓				✓	✓	✓

Assessment Pattern

Skill Level	**Ex. 1**	**Ex. 2**	**Ex. 3**	**Ex. 4**
1. Assembling	✓		✓	✓
2. Testing				
3. Observing	✓	✓	✓	✓
4. Analyzing		✓		✓
5. Interpreting		✓	✓	✓
6. Designing				✓
7. Creating		✓		
8. Deducing	✓	✓	✓	✓
9. Concluding	✓	✓	✓	✓
C.A.	10	10	10	10

Class and Semester	:	**S. Y. B. Tech. (Mechanical Engineering), Part II, Semester III**					
Course Title	:	**FLUID MECHANICS LABORATORY**			*Course Code*:	:	**ME219**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**			*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE : Nil EPE : 50** **IOE : Nil EOE : Nil**			*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**First**			*Month*	:	**May 2017**

Pre-requisites **:** Laboratory work in Engineering Physics, Chemistry-I and Fluid Flow Operations.

Type of Course **:** Practical

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment and External Practical Examination

Course Objectives:

At the end of course student will able

1. To measure pressure using manometers.
2. To distinguish between different types of flows.
3. To understand the calibration of notches, orifice and venturimeter.
4. To demonstrate major and minor losses.

Course Outcomes:

At the end of course student will able to

1. Work efficiently in a group, integrating skills and knowledge to make decisions in the performance of fluid mechanics tasks, adopting a responsible and organized attitude to work and a willingness to learn.
2. Apply the basic concepts of fluid mechanics to carry out professional engineering activities in the field of fluid and power plants.
3. Calibrate Venturimeter, Orificemeter and V-notch.
4. Measure pressure loss due to friction for pipe flow.

Practical List **: Any eight**

1. Determination of viscosity using redwood viscometer.
2. Study of manometers and the demonstration of the same in the laboratory.
3. Determination of metacentric height of a floating body.
4. Flow pattern development using electrical analogy method.
5. Calibration of venturimeter or orifice meter.
6. Visualization of laminar and turbulent flow in the Halleshaw apparatus.
7. Determination of friction factor for flow through pipe.
8. Verification of Bernoulli's Theorem.
9. Calibration of V- notch or rectangular notch.
10. Study of minor losses in the flow system.

Lab Manual **:**

- Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO-1				✓				✓							
CO-2	✓	✓		✓		✓					✓				
CO-3	✓	✓		✓							✓		✓	✓	
CO-4	✓	✓		✓							✓			✓	

Assessment Pattern

Skill Level	**Ex. 1**	**Ex. 2**	**Ex. 3**	**Ex. 4**	**Ex. 5**	**Ex. 6**	**Ex. 7**	**Ex. 8**	**Ex. 9**	**Ex. 10**
1. Assembling			✓							
2. Testing	✓		✓		✓	✓	✓	✓	✓	✓
3. Observing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4. Analyzing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5. Interpreting	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6. Designing										
7. Creating										
8. Deducing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9. Concluding	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C.A.	10	10	10	10	10	10	10	10	10	10

Class and Semester	:	**S. Y. B. Tech. (Mechanical Engineering), Part II, Semester III**					
Course Title	:	**Workshop Practice I**			*Course Code*:	:	**ME2110**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**			*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE** : **50** **EPE** : **Nil** **IOE** : **Nil** **EOE** : **Nil**			*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**First**			*Month*	:	**May 2017**

Pre-requisites	**:**	Laboratory work in basic mechanical Engineering, engineering graphics and work shop
Type of Course	**:**	Practical
Course Domain	**:**	Core
Skills Imbibed	**:**	Cognitive: Understand, Apply, Analyze, Evaluate, Create Affective : Awareness, Respond, Value, Organize Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment and Internal Practical Examination.

Course Objectives:

1. To discuss various metal removal processes and machine tools.
2. To develop the skills about manufacturing aspects for any project work, as well as throughout his career.
3. To demonstrate the different tools used in various manufacturing operations such as machining on lathe.
4. To explain the various parts and working of lathe, drilling, milling, grinding machines.

Course Outcomes:

At the end of course student will able to

1. Describe the significance of properties of fluid.
2. Apply the knowledge of fluid statics, kinematics and dynamics while addressing problems of mechanical engineering.
3. Estimate the discharge through a pipe or open channel.
4. Solve the practical problems in design of channels, openings

Practical List **:**

The load of workshop practice III will be allotted to the teaching staff and will be assisted by workshop staff for completing the jobs.

1. Preparation of pattern from component drawing, Pattern manufacturing after preparing pattern drawing.
2. Study of different types of forging processes and one job based on smithy/ forging.
3. Study of different types of welding processes and one job based on any one welding method.

Lab Manual **:**

- Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO-1	✓	✓	✓	✓	✓				✓		✓		✓		✓
CO-2	✓	✓	✓		✓		✓						✓		
CO-3	✓	✓	✓	✓	✓				✓		✓		✓	✓	✓
CO-4	✓	✓	✓		✓								✓	✓	

Assessment Pattern

Skill Level	Ex. 1	Ex. 2	Ex. 3
1. Assembling		✓	✓
2. Testing			
3. Observing	✓	✓	✓
4. Analyzing	✓		
5. Interpreting	✓		
6. Designing	✓	✓	✓
7. Creating	✓	✓	✓
8. Deducing			
9. Concluding			
C.A.	10	10	10

Class & Semester	:	**S. Y. B.Tech Mechanical Engineering, Part I, Semester III**			
Course Title	:	**Environmental Studies**	*Course Code*:	:	**HS211**
Teaching Scheme (Hours)	:	**Lectures 2 hours/weeks = 2 x 13 weeks= 26 hours Tutorial= 00 hour/week Practical= 00 hours/week**	*Total Credits*	:	**Nil**
Evaluation Scheme (Marks)	:	**CIE = 00 IPE=30 : SEE = 70 : Grand Total=100**	*Duration of SEE*	:	**2 hours** (SEE at the yearend)
Revision:	:	**Third**	*Month*	:	**December 2016**

Pre-requisites **:** Engineering Chemistry

Type of Course **:** Theory and field work

Course Domain **:** Humanities and Applied Science

Skills Imbibed **:** Affective : Awareness, Respond, Value, Organize
Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Project / Field work
2. Semester End Examination.

Course Objectives:

1. To recall fundamental physical and biological principles those govern natural processes.
2. To understand the importance of ecological balance for sustainable development.
3. To Understanding the impacts of developmental activities and mitigation measures and to further understand the environmental policies and regulations.
4. To identify the complex relationships between scientific approaches to environmental issues and political, social, economic, and ethical perspectives on the environment.
5. To collect and interpret scientific data in both field and laboratory settings.
6. To integrate and apply perspectives from across the natural sciences, social sciences, and the humanities in the context of complex environmental problems.

7. To communicate scientific information to both professional and lay audiences.

Course Outcomes:

1. Develop an understanding of different natural resources including renewable resources.
2. Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
3. Aware of important acts and laws in respect of environment.
4. Demonstrate critical thinking skills in relation to environmental affairs
5. Develop an understanding of environmental pollutions and hazards due to engineering/technological activities and general measures to control them.
6. Demonstrate knowledge and application of communication skills and the ability to write effectively in a variety of environmental contexts.
7. Demonstrate an ability to integrate the many disciplines and fields that intersect with environmental concerns.
8. Demonstrate an appreciation for need for sustainable development and role of science.

Curriculum Content	**Hours**
UNIT I: Significance of environmental studies Multidisciplinary nature of environmental studies Need for public awareness. a) Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forests and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Usage and exploitation, environmental effects of extracting and using mineral resources. d) Food resources: World food problem, changes caused by agriculture effects of modern agriculture, fertilizer-pesticide problems. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. g) Role of an individual in conservation of natural resources. h) Equitable use of resources for sustainable lifestyle.	**04**
UNIT II: Ecosystems Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristics features, structure and function of the following Ecosystem: - a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	**04** **04**
UNIT III: Biodiversity and its Conservation Introduction – Definition: genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.; Biodiversity at global, National and local levels.; India as a mega-diversity nation; Western Ghats as a bio-diversity region; Hot-spots of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ	**04**

and Ex-situ conservation of biodiversity.

