Department of Mechanical Engineering
Aravali Institute of Technical Studies, UDAIPUR

COURSE DESCRIPTION
Diploma in Mechanical
Academic Session 2021-2022

Affiliated with

BOARD OF TECHNICAL EDUCATION, RAJASTHAN
Government of Rajasthan

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Vision of Department of Mechanical Engineering

Towards a Global Knowledge Hub, striving continuously in pursuit of excellence in Mechanical Engineering Education, Entrepreneurship and Innovation.

Mission of Department of Mechanical Engineering

- To impart total quality education through effective hi-tech teaching-learning techniques and department-industries collaboration.
- To mold the young dynamic potential minds to emerge as full-fledged future professionals so as to achieve top ten ranking status in the national level.
- To achieve international standards to fulfill the Government's "Make In India" industrial policy through innovation and research.

Programme Educational Objectives (PEOs)

PEO-1- KNOWLEDGE: Mechanical engineering graduates have a strong foundation in engineering and use software tools to broaden their knowledge and promote lifelong learning in a variety of areas such as manufacturing, design, heat, industry, and related disciplines. You can develop core competencies in your field.
PEO-2- SKILLS: Graduates have effective communication, leadership, team building, problem solving, decision making, software and creative skills to understand current issues and contribute to overall personality and career development**..**
PEO-3- ATTITUDE: Graduates have ethical responsibilities and service to their colleagues, employers and society and follow these principles in their daily lives.
PEO-4- APPLICATIONS: Provides a solid foundation for engineering foundations for solving, analyzing and designing real-time engineering products**.**

PROGRAM SPECIFIC OUTCOMES (PSO's)

PSO1: Ability to challenge the start of an accessible business and address the complex technical iss identified in designing, heat, and creating related businesses with the target device.
PSO2: Ability to directly analyze and recover actual situations related to design using calculation methods and tools. You can work freely under research and mechanical conditions**.**
PSO3: The ability to intelligently incorporate information received both verbal and compound.

Programme Outcomes (POs)

A student will develop:

PO1: BASICS AND DISCIPLINE SPECIFIC KNOWLEDGE: An ability to apply knowledge of mathematics, science and engineering to the solution of complex engineering problems.
PO2: PROBLEM ANALYSIS: Ability to analyze and interpret data by designing and conducting experiments.
PO3:DESIGN/ DEVELOPMENT OF SOLUTION: An ability to Design a system component or process to meet desired needs within realistic constraints such as economic, environmental, political, health and safety, manufacturability and sustainability
PO4: ENGINEERING TOOLS, EXPERIMENTATIG: An ability to use the techniques, skills, software, equipment and modern engineering tools to analyze problems which are necessary for engineering practice.
PO5: THE ENGINEERING AND SOCIETY: Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context and prepare students who can participate and succeed in competitive examinations
PO6: PROJECT MANAGEMENT & FINANCE: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in team, to manage projects and in multidisciplinary environment.
PO7: LIFE-LONG LEARNING: confidence for self-education and ability for life-long learning in students.

SCHEME OF TEACHING AND EXAMINATION

Teaching and Examination

SEMESTER I SCHEME, SESSION 2020-2021 & ONWARDS

Subject Category	Subject Code.	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU	PR(S)		
BS	1001	Mathematics-I	3	2	0	5	60	3	--	--	20	20	--	100	5
BS	1002	Applied Physics-I	3	2	0	5	60	3	--	--	20	20	--	100	5
BS	1003	Applied Chemistry	3	2	0	5	60	3	--	--	20	20	--	100	5
HS	1004	Communication Skills in English	3	0	0	3	60	3	--	--	40	--	--	100	3
ES	1005	Engineering Graphics	0	0	4	4	--	--	40	3	--	--	60	100	2
ES	1006	Engineering Workshop Practice	0	0	4	4	--	--	40	3	--	--	60	100	2
BS	1007	Applied Physics-I Lab	0	0	2	2	--	--	40	3	--	--	60	100	1
BS	1008	Applied Chemistry Lab	0	0	2	2	--	--	40	3	--	--	60	100	1
HS	1009	Communication Skills in English-Lab	0	0	2	2	--	--	40	3	--	--	60	100	1
HS	1010	Sports & Yoga	0	0	2	2	--	--	--	--	--	--	100	100	1
VS	1011	**Anandam (Joy of Giving)**	--	--	**1**	**1**	--	--	--	--	--	--	**100**	**100**	**2**
		Students Centered Activities*	--	--	**1**	**1**	--	--	--	--	--	--	--	--	--
		Total	**12**	**6**	**18**	**36**	**240**	--	**200**		**100**	**60**	**400**	**1100**	**28**
													Grand Total :	**1100**	**28**

1. L : Lecture
2. T : Tutorial
3. P : Practical
4. TH : Marks for End Semester Exam for Theory
5. PR : Marks for End Semester Exam for Practical
6. CT : Marks for class tests (Internal Assessment)
7. TU : Marks for tutorials (Internal Assessment)
8. PR(S) : Marks for practical and viva (Internal Assessment)

BS: Basic Science, HS: Humanities Science, ES; Engineering Science VS: Value Studies Two weeks Induction Programme for students to be offered right at the start of First Semester.

Induction Programme includes 1. Creative Arts 2. Universal Human Values 3. Literary 4. Proficiency Modules 5. Lectures by Eminent Persons 6. Visits to City / Nearby Industries 7. Familiarization to Department / Branch / Exhibition room.**Anandam (Joy of Giving):** In addition to the practical of one hour every week, students will have to do activities at home and college after college hours.

*** Student Centered Activities include** 1. Expert lectures/ practice sessions on technical topics of common interest 2. Personality development 3. Human values

4. Industrial visits 5. Art of living 6. Environmental issues 7. Quiz programs 8. Interview techniques 9. Greening and cleaning of campus etc.