UNIT IV: Environmental Pollution

Definition: Causes, effects and control measures of:

a) Air pollution, b) Water pollution, c) Soil pollution, d) Marine pollution, e) Noise pollution, f) Thermal pollution, g) Nuclear hazards **05**

• Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

• Role of an individual in prevention of pollution.• Pollution case studies• Disaster management: Floods, earthquake, cyclone and landslides. Tsunami **05**

UNIT V: Social Issues and the Environment

From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its problems and concerns; Environmental ethics: Issue and possible solutions; Climate change, Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust; Wasteland reclamation; Consumerism and waste products.

UNIT VI: Environmental Protection

Environment Protection Act.; Air (Prevention and Control of Pollution) Act.; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Population Growth and Human Health, Human Rights. ;Field Work--Visit to a local area to document environmental assets river/forest/grassland/hill/mountain or Visit to a local polluted site –urban/rural/Industrial/Agricultural or Study of common plants, insects, birds or Study of simple ecosystems-ponds, river, hill slopes, etc.

Text Books **:**

1. Agarwal, K. C. 2001, Environmental Biology, Nidi Publ. Ltd., Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad, 380013, India, Email:mapin@icenet.net (R)
3. Brunner R. C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p

Reference Books **:**

1. Clark R. S., Marine Pollution, Clanderson Press Oxford (TB) Pg No. 6
2. Cunningham, W. P. Cooper, T. H. Gorhani, E. & Hepworth, M. T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
3. De A. K., Environmental Chemistry, Wiley Eastern Ltd.
4. Down to Earth, Centre for Science and Environment (R)
5. Gleick, H., 1993, Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press 473p
6. Hawkins R. e., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
7. Heywood, V. H. & Watson, R. T. 1995, Global Biodiversity Assessment, Cambridge Univ. Press 1140p.
8. Jadhav, H. & Bhosale, V. M. 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi 284p.
9. Mckinney, M. L. & Schocl. R. M. 1996, Environmental Science Systems & Solutions, Web

enhanced edition
10. Mhskar A. K., Matter Hazardous, Techno-Science Publications (TB)
11. Miller T. G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
12. Odum, E. P. 1971, Fundamentals of Ecology, W. B. Saunders Co. USA, 574p.
13. Rao M. N. & Datta, A. K. 1987, Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd.,
14. Sharma B. K., 2001, Environmental Chemistry, Goel Publ. House, Meerut
15. Survey of the Environment, The Hindu (M)
16. Townsend C., Harper, J. and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
17. Trivedi R. K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media (R)
18. Trivedi R. K. and P. K. Goel, Introduction to air pollution Techno-Science Publications (TB)
19. Wagner K. D., 1998, Environmental Management, W. B. Saunders Co. Philadelphia, USA.
(M) Magazine
(R) Reference
(TB) Textbook
20. Paryavaram Swhastra – Gholap T. N.
21. Paryavaram Shastra - Gharapure.
22. Paryavaran Vighyan - V. R. Ahirrao - Nirali Prakashan, Pune.
23. Paryavaram Shastra Parichay - Jay Kumar Magar Vidya Prakashan, Nagpur.
24. Desh Ka Paryavaran - Anupam Misra, Ganolai santi Pratisthan. New Delhi.

Class & Semester	:	**S. Y. B. Tech. (Mechanical Engineering), Part II, Semester III**				
Course Title	:	**Environmental Studies**		*Course Code*:	:	EC 218
Teaching Scheme (Hours)	:	**Lectures** **2 hours/weeks = 2 x 13 weeks= 26 hours** **Tutorial= 00 hour/week** **Practical= 00 hours/week**		*Total Credits*	:	**Nil**
Evaluation Scheme (Marks)	:	**CIE = 00** **SEE = 70**	**IPE=30** **IOE=Nil** **EPE= Nil**	: **Grand Total=** : **100**		
Revision:	:	**First**			*Month*	: **May 2017**

Pre-requisites **:** Engineering Chemistry

Type of Course **:** Theory and field work

Course Domain **:** Applied Science

Skills Imbibed **:** Affective : Awareness, Respond, Value, Organize

Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Project / Field work

2. Semester End Examination.

Course Objectives:

8. To recall fundamental physical and biological principles those govern natural processes.
9. To understand the importance of ecological balance for sustainable development.
10. To Understanding the impacts of developmental activities and mitigation measures and to further understand the environmental policies and regulations.
11. To identify the complex relationships between scientific approaches to environmental issues and political, social, economic, and ethical perspectives on the environment.
12. To collect and interpret scientific data in both field and laboratory settings.
13. To integrate and apply perspectives from across the natural sciences, social sciences, and the humanities in the context of complex environmental problems.
14. To communicate scientific information to both professional and lay audiences.

Course Outcomes:

9. Develop an understanding of different natural resources including renewable resources.
10. Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
11. Aware of important acts and laws in respect of environment.
12. Demonstrate critical thinking skills in relation to environmental affairs
13. Develop an understanding of environmental pollutions and hazards due to engineering/technological activities and general measures to control them.
14. Demonstrate knowledge and application of communication skills and the ability to write effectively in a variety of environmental contexts.
15. Demonstrate an ability to integrate the many disciplines and fields that intersect with environmental concerns.
16. Demonstrate an appreciation for need for sustainable development and role of science.

Curriculum Content **Hours**

UNIT I: Significance of environmental studies **4**

Multidisciplinary nature of environmental studies Need for public awareness. a) Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forests and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Usage and exploitation, environmental effects of extracting and using mineral resources. d) Food resources: World food problem, changes caused by agriculture effects of modern agriculture, fertilizer-pesticide problems. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. g) Role of an individual in conservation of natural resources. h) Equitable use of resources for sustainable lifestyle.

UNIT II: Ecosystems **4**

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristics features, structure and function of the following Ecosystem: - a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem,
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT III: Biodiversity and its Conservation **4**

Introduction – Definition: genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.; Biodiversity at global, National and local levels.; India as a mega-diversity nation; Western Ghats as a bio-diversity region; Hot-spots of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT IV: Environmental Pollution **4**

Definition: Causes, effects and control measures of:
a) Air pollution,b) Water pollution,c) Soil pollution,d) Marine pollution,e) Noise pollution,f) Thermal pollution,g) Nuclear hazards
• Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
• Role of an individual in prevention of pollution.• Pollution case studies• Disaster management: Floods, earthquake, cyclone and landslides. Tsunami

UNIT V: Social Issues and the Environment **5**

From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of

people; its problems and concerns; Environmental ethics: Issue and possible solutions; Climate change, Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust; Wasteland reclamation; Consumerism and waste products.

UNIT VI: Environmental Protection **5**

Environment Protection Act.; Air (Prevention and Control of Pollution) Act.; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Population Growth and Human Health, Human Rights. ;Field Work--Visit to a local area to document environmental assets river/forest/grassland/hill/mountain or Visit to a local polluted site – urban/rural/Industrial/Agricultural or Study of common plants, insects, birds or Study of simple ecosystems-ponds, river, hill slopes, etc.

Text Books **:**

1. Agarwal, K. C. 2001, Environmental Biology, Nidi Publ. Ltd., Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380013, India, Email:mapin@icenet.net (R)
3. Brunner R. C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p

Reference Books **:**

1. Clark R. S., Marine Pollution, Clanderson Press Oxford (TB) Pg No. 6
2. Cunningham, W. P. Cooper, T. H. Gorhani, E. & Hepworth, M. T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
3. De A. K., Environmental Chemistry, Wiley Eastern Ltd.
4. Down to Earth, Centre for Science and Environment (R)
5. Gleick, H., 1993, Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press 473p
6. Hawkins R. e., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
7. Heywood, V. H. & Watson, R. T. 1995, Global Biodiversity Assessment, Cambridge Univ. Press 1140p.
8. Jadhav, H. & Bhosale, V. M. 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi 284p.
9. Mckinney, M. L. & Schocl. R. M. 1996, Environmental Science Systems & Solutions, Web enhanced edition
10. Mhskar A. K., Matter Hazardous, Techno-Science Publications (TB)
11. Miller T. G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
12. Odum, E. P. 1971, Fundamentals of Ecology, W. B. Saunders Co. USA, 574p.
13. Rao M. N. & Datta, A. K. 1987, Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd.,
14. Sharma B. K., 2001, Environmental Chemistry, Goel Publ. House, Meerut
15. Survey of the Environment, The Hindu (M)
16. Townsend C., Harper, J. and Michael Begon, Essentials of Ecology, Blackwell Science (TB)

17. Trivedi R. K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media (R)
18. Trivedi R. K. and P. K. Goel, Introduction to air pollution Techno-Science Publications (TB)
19. Wagner K. D., 1998, Environmental Management, W. B. Saunders Co. Philadelphia, USA.
(M) Magazine
(R) Reference
(TB) Textbook
20. Paryavaram Swhastra – Gholap T. N.
21. Paryavaram Shastra - Gharapure.
22. Paryavaran Vighyan - V. R. Ahirrao - Nirali Prakashan, Pune.
23. Paryavaram Shastra Parichay - Jay Kumar Magar Vidya Prakashan, Nagpur.
24. Desh Ka Paryavaran - Anupam Misra, Ganolai santi Pratisthan. New Delhi.

Class & Semester	:	**S. Y. B.Tech Mechanical Engineering Part II, Semester III**

Course Title	:	**Introduction to Performing Arts**				*Course Code*:	: **HS222**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**				*Credits*	: **Nil**
Evaluation Scheme (Marks)	:	**Assignments** : **50** **Written Test** : **25** **Viva voce** : **25** **Grand Total** : **100**				*Duration of Exam*	: **Not Applicable**
Revision:	:	**Third**				*Month*	: **December 2016**

Pre-requisites	**:**	In order to conduct the course successfully, student's involvement and interest in the classroom is the pre- requisite.
Type of Course	**:**	Audit Course at institute level
Course Domain	**:**	Humanity and Fine Arts
Skills Imbibed	**:**	Cognitive: Understand, Apply Affective : Awareness, Respond, Value, Organize Psychomotor: Perceive, Imitate, Manipulate, Articulate, Adapt

Course Assessment Methods:

The students will be given five assignments each for 10 marks. At the end of the course, there will be a written test of 25 marks and a viva voce of 25 marks. There will be assessment for a total of 100 marks. Based on the marks obtained, they will be awarded with a grade similar to other credit courses. Though it is an audit course, obtaining passing grade is essential.

Course Objectives:

1. To understand the history of arts.
2. To cultivate and enhance the interest in Music and other performing arts.
3. To highlight that these arts are not only the medium of entertainment but also a medium for proper channelization of emotions as this plays a vital role in determining the quality of life.
4. To form and defend value judgments about music.
5. To acquire audience skills such as listening and viewing responsibly.
6. To understand & develop skills to become lifelong learners in the musical art, both as participants and as audience members.

Course Outcomes:

1. Students will be able to learn Fundamentals and types of Music and other allied arts.
2. Students will be able to analyze, appreciate, and interpret significant works of art.
3. Students will demonstrate critical thinking through analysis and evaluation of works of art.
4. Students will develop good listening and viewing skills.
5. Students will be able to understand the '*Gharana'* system in Music.
6. Students will understand the classification of Musical instruments.
7. Students will demonstrate mastery of their designated area of concentration.
8. Students will demonstrate comprehension of global perspectives in visual culture.

Curriculum Content	Hours
Unit I: Introduction to Music, Dance & Drama, History of Indian Music, Various Forms of Vocal Music.	**04**
Unit II: History and introduction of Drama, Bharat muni natya shastra, street play, Sanskrit natya, Marathi sangit rangbhumi	**04**
Unit III: Dance, its type, greek and roman theatres,	**04**
Unit IV: Concept of *Raga*, Concept of *Taal*.	**04**
Unit V: Notation System, Study of *Gharana* system in Music, Classification of Indian Instruments, Instrumental Music.	**05**
Unit VI: Contribution of Great Musicians, Appreciation of Music. Performance of a Music Concert.	**05**

Reference Books **:**

1. 'Sangeet Visharad', Vasant, Sangeet Karyalaya, Hatras Prakashan.
2. Suchita Bidkar, 'Sangeet Shastra Vigyan', Sanskar Prakashan.
3. Sudhir Mainkar, 'Sangeet Kala Aani Shikshan', Sanskar Prakashan.
4. Bhaskar Chandavarkar, 'Vadyavedh', Sanskar Prakashan.
5. Arvind Mulgaonkar, 'Tabla', Popular Prakashan.
6. Chris Hogget ,'All about theatre-Off stage'.
7. Mrinalini Sarabhai,'Understanding of Bharat Natyam'.
8. Joan Borysenko ,'Minding the body and mending the mind',.
9. V.K.Subbanna ,'Ragadalli Antrang'.

Class & Semester	:	**S. Y. B. Tech. (Mechanical Engineering) Part II, Semester IV**			
Course Title	:	**APPLIED MATHEMATICS**	*Course Code*:	:	**ME221**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks = 52 hours minimum Tutorial = 01 hour/week Practical= -- hours/week**	*Total Credits*	:	**04+01 =05**
Evaluation Scheme (Marks)	:	**CIE = 50 SEE = 50 IPE=Nil IOE=Nil EPE= Nil EOE = Nil Grand Total=100**	*Duration of SEE*	:	**3 hours**
Revision:	:	**First**	*Month*	:	**May 2017**

Pre-requisites **:** Engineering Mathematics-I, Engineering Mathematics-II and Numerical methods

Type of Course **:** Theory

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate
Affective : Awareness, Respond, Value, Organize
Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination (SEE)

Course Objectives:

1. To describe solution of LDE and its applications in mechanical engineering.
2. To introduce Partial Differential Equations and its Applications.
3. To introduce Laplace Transform & Inverse Laplace transform and its Applications.
4. To explain Vector Differentiation and Vector Integration
5. The student must be able to formulate a mathematical model of a real life and engineering

problem, solve and interpret the solution in real world.

Course Outcomes:

At the end of course student will able to

1. Solve Linear Differential Equations and Apply them to realistic problems.
2. Solve Partial Differential Equations for solving problems in Mechanical Engineering fields.
3. Understand Application of Laplace Transform in Mechanical Engineering
4. Apply knowledge of Vector Calculus to solve engineering problems.

Curriculum Content	Hours
Unit I: Linear Differential Equations Linear Differential Equations with constant coefficients, Homogenous Linear differential equations, method of variation of parameters.	**08**
Unit II: Applications of Linear Differential Equations Applications of Linear Differential Equations with constant coefficients to Whirling of shafts and oscillations of a spring (Free oscillations, Damped oscillations, Forced oscillations without damping)	**08**
Unit III: Partial Differential Equations Four standard forms of partial differential equations of first order.	**08**
Unit IV: Applications of Partial Differential Equations Wave Equation, One and two dimensional heat flow equations, method of separation of variables, use of Fourier series.	**08**
Unit V: Laplace Transform Definition, L.T. of standard functions, Properties and theorems of Laplace transforms, Inverse L.T., Applications of L.T. to solve LDE (Initial value problems)	**10**
Unit VI: Vector Calculus Vector Differentiation: Differentiation of vectors, Gradient of scalar point function, Directional derivative, Divergence of vector point function, Curl of a vector point function. Solenoidal, Irrotational and Conservative field. Vector Integration: The line integral, Surface integral, volume integral, Gauss's Divergence theorem, Stoke's theorem, Green's theorem (Without proof).	**10**

Suggested list of Tutorials/Assignments-

1. To find solution of LDE with constant coefficients
2. To find Solution of Homogeneous LDE
3. Applications of LDE
4. To find solution of PDE
5. Applications Of PDE
6. Laplace Transform
7. Applications of Laplace transform
8. Vector differentiation
9. Vector Integration

General Instructions:

1. Batch wise tutorials are to be conducted. The number of students per batch should be as per the practical batches.
2. Students must be encouraged to solve engineering mathematics problems using different software's in tutorial class only.
3. Each Student has to write at least 6 assignments on entire syllabus.