Semester

FOR DIPLOMA II SEMESTER (MECHANICAL ENGINEERING) (ME)
SEMESTER II SCHEME, SESSION 2020-2021 & ONWARDS

Subject Category	Subject Code.	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU	PR(S)		
BS	2001	Mathematics-II	3	2	0	5	60	3	--	--	20	20	--	100	5
BS	2002	Applied Physics-II	3	1	0	4	60	3	--	--	20	20	--	100	4
ES	2003	Introduction to IT Systems	3	0	0	3	60	3	--	--	40	--	--	100	3
ES	2004	Fundamentals of Electrical & Electronics Engineering	2	2	0	4	60	3	--	--	20	20	--	100	4
ES	2005	Engineering Mechanics	3	1	0	4	60	3	--	--	20	20	--	100	4
BS	2006	Applied Physics-II Lab	0	0	2	2	--	--	40	3	--	--	60	100	1
ES	2007	Introduction to IT Systems Lab	0	0	4	4	--	--	40	3	--	--	60	100	2
ES	2008	Fundamentals of Electrical & Electronics Engineering Lab	0	0	4	4	--	--	40	3	--	--	60	100	2
ES	2009	Engineering Mechanics Lab	0	0	2	2	--	--	40	3	--	--	60	100	1
AU	**2010	Environmental Sciences	2	0	0	2	--	--	--	--	--	--	--	--	0
VS	2011	**Anandam (Joy of Giving)**	--	--	**1**	**1**	--	--	--	--	--	--	**100**	**100**	**2**
		Students Centered Activities*	--	--	**1**	**1**	--	--	--	--	--	--	--	--	--
		Total	**16**	**6**	**14**	**36**	**300**	**--**	**160**		**120**	**80**	**240**	**1000**	**28**
													Grand Total :	**1000**	**28**

1. L : Lecture
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4. TH : Marks for End Semester Exam for Theory
5. PR : Marks for End Semester Exam for Practical
6. CT : Marks for class tests (Internal Assessment)
7. TU : Marks for tutorials (Internal Assessment)
8. PR(S) : Marks for practical and viva (Internal Assessment)

BS: Basic Science, HS: Humanities Science, ES: Engineering Science AU: Audit Course VS: Value Studies

Anandam (Joy of Giving): In addition to the practical of one hour every week, students will have to do activities at home and college after college hours.

*** Student Centered Activities include** 1. Expert lectures/ practice sessions on technical topics of common interest 2. Personality development 3. Human values 4. Industrial visits 5. Art of living 6. Environmental issues 7. Quiz programs 8. Interview techniques 9. Greening and cleaning of campus etc.

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

****2010 Environmental Sciences** is an Audit Course so will not be considered for Credit / CGPA.

NOTE: Students will go for one month (24 Working Days) Summer Internship in the Summer Vacations after Second Semester. The Assessment of the Summer Internship will be done in Third Semester.

Semester-

FOR DIPLOMA III SEMESTER (MECHANICAL ENGINEERING) (ME)
SEMESTER III SCHEME, SESSION 2020-2021 & ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs	PR	Hrs.	CT	TU/Assi	PR(S)		
PC	**ME 3001	Basic Mechanical Engineering	2	1	0	3	60	3	-	-	20	20	-	100	3
PC	*ME 3002	Material Science&Engineering	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	**ME 3003	Fluid Mechanics &Hydraulic Machinery	2	1	0	3	60	3	-	-	20	20	-	100	3
PC	*ME 3004	Manufacturing Engineering-I	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	ME 3005	Thermal Engineering-I	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	*ME 3006	Manufacturing Engineering –I Lab	0	0	2	2	-	-	40	3	-	-	60	100	1
PC	*ME 3007	Fluid Mechanics & Hydraulic Machinery Lab	0	0	2	2	-	-	40	3	-	-	60	100	1
PC	ME 3008	Thermal Engineering -I Lab	0	0	2	2	-	-	40	3	-	-	60	100	1
PC	*ME 3009	Computer Aided Machine Drawing Practice	0	0	4	4	-	-	40	3	-	-	60	100	2
SI	ME 3010	Summer Internship-I (4 weeks after II sem)	0	0	0	0	-	-	100	-	-	-	--	100	2
VS	+ME 3333	Anandam (Joy of Giving)	--	--	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	0	0	3	3	--	--	--	--	--	--	--	--	--
		Total	**13**	**2**	**14**	**29**	**300**	**--**	**260**	**--**	**100**	**100**	**340**	**1100**	**-**
													Grand Total :	**1100**	**24**

1. L : Lecture
2. T : Tutorial
3. P : Practical
4. TH : Marks for End Semester Exam for Theory
5. PR : Marks for End Semester Exam for Practical
6. CT : Marks for class tests (Internal Assessment)
7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment)
8. PR(S) : Marks for practical and viva (Internal Assessment)

*+ME 3333 is same in all branches of Engineering *ME 3002, *ME 3004, *ME 3006, *ME 3007 and *ME 3009 are same as *MA 3002, *MA 3004, *MA 3006, *MA 3007 and *MA 3009 respectively **ME 3001 and **ME 3003 are same as MA/MP 3001 and MA/MP 3003 respectively*

Anandam (Joy of Giving): In addition to the practical of one hour every week, students will have to do activities at home and college after college hours.

Student Centered Activities include 1. Expert lectures/ practice sessions on technical topics of common interest 2. Personality development 3. Human values 4. Industrialvisits 5. Art of living 6. Environmental issues 7. Quiz programs 8. Interview techniques 9. Greening and cleaning of campus 10. Disaster Management Techniches etc.

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

Semester-

FOR DIPLOMA IV SEMESTER (MECHANICAL ENGINEERING) (ME)
SEMSTER IV SCHEME , SESSION 2021-2022& ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU/Assi	PR(S)		
PC	*ME 4001	Measurements & Metrology	2	1	0	3	60	3	-	-	20	20	-	100	3
PC	**ME 4002	Strength of Materials	2	1	0	3	60	3	-	-	20	20	-	100	3
PC	ME 4003	Thermal Engineering-II	2	1	0	3	60	3	-	-	20	20	-	100	3
PE	ME 4004	**Programme Elective-I** **ME 40041-** Automobile Engineering ****ME 40042-** Material Handling Systems	3	0	0	3	60	3	-	-	20	20	-	100	3
PE	ME 4005	**Programme Elective-II** ***ME 40051-** Refrigeration & Air-conditioning **ME 40052-** Computer Integrated Manufacturing	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	*ME 4006	Material Testing lab	0	0	2	2	-	-	40	3		-	60	100	1
PC	*ME 4007	Measurement & Metrology Lab	0	0	2	2	-	-	40	3	-	-	60	100	1
PC	ME 4008	Thermal Engineering -II Lab	0	0	2	2	-	-	40	3	-	-	60	100	1
PR	ME 4009	Minor Project	0	0	4	4	-	-	40	--	-	-	60	100	2
AU	+ME 4222	Essence of Indian Knowledge and Tradition	2	0	0	2	--	--	--	--	--	--	--	--	--
VS	+ME 4444	Anandam (Joy of Giving)	--	--	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	0	0	3	3	--	--	--	--	--	--	--	--	--
		Total	**14**	**3**	**14**	**31**	**300**	**--**	**160**	**--**	**100**	**100**	**340**	**1000**	**22**
													Grand Total	**1000**	**22**