Text Books

1. Erwin Kreyszig, "Advanced Engineering Mathematics (7th Edition)", Wiley Eastern Ltd., Bombay.

Reference Books

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publications, New Delhi.
2. C.R.Wylie, "Advanced Engineering Mathematics", McGraw Hill Publication, New Delhi.
3. Merle C. Potter, "Advanced Engineering Mathematics", OXFORD University Press, 3rd Edition
4. P. N. Wartikar and J. N. Wartikar, "A Text Book of Engineering Mathematics (Volume-I ,II & II)", Pune Vidyarthi Griha Prakashan, Pune.
5. Shanti Narayan, "Differential Calculus" S. Chand and company, New Delhi.
6. S. S. Sastry, "Engineering Mathematics (Volume-I)", Prentice Hall Publication, New Delhi.
7. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill.
8. M. D. Greenberg, "Advanced Engineering Mathematics", Pearson Education.
9. H. K. Das, "Advanced Engineering Mathematics", S. Chand Publication.

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO-1	✓			✓		✓		✓			✓		✓		
CO-2	✓		✓						✓		✓			✓	
CO-3	✓	✓				✓	✓				✓		✓		
CO-4	✓				✓				✓	✓		✓	✓		✓

Assessment Pattern

Knowledge Level	UT-1	UT-2	ESE
1. Remember	5	--	10
2. Understand	5	5	10
3. Apply	7	7	40
4. Analyze	8	8	20
5. Evaluate	--	5	10
6. Create	--	--	10
Total	**25**	**25**	**100**

Class and Semester	:	**S. Y. B. Tech. (Mechanical Engineering) Part II, Semester IV**			
Course Title	:	**MECHANICS OF MATERIALS**	*Course Code*:	:	**ME222**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks = 52 hours minimum Tutorial= 01 hour/week Practical= -- hours/week**	*Total Credits*	:	**04+01 =05**
Evaluation Scheme (Marks)	:	**CIE = 50 SEE = 50 IPE=Nil : IOE=Nil : EPE= Nil : EOE = Nil Grand Total=100**	*Duration of SEE*	:	**3 hours**
Revision:	:	**First**	*Month*	:	**May 2017**

Pre-requisites **:** In order to complete the course studies successfully, it is important to have a good knowledge of Applied mechanics, Engineering Mathematics.

Type of Course **:** Theory

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate
Affective : Awareness, Respond, Value, Organize
Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I and Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination (SEE)

Course Objectives:

1. Demonstrate knowledge of fundamental concepts and problem solving techniques associated with stress, strain, stress-strain diagram, bulk modulus applied to brittle and ductile materials.
2. Applications involving axial loading, torsion, and bending, including introductory-level statically indeterminate systems.
3. To have understanding of different loading conditions and its graphical representation to model design problem.

4. Accumulate significant practice in solving a variety of application problems in solid mechanics involving concepts of principle stress-strain, deflection of beams and strain energy.

Course Outcomes:

At the end of course student will able to

1. Apply mathematics to obtain analytical solutions to design problems of mechanical components
2. Demonstrate knowledge of fundamental concepts to explain elastic and inelastic behavior, strain energy, and material properties.
3. Apply engineering principles toward solving power transmission problems of shaft, safe design of beams and to find deflection of beams
4. Recognize situations involving ethical considerations (safety through design) and be able to evaluate decisions
5. Compute and analyze stresses induced in mechanical components.

Curriculum Content	Hours
Unit I: Simple stresses and strains a) Concept of Stress and Strain, (Linear, Lateral, Shear and Volumetric), Hooke's Law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, Stress-strain diagram for ductile and brittle material, Factor of safety, Working stress. Normal and shear stresses, Thermal Stresses, shear stress, Bulk Modulus, Inter-relationship between elastic constants.	**10**
Unit II: **a) Shear force and bending moment diagrams** Concept and definition of shear force and Bending Moment in beams due to concentrated load, UDL, uniformly varying loads . Construction of SF, and BM diagrams for cantilevers, simply support beam. **b) Torsion of circular shaft** Basic assumptions, Derivation of torsion formulae, Solid circular shafts and hollow shaft, homogeneous and composite circular cross section subjected to twisting moments, stresses due to combine torsion, bending and axial force on shafts.	**10**
Unit III: Stresses in beams **1. Bending Stresses** Theory of simple bending, concept and assumptions, Derivation of Flexure formula. Bending stress distribution diagram. Moment of resistance and section modules calculations. Design of rectangular and circular (solid and hollow) sections: L, I and T sections **b) Shear stress**	**08**

Shear stresses concept, derivation of shear stress distribution formulae, shear stress distribution diagram for common symmetrical sections such as : circular, I, and T

Unit IV: **08**

a) Principal stresses and principal strain

Normal and shear stresses on any oblique planes and concept of principal planes derivation for principal stresses and maximum shear stress by analytical and graphical methods using Mohr's circle of stress 2-D.

b) Pressure Vessels.

Stresses, strains and deformation in thin walled seamless cylindrical and spherical vessels due to internal fluid pressure. Change in volume, effects of additional compressible or Incompressible Fluid injected under pressure.

Unit V: **08**

a) Axially loaded columns.

Concept of critical load and buckling, Euler's formulae for different end connections, concept of equivalent length for various end conditions. Rankin's formulae, safe load on column, Limitations of Euler's formulae.

b) Strain energy and impact.

Concept of strain energy, derivation and use of expressions for deformation of axially loaded members under gradual sudden and impact loads.

Unit VI: **08**

Slope and Deflection

Concept and definition, relation between B.M., slope and deflection, Solution of beam for slope and deflection by double integration method (McCauley's method) and Area moment method (Simply supported beam and cantilever beam)

Text Books

1. Ramamurtham, Strength of Materials
2. Beer and Johnston - Strength of Materials. - CSB Publisher.

Reference Books

1. Gere andTimoshenko – Mechanics of Material. – CSB Publisher 1984.
2. E.P. Popov – Introduction to Mechanics of solids. – Prentice Hall Publication.
3. Singer and Pytel – Strength of Materials. – Harper and Row Publications.
4. Timoshenko and Young – Strength of Materials. – CSB Publisher

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO-1	✓	✓	✓					✓	✓		✓	✓	✓		
CO-2	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓		
CO-3	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓		
CO-4		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		
CO-5	✓		✓	✓	✓		✓	✓		✓		✓	✓		

Assessment Pattern

Knowledge Level	UT-1	UT-2	ESE
1. Remember	5	--	10
2. Understand	5	5	10
3. Apply	7	7	40
4. Analyze	8	8	20
5. Evaluate	--	5	10
6. Create	--	--	10
Total	**25**	**25**	**100**

Class and Semester	:	**S. Y. B. Tech. (Mechanical Engineering) Part II, Semester IV**				
Course Title	:	**THEORY OF MACHINES – I**		*Course Code*:	:	**ME223**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks = 52 hours minimum Tutorial= -- hour/week Practical= 02 hours/week**		*Total Credits*	:	**04+01 =05**
Evaluation Scheme (Marks)	:	**CIE = 50 SEE = 50**	**IPE=Nil : IOE=Nil : EPE= Nil : EOE = 50**	**Grand Total=100**	*Duration of SEE*	: **4 hours**
Revision:	:	**First**			*Month*	: **May 2017**

Pre-requisites **:** In order to complete the course studies successfully, it is important to have a good command of English. Other Pre-requisites include Engineering Physics, Applied Mechanics and Mechanics of Material.

Type of Course **:** Theory

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate
Affective : Awareness, Respond, Value, Organize
Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I and Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination (SEE)

Course Objectives:

The course aims to:

1. To represent kinematic behavior of different machine elements and mechanisms.
2. Study and analyze the problems on balancing of rotary and reciprocating masses.
3. Study force analysis of simple mechanisms.
4. Know the basic theory on gears.
5. Analyze the various types of gear trains used for transmission of motion and power.
6. To compare types of Governing mechanisms

Course Outcomes:

Upon successful completion of this course, the student will be able to:

2. Understand different types of mechanisms and their applications.
3. Analyze kinematic theories of mechanism.
4. Do force analysis of mechanisms
5. Indentify the various types of gears.
6. Select a gear drive for practical purpose.
7. Select different governing mechanisms according to application.

Curriculum Content	Hours
Unit I: Fundamentals of kinematics and mechanisms. Definition of link, Pair, chain structures, mechanisms, machine, inversion of four bar chains, single and double slider crank chain, equivalent linkage of mechanism. Degrees of freedom, Grubler's criteria, straight line mechanism, pantograph, Geneva mechanism, steering gear mechanisms, Hooke's joint .Introduction to compliant mechanism	**10**
Unit II: Velocity and acceleration analysis. Relative velocity acceleration methods, Corioli's component of acceleration, instantaneous center of velocity, Kennedy theorem of three center in line, body and space centrode, velocity and acceleration in slider crank mechanism b analytical methods and Klein's construction.	**10**
Unit III: Static and dynamic force analysis. Static force analysis of slider crank mechanism, D'Alembert's principle, methods of finding inertia of rigid bodies, compound pendulum, bifilar and trifilar suspension methods, inertia	**10**

forces in engine mechanisms analytical and graphical methods, dynamically equivalent system, correction couple, inertia of geared system.

Unit IV: Theory of Gears I **08**

Classification. Spur gear: definition, terminology, fundamental law of toothed gearing, involute and cycloidal profile, conjugate action, contact ratio, minimum number of teeth, interference and under cutting. Helical gears: nomenclature, center distance, virtual number of teeth.

Unit V:Theory of Gears II **08**

Types of Gear trains - Simple, Compound, Reverted, Epicyclic gear train, Tabular method for finding the speeds of elements in Epicyclic gear train, Torques in Epicyclic gear train, Differential gear box.

Unit VI: Governor Mechanisms **07**

Introduction, Types, Governor Effort and governor power, Controlling force analysis, sensitivity, stability, isochronisms and hunting, friction, insensitiveness

Text Books : Text Books

1. "Theory of Machines", Rattan S.S. Tata McGraw Hill, 3rd Edition.
2. "Mechanism and Machine Theory", Rao, Dukkipati, New Age International, 2nd Edition.
3. "Theory of Machines", Dr. V.P.Singh, Dhanpat Rai Publications.
4. "Theory of Machines", Sadhu Singh , Pearson Education, 3rd Edition.
5. "Theory of Machines", Ballaney, Khanna Publication.
6. "Theory of Machines", R.K.Bansal ,Laxmi Publications, 5th Edition.

Reference Books : Reference Books

1. "Theory of Machines and Mechanisms" Shigley, Tata McGraw Hill.
2. "Theory of machines" Thomas Beven Pearson Education, 3rd Edition.
3. "Theory of Machines" Jagdishlal, Metropolitan Publication.
4. "Mechanisms and Dynamics of machines" J.Srinivas, SciTech Publication.
5. "Kinematics, Dynamics and Design of Machinery" , Walidron, Wiley India Publication, 2nd Edition.
6. "Kinematics, Dynamics of Machinery", Wilson, sadler, Pearson Education.

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO-1	✓		✓		✓				✓	✓	✓	✓			
CO-2	✓		✓		✓				✓	✓	✓	✓			
CO-3	✓	✓	✓		✓					✓	✓	✓		✓	
CO-4	✓	✓	✓		✓					✓	✓	✓			✓

Assessment Pattern

Knowledge Level	UT-1	UT-2	ESE
1. Remember	5	--	10
2. Understand	5	5	10
3. Apply	7	7	40
4. Analyze	8	8	20
5. Evaluate	--	5	10
6. Create	--	--	10
Total	**25**	**25**	**100**

Class and Semester	:	**S. Y. B. Tech. (Mechanical Engineering) Part II, Semester IV**			
Course Title	:	**FLUID AND TURBO MACHINERY**	*Course Code*:	:	**ME224**
Teaching Scheme (Hours)	:	**Lectures 3 hours/weeks=3 x 13 weeks = 39 hours minimum Tutorial= -- hour/week Practical= 02 hours/week**	*Total Credits*	:	**03+01 =04**
Evaluation Scheme (Marks)	:	**CIE = 50 SEE = 50 IPE=50 IOE=Nil EPE= 50 EOE = Nil Grand Total=100**	*Duration of SEE*	:	**3 hours**
Revision:	:	**First**	*Month*	:	**May 2017**

Pre-requisites **:** In order to complete the course studies successfully, it is important to have a good command of English. Other Pre-requisites include Engineering Physics, Chemistry-I, Chemical Engineering Thermodynamics-I and Fluid Flow Operations.

Type of Course **:** Theory

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate
Affective : Awareness, Respond, Value, Organize
Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I and Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination (SEE)

Course Objectives:

1. To understand impulse momentum principle and its applications
2. To learn the working principles of impulse and reaction water turbines.
3. To illustrate the concept of different types of pumps and compressor.
4. Train the students to acquire the knowledge and skill of analyzing different turbo machines

Course Outcomes:

At the end of course student will able to

1. To design and calculate different parameters for turbo machines.
2. To understand thermodynamics and kinematics behind turbo machines.
3. To formulate design criteria.
4. To understand the concept of centrifugal and axial compressors.

Curriculum Content

Hours

Unit I: Impulse Water Turbines **10**

Introduction to turbo machinery, Classifications, Machines classification of water turbines, Pelton wheel, its construction and working, velocity triangles. Pelton wheel design bucket dimensions, number of buckets, jet diameter, wheel diameter, jet ratio, speed ratio, number of jets, calculation of efficiency, power, discharge etc. Governing of Pelton wheel.

Unit II: Reaction Water Turbines **14**

Principle of operation, construction and working of Francis and Kaplan Turbine, effect of modification of velocity triangles on runner shape, draft tube, calculation of various efficiencies, power, discharge, blade angles, runner dimensions etc. Governing of Francis and Kaplan turbine. Draft tube-types and analysis.

Unit III: Centrifugal Pumps **07**

Working principles, Construction, various heads, multistage pumps, velocity triangles, minimum starting speed, cavitation, MPSH and NPSH. Methods of priming calculations of efficiencies, discharge, blade angles, head, power required, impeller dimensions etc.

Unit IV: Similarity Principles **07**

Model testing, unit quantities, Specific speed of turbine (Pelton wheel, Francis turbine, Kaplan turbine), specific speed of pumps. Prediction of performance at other operating conditions. Performance characteristics of Turbines and pumps.

Unit V: Air compressors **07**

Application of compressed air , classification of compressor, reciprocating compressors, construction , work input, necessity of cooling , isothermal efficiency, heat rejected, effect of clearance volume, volumetric efficiency, necessity of multi staging, construction, optimum intermediate pressure for minimum work required, after cooler,
Roots blower and vane blower (descriptive treatment)

Unit VI: Rotodyanamic Air Compressors **07**

Centrifugal compressor, velocity diagram, pre whirl, slip factor, performance calculations.
Axial flow compressors, velocity diagram, degree of reaction, polytropic efficiency, surging, chocking, stalling, performance.