1. L : Lecture
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4. TH : Marks for End Semester Exam for Theory
5. PR : Marks for End Semester Exam for Practical
6. CT : Marks for class tests (Internal Assessment)
7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment)
8. PR(S) : Marks for practical and viva (Internal Assessment)

+ME4222 and +ME 4444 are same in all branches of Engineering *ME 4001, *ME 4006, *ME 4007and ME 40051 are same as *MA 4001, *MA 4006, *MA 4007, and MA 40051 are respectively **ME 4002 and **ME 40042- are same as MA/MP 4002 and MA/MP 40042 respectively.

Anandam (Joy of Giving): In addition to the practical of one hour every week, students will have to do activities at home and college after college hours.

Student Centered Activities include 1. Expert lectures/ practice sessions on technical topics of common interest 2. Personality development 3. Human values 4. Industrial visits 5. Art of living 6. Environmental issues 7. Quiz programs 8. Interview techniques 9. Greening and cleaning of campus 10. Disaster Management Techniches etc.

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.Students will go for 6 Weeks Summer Internship in the Summer Vacations after Fourth Semester. The assessment of the Summer Internship will be done in Fifth Semester

FOR DIPLOMA V SEMESTER (MECHANICAL ENGINEERING) (ME)
SEMESTER V SCHEME ,SESSION 2022-2023& ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU/Assi	PR(S)		
PC	*ME 5001	Advanced Manufacturing Processes	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	*ME 5002	Theory of Machines & Mechanisms	2	1	0	3	60	3	-	-	20	20	-	100	3
OE	+ME 5100	**Open Elective-I** +**ME 51001**- Economic Policies in India +**ME 51002**- Engineering Economics & Accountancy	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	**ME 5003	Industrial Engineering & Management	3	0	0	3	60	3	-	-	20	20	-	100	3
PE	ME 5004	**Programme Elective-III** ***ME 50041**- Power Plant Engineering **ME 50042**- Heat Transfer	3	0	0	3	60	3	-	-	20	20	-	100	3
PE	ME 5005	**Programme Elective-IV** **ME 50051**- Computer Aided Design and Manufacturing ***ME 50052**- Industrial Robotics & Automation	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	*ME 5006	CAD/CAM Lab	0	0	2	2	-	-	40	3	-	-	60	100	1
PC	*ME 5007	Manufacturing Engineering –II Lab	0	0	2	2			40	3			60	100	1
SI	ME 5008	Summer Internship-II(6 weeks after IV Sem)	0	0	0	0	-	-	100	-	-	-	--	100	3
PR	ME 5009	Major Project	0	0	2	2	-	-	--		-	-	--	-	--
VS	+ME 5555	Anandam (Joy of Giving)	0	0	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	**0**	**0**	**3**	**3**	--	--	--	--	--	--	--	--	0
		Total	**17**	**1**	**10**	**28**	**360**	**18**	**180**	**--**	**120**	**120**	**220**	**1000**	-
													Grand Total :	**1000**	**25**

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3. P : Practical
4. TH : Marks for End Semester Exam for Theory
5. PR : Marks for End Semester Exam for Practical
6. CT : Marks for class tests (Internal Assessment)
7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment)
8. PR(S) : Marks for practical and viva (Internal Assessment)

+ME 51001, +ME 51002 and +ME 5555 are same in all branches of Engineering *ME 5001, *ME 5002, *ME 5006, *ME 5007 ,*ME 50041 and *ME 50052 are same as *MA 5001, *MA 5002, *MA 5006, *MA 5007 ,*MA 50041 and *ME 50052 respectively **ME 5003 is same as MP 5003

Anandam (Joy of Giving): In addition to the practical of one hour every week, students will have to do activities at home and college after college hours.

Student Centered Activities include 1. Expert lectures/ practice sessions on technical topics of common interest 2. Personality development 3. Human values 4. Industrialvisits 5. Art of living 6. Environmental issues 7. Quiz programs 8. Interview techniques 9. Greening and cleaning of campus 10. Disaster Management Techniches etc.

FOR DIPLOMA VI SEMESTER (MECHANICAL ENGINEERING) (ME)
SEMESTER VI SCHEME ,SESSIONSESSION 2022-2023 & ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU/Assi	PR(S)		
PC	*ME 6001	Design of Machine Elements	2	1	0	3	60	3	-	-	20	20	-	100	3
HS	+ME 6111	Entrepreneurship and Start-ups	3	1	0	4	60	3	-	-	20	20	-	100	4
OE	+ME 6200	**Open Elective-II** +**ME 62001**- Project Management +**ME 62002**- Renewable Energy Technologies	3	0	0	3	60	3	-	-	20	20	-	100	3
OE	+ME 6300	**Open Elective-III** +**ME 63001**- Product Design +**ME 63002**- Disaster Management	3	0	0	3	60	3	-	-	20	20	-	100	3
AU	+ME 6333	Indian Constitution	2	0	0	2	--	--	--	--	--	--	--	--	--
PC	ME 6002	Production & Operations Management	3	0	0	3	60	3	-	-	20	20	-	100	3
PR	ME 6003	Major Project	0	0	6	6	-	-	40	-	-	-	60	100	4
SE	ME 6004	Seminar	1	0	0	1	-	-	--	-	-	-	100	100	1
VS	+ME 6666	Anandam (Joy of Giving)	0	0	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	0	0	3	3	--	--	--	--	--	--	--	-	-
		Total	**17**	**1**	**14**	**29**	**300**	**18**	**40**	**-**	**100**	**100**	**260**	**800**	23
													Grand Total	**800**	**23**