Text Books

1. "Hydraulic Machines", V.P. Vasantdani, Khanna Publishers, 1996.
2. "Fluid flow machines", N.S. Govindrao, Tata McGraw-Hill,1983.
3. "Steam and gas Turbines", R. Yadav, Central Publishing House, Allahabad, 6th Edition , 1997 .
4. "Gas Turbines", V. Ganeshan, Published by TMH Education Pvt. Ltd. , 3rd Edition.
5. "Thermal Engg.", Kumar vasantdani, Khanna publisher
6. "Thermal Engg.",P.L. Balleny, Khannapublisher. , 20th Edition
7. "Gas turbines and Compressor", Cohen and Rogers, Saravanamutto Publisher

Reference Books

1. Hydraulic Machines by V.P. Vasantdani
2. Fluid flow machines by N.S. Govindrao
3. Turbo machines by S.M. Yahya
4. Fluid power Engineering by D.S. Kumar
5. Steam and gas Turbines by R. Yadav
6. Steam and gas Turbines by V. Ganeshan
7. Thermal Engg. by Kumar Vasantdani
8. Thermal Engg. By P.L. Balleny
9. Gas turbines and Compressor by Cohen and Rogers
10. Thermodynamics and Heat Engines – Vol-II by R. Yadav
11. Fluid mechanics and hydraulic machines by Modi and Seth
12. Thermal Engineering by R K Rajput
13. Fluid Mechanics and Hydraulic Machines S.C. Gupta Pearson Education.

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO-1	✓	✓	✓		✓						✓				✓
CO-2	✓	✓	✓								✓				
CO-3	✓	✓	✓					✓			✓		✓	✓	✓
CO-4	✓	✓			✓										

Assessment Pattern

Knowledge Level	UT-1	UT-2	ESE
1. Remember	5	--	10
2. Understand	5	5	10
3. Apply	7	7	40
4. Analyze	8	8	20
5. Evaluate	--	5	10
6. Create	--	--	10
Total	**25**	**25**	**100**

Class and Semester	:	**S. Y. B. Tech. (Mechanical Engineering) Part II, Semester IV**				
Course Title	:	**MATERIAL SCIENCE AND METALLURGY**		*Course Code*:	:	**ME225**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks = 52 hours minimum Tutorial= -- hour/week Practical= 02 hours/week**		*Total Credits*	:	**04+01 =05**
Evaluation Scheme (Marks)	:	**CIE = 50 SEE = 50**	**IPE=50 : IOE=Nil : EPE= Nil : EOE = 50**	**Grand Total=100**	*Duration of SEE*	**: 3 hours**
Revision:	:	**First**			*Month*	: **May 2017**

Pre-requisites **:** In order to complete the course studies successfully, it is important to have a good command of English. Other Pre-requisites include Engineering Physics, Engineering Chemistry, Manufacturing Engineering - I

Type of Course **:** Theory

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate
Affective : Awareness, Respond, Value, Organize
Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I and Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination (SEE)

Course Objectives:

1. To acquaint students with the basic concepts of Metal Structure
2. To impart fundamental knowledge of Ferrous and Non Ferrous Metal Processing
3. To study applications of different Metals and Alloys
4. To Know Fundamentals of Metallography
5. To develop futuristic insight into Metals

Course Outcomes:

At the end of this course, student will be able to

1. Understand basic concept of metal structure.
2. Understand fundamental knowledge of Ferrous and Non Ferrous Metal.
3. Selection of Metals and Alloys for different application.
4. Understand need of Heat treatment and various heat treatment processes.

Curriculum Content	Hours

Unit I: Metals and Alloy Systems **14**

Introduction to Metallic and Non-metallic materials and its classification (metals/alloys, polymers and composites)

1. Metals, Metallic bonds, Crystal structure (SC, BCC, FCC, HCP), Imperfections in crystals, Miller indices , indexing of lattice planes & directions, Lattice parameters (coordination number, no. of atoms per unit cell, atomic packing factor, density)
2. Alloy formation by crystallization, Nucleation and growth, Cooling curves, Dendritic structure and coring. Concept of solidification of pure metals & alloys, Nucleation : homogeneous and heterogeneous Cooling curves, Plotting of Equilibrium diagrams, Lever rule
3. Solid solutions and intermediate phases,Hume Ruthery's rule of solid solubility
4. Phases and Gibbs phase rule
5. Construction of equilibrium diagrams from cooling curves, Isomorphous system(Solid Solution), Eutectic, Partial solubility Peritectic and Intermetallic Compounds Lever arm principles.

Unit II: Study of Phase Diagrams **10**

(With respect to typical compositions, Properties and Applications for the following alloys.)

1. Fe- Fe_3C equilibrium diagram - Ferrous alloys (Plain carbon steels, cast iron)
2. Alloy steels- Free cutting steels, HSLA high carbon low alloy steels, maraging steels. creep resisting steels, Stainless steels- different types. Tool steels- types,
3. Selection of materials and Specifications based on -IS, BS, SAE, AISI,
4. Copper based alloys brasses Cu- Zn, Bronzes Cu- Sn, , Cu- Be, Cu-Ni.
5. Aluminum based alloys Al- Cu(Duralumin) - Al-Si (Modification),

6. Pb- Sn(Solders and fusible alloys)
7. Sn-Sb alloys (Babbits)

Unit III: Principles of Heat Treatment **07**

1. Transformation of Pearlite into austenite upon heating,
2. Transformation of austenite into Pearlite, Bainite and Martensite on cooling.
3. TTT –Diagram and CCT - Diagrams - significance, Effect of alloying elements on TTT diagram and its significance.
4. Heat treatment furnaces and equipments, controlled atmosphere.

Unit IV: Heat Treatment Processes **10**

a) Heat Treatment of Steels

1. Annealing – Types-Full, Partial and Sub critical annealing (Various types) and purposes
2. Normalising- Purposes
3. Hardening (Hardening types), Purposes, Austempering and Martempering, Mechanism of quenching and Quenching media, Hardenability- Concept and methods of determination of hardenability- Grossmans critical diameter method and Jominy end quench test.
4. Tempering Types, Structural transformations during tempering, purposes sub zero treatment
5. Surface hardening - Flame and Induction
6. Chemical heat treatments for case hardening - Carburising, Nitriding, Cyniding, Carbonitriding

b) Heat treatment of Non ferrous Alloys

1. Annealing- Stress relief, Recrystallization and Process annealing
2. Precipitation hardening - Basic requirements, Stages, Common alloys, Variables, theories

c) Heat treatment defects and remedies

Unit V: Principles of Mechanical Testing **07**

Principles of Mechanical Testing:

1. Destructive Testing methods: Tensile, Compressive, Impact, Fatigue, Creep, Hardness (Rockwell, Brinell and Vickers)
2. Non- Destructive Testing: Dye Penetrant, Magnetic, Ultrasonic, Radiography, Eddy Current testing.

Unit VI: Powder Metallurgy **07**

1. Advantages, Limitations and Applications of Powder Metallurgy
2. Powder manufacturing types- Mechanical, Physical, Chemical and Electro- Chemical
3. Mixing/ Blending- (Double cone and Y- Cone mixers)
4. Compaction- types- Conventional, Isostatic, HERF, Powder rolling and extrussion
5. Sintering- Types liquid stage and solid stage sintering
6. Finishing operations: Sizing, Machining, Infiltration and Impregnation

Text Books

1. "Introduction to physical metallurgy", S.H.Avner, Mcgraw Hill Book Company Inc, Edition, 2nd , 1974.
2. "Physical metallurgy", Vijendrasingh, Standard Publishers delhi
3. "Material science and engineering",W.D Callister, Wiley India Pvt.Ltd., 5th Edition.
4. "Material science and metallurgy for engineers", V.D.Kodgire, Everest Publishers Pune,12th Edition.
5. "Heat Treatments Principles and Practices", T.V. Rajan / C.P. Sharma, Prentice Hall of India Pvt Ltd, New Delhi,
6. "Material Science and Engineering",V Raghwan., Prentice Hall of India Pvt. Ltd., New Delhi ,3rd Edition, 1995.