1. L : Lecture
2. T : Tutorial
3. P : Practical
4. TH : Marks for End Semester Exam for Theory
5. PR : Marks for End Semester Exam for Practical
6. CT : Marks for class tests (Internal Assessment)
7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment)
8. PR(S) : Marks for practical and viva (Internal Assessment)

+ME 6111, +ME 62001, +ME 62002, +ME 63001, +ME 63002, +ME 6333 and +ME 6666 are same in all branches of Engineering

****ME 6001 is same as MA 6001***

Anandam (Joy of Giving): In addition to the practical of one hour every week, students will have to do activities at home and college after college hours. **Student Centered Activities include** 1. Expert lectures/ practice sessions on technical topics of common interest 2. Personality development 3. Human values 4. Industrial visits 5. Art of living 6. Environmental issues 7. Quiz programs 8. Interview techniques 9. Greening and cleaning of campus 10. DisasterManagement Techniches etc. Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

Detailed Syllabus & Course Outcome

SEMESTER I

Mathematics-I

Course Code	1001
Course Title	Mathematics-I
Number of Credits	5 (L-3,T-2,P-0)
Prerequisites	None
Course Category	Basic Science

COURSE OBJECTIVES

This course is designed to give a comprehensive coverage at an introductory level to the subject of Trigonometry,
Differential Calculus, Complex Numbers and Basic elements of Algebra.

Course outcome	Details
CO1001.1	To determine Different Types of Expansion, Complex Number and problem based on these topic
CO1001.2	To learn Matrices and Determinants, Two Dimensional Coordinate Geometry and their mathematical problem and solutions
CO1001.3	To learn Conic, Function, Trigonometry functions and their uses in mathematical aspects in various field
CO1001.4	To determine and implement Differential Calculus, Integral Calculus in various field and their problem with solutions
CO1001.5	Differential Equations, Vector Algebra

UNIT	Syllabus
UNIT 1	**TRIGONOMETRY** **1.1 Concept of angles, measurement of angles in degrees, grades and radiance and their conversions.** **1.2 T-Ratios of Allied angles (without proof),Sum, difference formulae (without proof).** **1.3 Applications of Sum and difference formulae** **1.4 Product formulae (Transformation of product to sum, difference and vice versa).** **1.5 T- Ratios of multiple angles (2A, 3A).** **1.6 Graphs of sin x, cos x and tan x.**

UNIT 2	**DIFFERENTIAL CALCULUS** 2.1 Definition of function; Graphs of e^x, $\log x$ *and* $\|x\|$. 2.2 Concept of limits. standard limits $\lim_{x\to a}\frac{x^n-a^n}{x-a}$, $\lim_{x\to 0}\frac{\sin x}{x}$, $\lim_{x\to 0}\frac{a^x-1}{x}$ and $\lim_{x\to 0}(1+x)^{\frac{1}{x}}$ 2.3 Differentiation of trigonometric functions. 2.4 Differentiation of inverse trigonometric functions.
UNIT 3	**COMPLEX NUMBERS** **3.1 Definition, Real and imaginary parts of a Complex number.** **3.2 Addition, Subtraction, Multiplication and Division of a complex number** **3.3 Introduction of De-movier's theorem** **3.4 Application of De-movier's theorem**
UNIT 4	**PARTIAL FRACTIONS** **4.1 Definition of polynomial fraction, Proper & improper fractions.** **4.2 Definition of partial fractions.** **4.3 To resolve proper fraction into partial fraction with denominator containing Non-repeated linear factors** **4.4 To resolve proper fraction into partial fraction with denominator containing repeated linear factors.**
UNIT 5	**PERMUTATIONS, COMBINATIONSANDBINOMIAL THEOREM** **5.1 Value of nPr and nCr and formula-based problems.** **5.2 Problems based on General term.**

Text Books	
1	**REFERENCES:** **1. Applied Mathematics Dr. D.KS. Rewar ,Dr. S. K. Sharma, O.P. Baheti** **2. Applied Mathematics Dr. D.C. Gokhroo** **3. Polytechnic Mathematics H. K. Dass** **4. Text Book on Differential Calculus Chandrika Prasad** **5. Text Book on Integral Calculus Chandrika Prasad** **6. Differential Calculus M. Ray, S. S. Seth, & G. C. Sharma** **7. Integral Calculus M. Ray, S. S. Seth, & G. C. Sharma** **8. Calculus and Analytic Geometry B.S. Grewal,Khanna Publishers,New Delhi, 40th Edition, 2007** **9. Engineering Mathematics, Reena Garg, Khanna Publishing House, New Delhi(Revised Ed.2018)** **10. Engineering Mathematics V. Sundaram, R. Balasubramanian, K.A. Lakshminarayanan, , 6/e.,** **VikasPublishing House.** **11. Advanced Engineering Mathematics Reena Garg & Chandrika Prasad, , Khanna Publishing House, New** **Delhi**

APPLIED PHYSICS-I

Course Code	1002
Course Title	Applied Physics-I
Number of Credits	5 (L-3,T-2, P-0)
Prerequisites	None
Course Category	Basic Science

COURSE OBJECTIVES

Applied Physics includes the study of a large number of diverse topics all related to materials/things that exist in the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which such objects behave. Concrete use of physical principles and analysis in various fields of engineering and technology are given prominence in the course content. The course will help the diploma engineers to apply the basic concepts and principles to solve broad-based engineering problems and to understand different technology based applications.

Course outcome	Details
CO1002.1	**To understand Units and Dimensions of various physical quantities, Modern Physics and their uses in daily life**
CO1002.2	**To determine various kind of properties of materials like Elasticity, Properties of Liquids, Transfer of Heat, Electrostatics and their uses**
CO1002.3	**To understand the effect of Gravitation on various kind of object & study about Satellites and their uses in science world and technology**
CO1002.4	**To learn about Simple Harmonic Motion and Sound Waves of various types of object, Pollution and its controlling object and their effect in normal human life**
CO1002.5	**To study abiout D.C. Circuits, A.C.Circuits, Basic Electronics element in normal life and their uses**

UNIT	Syllabus
UNIT 1	**PHYSICAL WORLD, UNITS AND MEASUREMENTS** **1.1 Physical quantities** **1.1.1 Fundamental and derived** **1.1.2 Dimensions and dimensional formulae of physical quantities** **1.1.3 Principle of homogeneity of dimensions** **1.2 Measurements** **1.2.1 Measuring instruments, least count** **1.2.2 Types of measurement (direct, indirect)** **1.3 Errors in measurements (systematic and random)** **1.3.1 Absolute error**

	1.3.2 Relative error **1.3.3 Significant figures.**
UNIT 2	**2. FORCE WORK AND ENERGY** **2.1 Force, Momentum- Statement and derivation of conservation of linear momentum** **2.2 Applications such as recoil of gun, rockets** **2.3 Work Concept and units** **2.3.1 Examples of zero work, positive work and negative work** **2.4 Energy and its units** **2.4.1 Kinetic energy, Gravitational potential energy, and Mechanical energy** **2.5 Conservation of mechanical energy for freely falling bodies** **2.6 Power and its units** **2.6.1 Power and work relationship** **2.6.2 Calculation of power (numerical problems)**
UNIT 3	**3. ROTATIONAL MOTION** **3.1 Circular motion** **3.1.1 Definition of angular displacement** **3.1.2 Angular velocity, angular acceleration, frequency and time period** **3.2 Centripetal and Centrifugal forces with live examples**
UNIT 4	**4. PROPERTIES OF MATTER** **4.1 Elasticity** **4.1.1 Definition of Stress and Strain** **4.1.2 Hooke's law and** **4.2 Modulus of elasticity, Significance of stress-strain curve** **4.3 Pressure** **4.3.1 Definition, units** **4.3.2 Atmospheric pressure, gauge pressure, absolute Pressure** **4.4 Surface tension** **4.4.1 Cohesive and adhesive forces** **4.4.2 Angle of contact** **4.5 Applications of surface tension** **4.6 Effect of temperature and impurity on surface tension**
UNIT 5	**5. HEAT AND THERMOMETRY** **5.1 Concept of heat and temperature** **5.2 Modes of heat transfer with examples (Conduction, Convection and Radiation)** **5.3 Newton's law of cooling** **5.4 Scales of temperature and their relationship** **5.5 Types of Thermometer (Mercury, Platinum resistance thermometer, Pyrometer) and their uses**

Text Books	
1	**REFERENCES** **1. Text Book of Physics for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi** **2. Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi.** **3. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi** **4. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi** **5. 5 . Engineering Physics by DK Bhhatacharya&PoonamTandan; Oxford University Press, New Delhi.** **6. Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi** **7. Practical Physics by C. L. Arora, S. Chand Publication.** **8. e-books/e-tools/ learning physics software/websites etc.** **9. Engineering Physics by Gaur & Gupta.** **10. Engineering Physics by S.L. Kakani& S. Kakani** **11. Applied Physics Vol.-I by Hari Harlal, NITTTR** **12. Applied Physics Vol.-II by Hari Harlal, NITTTR** **13. A Text Book of Applied Physics by N.S. Kumar** **14. Principles of Physics by Brijlal, Subhramanyam**

APPLIED CHEMISTRY

Course Code	BS 1003
Course Title	Applied Chemistry
Number of Credits	5 (L-3,T-2, P-0)
Prerequisites	None
Course Category	Basic Science

COURSE OBJECTIVES

There are numerous number materials are used in fabricating and manufacturing devices for the comfort of life. The selection, characterization and suitability assessment of natural raw materials essentially requires principles and concepts of Applied Chemistry for technicians. On successful completion of this course content will enable technicians to understand, ascertain and analyse and properties of natural raw materials require for producing economical and eco- friendly finished products.

1. Solve various engineering problems applying the basic knowledge of atomic structure and chemical bonding.
2. Use relevant water treatment method to solve domestic and industrial problems.
3. Solve the engineering problems using knowledge of engineering materials and properties.
4. Use relevant fuel and lubricants for domestic and industrial applications
5. Solve the engineering problems using concept of Electro chemistry and corrosion.

Course outcome	Details
CO1003.1	**Understand the classification and general properties of engineering materials such as metal, alloys, glasses,cement, refractory and composite materials using knowledge of chemical bonding.**
CO1003.2	**Understand and assess the suitability of water source for domestic and industrial application, effluents and minimize water pollution.**
CO1003.3	**Qualitatively analyze the engineering materials and understand their properties and applications.**
CO1003.4	**Choose fuel and lubricants suitable for economical industrial processing to obtain eco-friendly finished products.**
CO1003.5	**Ascertain construction, mechanism efficiency of electrochemical cells, solar cell fuel cells**

UNIT	Syllabus
UNIT 1	**Atomic Structure, Chemical Bonding and Solutions:** **Hydrogen spectrum explanation based on Bohr's model of atom** **Heisenberg uncertainty principle** **Quantum numbers – Principal Quantum Numbers, azimuthal Quantum Numbers, Magnetic Quantum Numbers, Spin Quantum Numbers orbital concept with shape of orbitals**

	Aufbau rule, Electronic configuration. **Solution–idea of solute, solvent and solution, methods to express the concentration of solution- molarity (M = mole per litre), normality, molality, ppm, mass percentage, volume percentage, mole fraction and PH.**
UNIT 2	**WATER** **2.1 Classification of soft and hard water based on soap test** **2.2 Problems caused by the use of hard water in boiler (scale and sludge, foaming and priming, corrosion** **etc)** **2.3 Water softening techniques** **2.3.1 Soda lime process** **2.3.2 Zeolite process** **2.4 Municipal water treatment (in brief only)** **2.4.1 Sedimentation** **2.4.2 Coagulation** **2.4.3 Filtration** **2.4.4 Sterilization.**
UNIT 3	**ENGINEERING MATERIALS** **3.1 Natural occurrence of metals** **3.1.1 Minerals** **3.1.2 Ores of iron, aluminium and copper** **3.1.3 Gangue (matrix)** **3.1.4 Flux** **3.1.5 Slag** **3.1.6 Metallurgy - brief account of general principles of metallurgy.** **3.2 Portland cement and hardening** **3.3 Glasses** **3.4 Refractory** **3.5 Rubber _Natural Rubber, Vulcanization of rubber**
UNIT 4	**CHEMISTRY OF FUELS AND LUBRICANTS** **4.1 Definition of fuel** **4.1.1 Combustion of fuel,** **4.1.2 Classification of fuels** **4.1.3 Calorific values (HCV and LCV)** **4.1.4 Calculation of HCV and LCV using Dulong's formula** **4.2 petrol and diesel - fuel rating (octane and cetane numbers)** **4.3 Chemical properties of lubricants** **4.3.1.1 Coke number,** **4.3.1.2 Total acid number** **4.3.1.3 Saponification value**
UNIT 5	**ELECTRO CHEMISTRY** **5.1 Faradays laws of electrolysis, Simple numerical problems.** **5.2 Introduction to Corrosion of metals –** **5.2.1 Definition** **5.2.2 Types of corrosion (chemical and electrochemical)** **5.3 H2 liberation and O2 absorption mechanism of electrochemical corrosion** **5.4 Factors affecting rate of corrosion**