Reference Books

1. "Engineering Metallurgy", R.A. Higgins, Viva Books Pvt. Ltd., New Delhi, 1st Edition ,1998
2. "Physical Metallurgy for Engineers ", D.S.Clark, W. R. Varney, AN East West Press Pvt. Ltd. , New Delhi, 2nd Edition,1962
3. "Heat Treatment of Metals", J L Smith and SC Bhatia , CBS Publisheres and distibutors, New Delhi, 1st edition, 2008.
4. Prabhudev, Heat treatment of Steels, HMT Handbook
5. A.K. Sinha, Powder Metallurgy
6. G.E. Dieter, Mechanical Metallurgy, Tata McGraw-Hill, New Delhi.
7. Engineering Physical Metallurgy - Lakhtin, C.B.S. Publishers & Distributors
8. Heat treatment of Metals – B. Zaharov, C.B.S. Publishers & Distributors India
9. Material science and Metallurgy, C. Daniel Yesudin, D. G. Harris Samuel Scitech
10. Material Science And Engineering , Callister Wiley India Edition

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO-1	✓			✓			✓	✓		✓	✓	✓	✓	✓	
CO-2	✓	✓		✓	✓					✓	✓		✓		
CO-3	✓	✓	✓	✓	✓			✓	✓	✓	✓		✓		
CO-4	✓	✓		✓		✓				✓			✓	✓	

Assessment Pattern

Knowledge Level	UT-1	UT-2	ESE
1. Remember	5	--	10
2. Understand	5	5	10
3. Apply	7	7	40
4. Analyze	8	8	20
5. Evaluate	--	5	10
6. Create	--	--	10
Total	**25**	**25**	**100**

Class and Semester	:	**S. Y. B. Tech. (Mechanical Engineering), Part II, Semester IV**			
Course Title	:	**FLUID AND TURBO MACHINERY LABORATORY**	*Course Code*:	:	**ME226**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**	*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE : 50 EPE : 50** **IOE : Nil EOE : Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**First**	*Month*	:	**May 2017**

Pre-requisites	**:**	Laboratory work in Engineering Physics, Chemistry-I and Fluid Flow Operations.
Type of Course	**:**	Practical
Course Domain	**:**	Core
Skills Imbibed	**:**	Cognitive: Understand, Apply, Analyze, Evaluate, Create Affective : Awareness, Respond, Value, Organize Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment, Internal Practical Examination and External Practical Examination

Course Objectives:

1. To describe the main / operating characteristics of turbines and pumps.
2. To explain the working of reciprocating compressor.
3. To distinguish between different hydraulic devices.
4. To distinguish between different types of pumps.

Course Outcomes:

At the end of course, student will able to

1. Conduct trial and Calculate performance parameters of different turbomachinery.
2. Draw and compare performance characteristics curves with their theoretical nature of

different turbomachinery.

3. Explain construction and working of different types of pumps.
4. Explain construction and working of various hydraulic devices.

Practical List **: Any seven**

1. Study and trial on Pelton wheel.
2. Study and trial on Francis/ Kaplan turbine
3. Trial on Centrifugal pump
4. Study and demonstration of reciprocating pump and hydraulic ram
5. Study and trial on reciprocating compressor
6. Study and trial on centrifugal blower
7. Study of hydraulic devices- Intensifier, Accumulator, Hydraulic jacks, press, Crane.
8. Study of other types of pumps- Gear pump, Jet pump, submersible pump, air lift pump
9. Industrial visit or hydro power plant visit

Lab Manual **:**

- Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO-1	✓	✓	✓								✓				
CO-2	✓				✓			✓			✓	✓			
CO-3	✓									✓					
CO-4										✓					

Assessment Pattern

Skill Level	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Ex. 7	Ex. 8	Ex. 9
1. Assembling						✓	✓	✓	
2. Testing	✓	✓	✓	✓	✓	✓	✓		
3. Observing	✓	✓	✓	✓	✓	✓	✓	✓	✓
4. Analyzing	✓	✓	✓	✓	✓		✓	✓	
5. Interpreting	✓	✓	✓	✓	✓			✓	✓
6. Designing									
7. Creating									
8. Deducing									
9. Concluding	✓	✓	✓	✓	✓	✓	✓	✓	✓
C.A.	10	10	10	10	10	10	10	10	10

Class and Semester	:	**S. Y. B. Tech. (Mechanical Engineering), Part II, Semester IV**						
Course Title	:	**MATERIAL SCIENCE AND METALLURGY LABORATORY**				*Course Code*:	:	**ME227**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**				*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE** : **50** **EPE** : **Nil** **IOE** : **Nil** **EOE** : **50**				*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**First**				*Month*	:	**May 2017**

Pre-requisites **:** Laboratory work in Engineering Physics, Chemistry-I and Fluid Flow Operations.

Type of Course **:** Practical

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment, Internal Practical Examination and External Oral Examination

Course Objectives:

1. To evaluate mechanical properties through destructive testing.
2. To understand micro structural details of ferrous and non-ferrous materials.
3. To understand non-destructive testing methods.
4. To understand different heat treatment processes and hardenability test.
5. To know the basics of selection of materials and failure analysis.

Course Outcomes:

At the end of this course

1. Student will able to interpret properties on stress-strain diagram and able to select different hardness machine as per requirement.
2. Student will able to set process parameters for different heat treatment processes.
3. Student will able to understand basics of selection of materials and failure analysis
4. Student will able to select different NDT methods, depending on types of defects.

Practical List **: Any seven**

1. Study of effect of a heat treatment process on tensile strength of a sample, e.g. Mild steel.
2. Study of effect of a heat treatment process on hardness of a test sample, e.g. Mild steel.
3. Study of effect of a heat treatment process on Impact strength of a test sample, e.g. Mild Steel.
4. Non-Destructive tests: Magnaflux testing, Dye penetrant testing and Ultrasonic testing.
5. Study and drawing of microstructures of mild steel, medium carbon steel, eutectoid steel and hypereutectoid steel.
6. Study and drawing of microstructures of brass. Tin bronze, Al-bronze, Babbit metal.
7. Study and drawing of microstructures of white malleable, gray and nodular cast irons.
8. Study and drawing of microstructures of hardened steel, tempered steel.

Lab Manual **:**

- Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO-1	✓	✓		✓	✓		✓	✓		✓	✓		✓		
CO-2	✓	✓		✓	✓		✓	✓	✓	✓	✓			✓	
CO-3	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓
CO-4	✓			✓	✓		✓	✓		✓	✓		✓	✓	✓

Assessment Pattern

Skill Level	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Ex. 7	Ex. 8
1. Assembling								
2. Testing	✓	✓	✓	✓	✓	✓	✓	✓
3. Observing	✓	✓	✓	✓	✓	✓	✓	✓
4. Analyzing	✓	✓	✓	✓	✓	✓	✓	✓
5. Interpreting	✓	✓	✓	✓	✓	✓	✓	✓
6. Designing						✓	✓	✓
7. Creating						✓	✓	
8. Deducing	✓	✓	✓	✓	✓	✓	✓	✓
9. Concluding	✓	✓	✓	✓	✓	✓	✓	✓
C.A.	10	10	10	10	10	10	10	10

Class and Semester	:	**S. Y. B. Tech. (Mechanical Engineering), Part II, Semester IV**			
Course Title	:	**WORKSHOP PRACTICE – II**	*Course Code*:	:	**ME228**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**	*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE : Nil EPE : 50** **IOE : Nil EOE : Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**First**	*Month*	:	**May 2017**

Pre-requisites **:** Laboratory work in Engineering Physics, Chemistry-I and Fluid Flow Operations.

Type of Course **:** Practical

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment and External Practical Examination

Course Objectives:

1. To explain pattern and its types, material used, allowances.
2. To apply their skills for manufacturing the pattern from the given drawing.
3. To characterize the sand based on various properties, to enhance the skills in operations like pattern making, moulding.
4. To use machining skills to fabricate a job on various machining tools

Course Outcomes:

At the end of this course, student will able to

1. Conduct test on sand for size analysis, grain fineness number, hardness, permeability, moisture percentage, clay content etc.

2. Indentify the practical difficulties encountered in the process of sand testing and mould making.
3. Explain types, allowances and construction of pattern and core.
4. Use machining skills to fabricate a job on various machining tools.