	5.5 Internal corrosion preventive measures – **Purification** **Alloying** **Heat treatment** **5.6 External corrosion preventive measuresmetal** **(anodic, cathodic) coatings** **organic inhibitors.**

Text Books	
1	**REFERENCES** **1. Text Book of Chemistry for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi, 2017-18.** **2. Agarwal, & Shikha, Engineering Chemistry, Cambridge University Press; New Delhi, 2015.** **3. C.N.R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.** **4. Dara, S. S. &Dr.S.S.Umare, Engineering Chemistry, S.Chand. Publication, New Delhi, 2015.** **5. Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi, 2015.** **6. Dr.Vairam, S., Engineering Chemistry, Wiley India Pvt. Ltd., New Delhi, 2013.** **7. Dr. G.H. Hugar& Prof A.N. Pathak, Applied Chemistry Laboratory Practices, Vol. I and Vol. II, NITTTR,** **Chandigarh, Publications, 2013-14.** **8. Agnihotri, Rajesh, Chemistry for Engineers, Wiley India Pvt. Ltd., 20**

COMMUNICATION SKILLS IN ENGLISH

Course Code	1004
Course Title	Communication Skills in English
Number of Credits	3 (L-3,T-0, P-0)
Prerequisites	None
Course Category	Humanities & Science

COURSE OBJECTIVES

Communication skills play an important role in career development. This course aims at introducing basic concepts of communication skills with an emphasis on developing personality of the students. Thus, the main objectives of this courseare:

1. To develop confidence in speaking English with correct pronunciation.
2. To develop communication skills of the students i.e. listening, speaking, reading and writing skills.
3. To introduce the need for personality development- focus will be on developing certain qualities which will aid students in handling personal and career challenges, leadership skills etc.

Course outcome	Details
CO1004.1	**Develop basic speaking and writing skills including proper usage of language and vocabulary so that they can become highly confident and skilled speakers and writers.**
CO1004.2	**Be informed of the latest trends in basic verbal activities such as presentations, facing interviews and other forms of oral communication.**
CO1004.3	**Also develop skills of group presentation and communication in team.**
CO1004.4	**Develop non-verbal communication such as proper use of body language and gestures**

UNIT	Syllabus
UNIT 1	**COMMUNICATION THEORY AND PRACTICE** **1.1 Basics of Communication: -** **1.1.1 Introduction** **1.1.2 Meaning and Definition** **1.1.3 Process of Communication** **1.2 Types of Communication: -** **1.2.1 Formal and Informal** **1.2.2 Verbal and Non-verbal** **1.3 Art of Effective Communication** **1.3.1 Choosing Words** **1.3.2 Voice and Modulation** **1.3.3 Framing of questions and answers**

UNIT 2	**SOFT SKILLS FOR PROFESSIONAL EXCELLENCE** **2.1 Introduction: Soft Skills and Hard Skills.** **2.2 Applying Soft Skills across Cultures.**
UNIT 3	**READING COMPREHENSION** **Comprehension, vocabulary enhancement and grammar exercises based on reading of the following texts:** **3.1 "The Blind Dog" (a story from Malgudi Days) by R.K. Narayan** **"The Gift of the Magi" (story) by O. Henry** **3.2 "If" (poem) by Rudyard Kipling** **"Where the Mind is Without Fear" (poem) by Rabindranath Tagore**
UNIT 4	**PROFESSIONAL WRITING** **4.1 Letters: Formal letters** **4.2 Job Application with CV** **4.3 Drafting E-mail and Notice**
UNIT 5	**VOCABULARY AND GRAMMAR** **5.1 Types of Sentences with correct form of the verb** **5.2 Active and Passive Voice** **5.3 Modals (may, might, can, could, would, should, ought to, will, shall, must)**

Text Books	
1	**1. Lindley Murray. An English Grammar: Comprehending Principles and Rules. London: Wilson and Sons, 1908.** **2. 2. Kulbhushan Kumar, Effective Communication Skills, Khanna Publishing House, New Delhi (Revised Edition** **2018)** **3. Margaret M. Maison. Examine your English. Orient Longman: New Delhi, 1964.** **4. M. Ashraf Rizvi. Effective Technical Communication. Mc-Graw Hill: Delhi, 2002.** **5. John Nielson. Effective Communication Skills. Xlibris, 2008.** **6. Oxford Dictionary** **7. Collin's English Dictionary** **8. Roget's Thesaurus of English Words and Phrases**

ENGINEERING GRAPHICS

Course Code	1005
Course Title	Engineering Graphics
Number of Credits	2 (L-0,T-0, P-4)
Prerequisites	None
Course Category	Engineering Science

COURSE OBJECTIVES

1. To understand the language of graphics which is used to express ideas, convey instructions while carrying outengineering jobs.
2. To develop drafting and sketching skills, to know the applications of drawing equipments, and get familiarize withIndian Standards related to engineering drawings.
3. To develop skills to visualize actual object or a part of it, on the basis of drawings.
4. To develop skills to translate ideas into sketches and to draw and read various engineering curves, projections anddimensioning styles.
5. To understand the basic commands and develop basic skills related to computer aided drafting, of how to draw, modify, and edit basic shapes (2D), using AUTOCAD.

Course outcome	Details
CO1005.1	Select and construct appropriate drawing scales, use drawing equipment's, and understand Indian Standards of engineering drawing
CO1005.2	Draw views of given object and components
CO1005.3	Sketch orthographic projections into isometric projections and vice versa.
CO1005.4	Apply computer aided drafting tools to create 2D engineering drawings

UNIT	Syllabus
UNIT 1	BASIC ELEMENTS OF DRAWING 1.1 Drawing Instruments and supporting materials: method to use them with applications. 1.2 Convention of lines and their applications. 1.3 Representative Fractions – reduced, enlarged and full size scales 1.4 Engineering Scales such as plain and diagonal scale. 1.5 Dimensioning techniques as per SP-46:2003. 1.6 Geometrical and Tangency constructions. (Redraw the figure)
UNIT 2	ORTHOGRAPHIC PROJECTIONS 2.1 Introduction of projections-orthographic, perspective, isometric and oblique 2.1.1 Concept and applications. (No question to be asked in examination). 2.2 Introduction to orthographic projection

	2.2.1 First angle and Third angle method, their symbols. **2.3 Conversion of pictorial view into Orthographic Views –** **2.3.1 object containing plain surfaces,** **2.3.2 Slanting surfaces,** **2.3.3 Slots,** **2.3.4 Ribs,** **2.3.5 Cylindrical surfaces. (Use First Angle Projection method only)**
UNIT 3	**ISOMETRIC PROJECTIONS** **3.1 Introduction to isometric projections.** **3.2 Isometric scale and Natural scale.** **3.3 Isometric view and isometric projection.** **3.4 Illustrative problems related to objects containing lines, circles and arcs shape only.**
UNIT 4	**FREE HAND SKETCHES OF ENGINEERING ELEMENTS** **4.1 Free hand sketches of machine elements:** **4.1.1 Thread profiles** **4.1.2 Nuts** **4.1.3 Bolts** **4.1.4 Studs** **4.1.5 Set screws** **4.1.6 Washer** **4.1.7 Locking arrangements** **4.2 Free hand sketches of orthographic view (on squared graph paper)** **4.3 Free hand sketches of isometric view (on isometric grid paper)**
UNIT 5	**COMPUTER AIDED DRAFTING INTERFACE** **5.1 Computer Aided Drafting** **5.1.1 Concept** **5.1.2 Hardware and various CAD software available** **5.1.3 System requirements and Understanding the interface** **5.2 Components of AutoCAD software window:** **5.2.1 Title bar** **5.2.2 Standard tool bar** **5.2.3 Menu bar** **5.2.4 Object properties tool bar** **5.2.5 Draw tool bar** **5.2.6 Modify tool bar** **5.2.7 Cursor cross hair** **5.2.8 Command window** **5.2.9 Status bar** **5.2.10 drawing area** **5.2.11 UCS icon** **5.3 File features:-** **5.3.1 New file** **5.3.2 Saving the file** **5.3.3 Opening an existing drawing file** **5.3.4 Creating templates** **5.3.5 Quit** **5.4 Setting up new drawing:-**

	5.4.1 Units **5.4.2 Limits** **5.4.3 Grid** **5.4.4 Snap** **5.4.5 Undoing and redoing action.**
UNIT 6	**COMPUTER AIDED DRAFTING** **6.1 Draw basic entities like Line, Circle, Arc, Polygon, Ellipse, Rectangle, Multiline, PolyLine** **6.2 Method of specifying points: Absolute coordinates, Relative Cartesian and Polar coordinates.** **6.3 Modify and edit commands like trim, extend, delete, copy, offset, array, block, layers.** **6.4 Dimensioning: Linear, Horizontal Vertical, Aligned, Rotated, Baseline, Continuous, Diameter, Radius,** **Angular Dimensions** **6.5 Dim scale variable.** **6.6 Editing dimensions.** **6.7 Text: Single line Text, Multiline text.** **6.8 Standard sizes of sheet.** **6.9 Selecting various plotting parameters such as Paper size, paper units, Drawing orientation, plot scale, plot** **offset, plot area, print preview.**

Text Books	
1	**1. Bureau of Indian Standards. Engineering Drawing Practice for Schools and Colleges IS: Sp-46. BIS. Government** **of India, Third Reprint, October 1998; ISBN: 81-7061-091-2.** **2. Bhatt, N. D. Engineering Drawing. Charotar Publishing House, Anand, Gujrat 2010; ISBN: 978-93- 80358-17-8.** **3. Jain & Gautam, Engineering Graphics & Design, Khanna Publishing House, New Delhi (ISBN: 978- 93-86173-** **478)** **4. Jolhe, D. A. Engineering Drawing. Tata McGraw Hill Edu. New Delhi, 2010; ISBN: 978-0-07- 064837-1** **5. Dhawan, R. K. Engineering Drawing. S. Chand and Company, New Delhi; ISBN: 81-219-1431-0.** **6. Shah, P. J. Engineering Drawing. S. Chand and Company, New Delhi, 2008, ISBN:81-219-2964-4.** **7. Kulkarni, D. M.; Rastogi, A. P.; Sarkar, A. K. Engineering Graphics with AutoCAD. PHI Learning Private** **Limited-New Delhi (2010); ISBN: 978-8120337831.** **8. 8.Jeyapoovan, T. Essentials of Engineering Drawing and Graphics using AutoCAD. Vikas Publishing HousePvt.** **Ltd, Noida, 2011; ISBN: 978-8125953005.** **9. Autodesk. AutoCAD User Guide. Autodesk Press, USA, 2015. 10. Sham, Tickoo. AutoCAD 2016 for Engineers** **and Designers. Dreamtech Press; Galgotia Publication, New Delhi, 2015; ISBN 978-**

	9351199113. **10. Gill P.S., Machine Drawing, SK Kataria& Sons, New Delhi** **11. Laxminarayan & Mathur M.L., A text book of Machine Drawing , Jain Brother, New Delhi** **12. Goyal B. K., Engineering Drawing (Hindi), Asian Publishers, Muzaffarnagar** Software/LearninG Websites 1. https://www.youtube.com/watch?v=TJ4jGyD-WCw 2. https://www.youtube.com/watch?v=dmt6_n7Sgcg 3. https://www.youtube.com/watch?v=_MQScnLXL0M 4. https://www.youtube.com/watch?v=3WXPanCq9LI 5. https://www.youtube.com/watch?v=fvjk7PlxAuo 6. http://www.me.umn.edu/coursesme2011/handouts/engg%20graphics.pdf 7. https://www.machinedesignonline.com