Practical List **:**

1. Demonstration of various hand tools used in workshop
2. Visit to a factory to study the various foundry and foundry related operations
3. Fabrication of a job involving turning, drilling, milling and welding (One or two jobs)

Lab Manual **:**

- Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO-1	✓	✓	✓	✓	✓								✓	✓	✓
CO-2	✓	✓	✓		✓				✓		✓				✓
CO-3	✓	✓	✓		✓										✓
CO-4	✓	✓	✓	✓	✓				✓		✓			✓	✓

Assessment Pattern

Skill Level	Ex. 1	Ex. 2	Ex. 3
1. Assembling	✓	✓	✓
2. Testing	✓	✓	✓
3. Observing	✓	✓	✓
4. Analyzing	✓	✓	✓
5. Interpreting	✓	✓	✓
6. Designing			✓
7. Creating			✓
8. Deducing	✓		✓
9. Concluding	✓	✓	✓
C.A.	10	10	10

Class and Semester	:	**S. Y. B. Tech. (Mechanical Engineering), Part II, Semester IV**			
Course Title	:	**THEORY OF MACHINE – I LABORATORY**	*Course Code*:	:	**ME229**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**	*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE : Nil EPE : Nil** **IOE : Nil EOE : 50**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**First**	*Month*	:	**May 2017**

Pre-requisites **:** Laboratory work in Engineering Physics, and theory of machine.

Type of Course **:** Practical

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment and External Oral Examination

Course Objectives:

At the end of course student will able to

1. To draw velocity and acceleration diagram of mechanism
2. To draw cam and follower profiles
3. To calculate power using dynamometers
4. To explain principle and working of governors

Course Outcomes:

At the end of course student will able

1. To draw velocity and acceleration diagrams for different mechanisms.
2. To analyse hooks joint.
3. To draw cam follower profile for different applications.
4. To understand characteristics of governor.

Practical List **: Any seven**

A term work shall consist of report on the following.

1. One A3 size sheet of Velocity and acceleration problems by relative velocity and
2. acceleration method.
3. One A3 size sheet of problems on Instantaneous center method and Klein's construction.
4. Verification of ratio of angular velocities of shafts connected by Hooks joint.
5. Determination of M.I. by Bifilar suspension, Trifilar suspension, compound pendulum.
6. Synthesis of mechanism –Two position for slider crank and Three position for four bar Mechanism
7. One A3 size sheet of Problems on involute and cycloidal profile. (Minimum two problems)
8. Governor characteristics for Porter or Hartnell governor.

Lab Manual **:**

- Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Mapping of COs and POs (a to l) and PSOs (m,n,o)

Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO-1			✓		✓				✓			✓	✓		
CO-2	✓	✓								✓			✓		✓
CO-3			✓		✓				✓			✓	✓	✓	✓
CO-4	✓	✓								✓			✓		✓

Assessment Pattern

Skill Level	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Ex. 7	Ex. 8
1. Assembling	✓							
2. Testing					✓	✓	✓	
3. Observing	✓	✓	✓	✓				✓
4. Analyzing		✓	✓	✓	✓			✓
5. Interpreting		✓	✓	✓		✓	✓	✓
6. Designing		✓	✓	✓				✓
7. Creating								✓
8. Deducing		✓	✓	✓	✓	✓	✓	
9. Concluding		✓	✓	✓	✓	✓	✓	
C.A.	10	10	10	10	10	10	10	10

Class & Semester : **S. Y. B.Tech (Mechanical Engineering) Part II, Semester IV**

Course Title	:	**Environmental Studies Project Work**			*Course Code*:	:	**HS221**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x12= 24 hours**			*Credits*	:	**Nil**
Evaluation Scheme (Marks)	:	**IPE : 30** **IOE : Nil**	**EPE : Nil** **EOE : Nil**		*Duration of SEE for Theory part*	:	**2 hours** (SEE at the yearend)
Revision	:	**Third**			*Month*	:	**December 2016**

Pre-requisites **:** Knowledge of Engineering Mathematics, fundamentals of Physics and Chemistry

Type of Course **:** Filed work with necessary laboratory experimentation

Course Domain **:** Humanities and Applied Science

Skills Imbibed **:** Cognitive: Understand, Apply, Analyze, Evaluate, Create
Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:
Students Project/ field work assessment. However, their overall response during entire semester is also considered for evaluation.

Practical List **:**

Field work under the supervision of course coordinator.

Lab Manual **:**

Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow in case of use of related apparatus, equipment.

Class & Semester	:	**S. Y. B. Tech. (Mechanical Engineering), Part II, Semester IV**					
Course Title	:	**Soft Skills Development**				*Course Code*:	: **HS212**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**				*Credits*	: **Nil**
Evaluation Scheme (Marks)	:	**Assignments** : **50**	**Written Test** : **25**			*Duration of Exam*	: **Not Applicable**
		Viva voce : **25**	**Grand Total** : **100**				
Revision:	:	**First**				*Month*	: **May 2017**

Pre-requisites **:** H.S.C level English Language Competency

Type of Course **:** Audit Course at institute level

Course Domain **:** Humanity and Arts

: Cognitive: Understand, Predicting Situation, Comprehend,

Skills Imbibed Affective : Receive, Listen, Respond, Showing self reliance, Organize

Psychomotor: Imitation, adaptation, articulation, origination

Course Assessment Methods:

The students will be given five assignments each for 10 marks. At the end of the course, there will be a written test of 25 marks and a viva voce of 25 marks. There will be assessment for a total of 100 marks. Based on the marks obtained, they will be awarded with a grade similar to other credit courses. Though it is an audit course, obtaining passing grade is essential.

Course Objectives:

1. To develop effective communication skills (spoken and written).
2. To develop effective presentation skills.
3. To compete successfully in the business environment.
4. To generate ability in the learners to put their domain knowledge into effective practice.

5. To make the students self-confident individuals by mastering inter-personal skills, team management skills, and leadership skills..
6. To prepare the learners to take part effectively in various selection procedures adopted by the recruiters and to increase employment opportunities

Course Outcomes:

1. Students are able to expertise in self development, effective communication skills and interview skills
2. Understand how to handle situation and take decision
3. Equip to any sort of interviews particularly job interviews
4. Acquaintance with documentation skills
5. Become self reliant and responsible
6. Team build up, its development and management

Curriculum Content **Hours**

Unit I : Self Development **02**

Self analysis, creativity, attitude, motivation, goal setting. Importance of career visioning and planning.

Unit II : Effective Communication Skills **06**

Importance of communication, Communication process, Elements of communication, Communication Types-verbal and non verbal, objectives of communication. Business Communication, current English usage, debates, language games, situational dialogues, precise writing, essay writing, presentations.

Unit III : Behavioral Skills **08**

Psychological Tests: Aptitude and personality assessment, suggestions for improvement, **Team Skills:** Team building and leadership, evolution of groups into teams, group dynamics, emergence of leadership, intra-group dynamics, inter-group dynamics, conflict management, inter dependency, assessment of team-based projects, **Time Management:** Pareto's Principle, Parkinson's Laws, Murphy's Laws, Law of Clutter, prioritization, goal setting, effective time management, **Interpersonal Skills:** Negotiations, listening skills, social skills, assertive skills, cross-cultural communications, **Leadership Skills:** Concepts of leadership, leadership styles, insights from great leaders.

03

Unit II : Documentation

Report writing-Formal report, study tour report, project report, Writing proposal-solicited proposals and unsolicited proposals. **04**

Unit III: Emotional Intelligence

Emotional Brain, Nature of emotional intelligence, emotional intelligence applied windows of opportunity, emotional literacy. **03**

Unit VI: Interview Skills

Importance of Interview Skills, Resume Building, Group discussion and personal interview, Psychometric Test, actual career planning.

Text Book **:**

1. Soft Skills, 2015, Career Development Centre, Green Pearl Publications.

Reference Books **:**

1. "*Seven Habits of Highly Effective Teens"*, Covey Sean, New York, Fireside Publishers, 1998.

2. "*How to win Friends and Influence People"*, Carnegie Dale, New York: Simon & Schuster, 1998.

3. "*I am ok, You are ok "*,Thomas A Harris, New York-Harper and Row, 1972

4. "*Emotional Intelligence"*, Daniel Goleman, Bantam Book, 2006

5. "Effective communication skill", MTD training & Ventus publishing ApS ISBN 978-87-7681-598-1.