ENGINEERING WORKSHOP PRACTICE

Course Code	1006
Course Title	Engineering Workshop Practice
Number of Credits	2 (L-0,T-0, P-4)
Prerequisites	None
Course Category	Engineering Science

COURSE OBJECTIVES

1. To understand basic engineering processes for manufacturing and assembly.
2. To understand, identify, select and use various marking, measuring, and holding, striking and cutting tools andequipments.
3. To understand and interpret job drawings, produce jobs, and inspect the job for specified dimensions.
4. To understand, operate, control different machines and equipment's adopting safety practices

Course outcome	Details
CO1006.1	**Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking and cutting tools & equipment's and machines**
CO1006.2	**Understand job drawing and complete jobs as per specifications in allotted time**
CO1006.3	**Inspect the job for the desired dimensions and shape**
CO1006.4	**Operate, control different machines and equipment's adopting safety practices**

UNIT	Syllabus
UNIT 1	**1.1 CARPENTRY** **1.2 Demonstration of different wood working tools / machines.** **1.3 Demonstration of different wood working processes, like plaining, marking, chiseling, grooving, turning ofwood etc.** **1.4 One simple job involving any one joint like mortise and tenon, dovetail, bridle and half lap.**
UNIT 2	**FITTING** **2.1 Demonstration of different fitting tools and drilling machines and power tools** **2.2 Demonstration of different operations like filing, drilling, tapping, sawing, cutting etc.** **2.3 One simple fitting job involving practice of cutting, filing, marking, hacksawing, drilling, tapping, etc.**

UNIT 3	**WELDING** **3.1 Demonstration of different welding tools / machines.** **3.2 Demonstration on Arc Welding, Gas Welding, MIG welding, gas cutting and rebuilding of broken parts with welding.** **3.3 One simple job involving butt and lap joint using electric arc welding.**
UNIT 4	**SHEET METAL WORKING** **4.1 Demonstration of different sheet metal tools / machines.** **4.2 Demonstration of different sheet metal operations like sheet cutting, bending, edging, end curling, lancing, soldering, brazing, and riveting.** **4.3 One simple job involving sheet metal operations,soldering and riveting.**
UNIT 5	**PLUMBING** **5.1 Demonstration of different plumbing tools, accessories, valves and different pipe fittings and joints (GI and PVC).** **5.2 Demonstration of different plumbing operations like cutting, threading, pipe fitting (GI and PVC).** **5.3 One simple job involving pipecutting and external thread cutting on GI pipe.**

Text Books	
1	**1. S.K. Hajara Chaudhary, Workshop Technology, Media Promoters and Publishers, New Delhi, 2015** **2. B.S. Raghuwanshi, Workshop Technology, Dhanpat Rai and sons, New Delhi 2014** **3. K. Venkat Reddy, Workshop Practice Manual, BS Publications, Hyderabad 2014** **4. Kents Mechanical Engineering Hand book, John Wiley and Sons, New York** **5. Roop Lal and Bharadwaj P. K., PrarambhikKaryashalaTakneeki (Hindi), Vayu Education of India, New Delhi**

APPLIED PHYSICS-I LAB

Course Code	1007
Course Title	Applied Physics-I Lab
Number of Credits	1 (L-0,T-0, P-2)
Prerequisites	None
Course Category	Basic Science

COURSE OBJECTIVES

Study of Applied Physics aims to give an understanding of physical world by observations and predictions. Concrete use of physical principles and analysis in various fields of engineering and technology is very prominence. The course aims to supplement the factual knowledge gained in the lecture by first hand manipulation of apparatus. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering and technology based problems. In addition, students get necessary confidence in handling equipment and thus learn various skills in measurement.

Course outcome	Details
CO1007.1	**Select right kind of measuring tools (Meter scale, Vernier caliper, Screw gauge, Spherometer etc.) for determining dimensions of physical quantities and make measurements with accuracy and precision**
CO1007.2	**Differentiate various shapes and determine dimensions of plane, curved and regular surfaces/bodies. Apply and Verify laws of forces and determine resultant force acting on a body**
CO1007.3	**Appreciate role of friction and measure co-efficient of friction between different surfaces.**
CO1007.4	**Describe and verify Hook's law and determine force constant of spring body.**
CO1007.5	**Understand Stoke's law for viscous liquids and determine viscosity of a given liquid.**

UNIT	Syllabus
	LIST OF PRACTICALS/ACTIVITIES(Minimum 8 practicals must be performed) **1. To measure length, radius of a given cylinder, a test tube and a beaker using a Vernier caliper and find volume of each object.** **2. To determine diameter of a wire, a solid ball and thickness of cardboard using a screw gauge.** **3. To determine radius of curvature of a convex and a concave mirror/surface using a Spherometer.**

	4. To verify triangle and parallelogram law of forces. **5. To find the co-efficient of friction between wood and glass using a horizontal board.** **6. To determine force constant of a spring using Hook's Law.** **7. To verify law of conservation of mechanical energy (PE to KE).** **8. To find the viscosity of a given liquid (Glycerin) by Stoke's law.** **9. To measure room temperature and temperature of a hot bath using mercury thermometer and convert it intodifferent scales.** **10. To verify Newton's law of cooling.** **SUGGESTED STUDENT ACTIVITES & STRATEGIES** **Apart from classroom and laboratory learning following are the suggested student related activities which can be undertaken to accelerate the attainment of various outcomes of the course** **1. Survey of different physical products and comparison on the basis of the following points** **1.1. Measurements of dimensions** **1.2. Properties** **1.3. Applications** **2. Library survey regarding engineering materials/products used in different industries** **3. Seminar on any relevant topic.** **Teachers should use the following strategies to achieve the various outcomes of the course.** **1. Different methods of teaching and media to be used to attain classroom attention.** **2. Massive open online courses (MOOCs) may be used to teach various topics/sub topics.** **3. 15-20% of the topics which are relatively simpler of descriptive in nature should be given to the students for selflearning** **and assess the development of competency through classroom presentations.** **4. Micro-projects may be given to group of students for hand-on experiences.**

Text Books	
1	**REFERENCES:** **1. Text Book of Physics for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi** **2. Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P)Ltd.,** **3. Practical Physics by C. L. Arora, S. Chand Publication.** **4. e-books/e-tools/ learning physics software/YouTube videos/websites etc.**

APPLIED CHEMISTRY LAB

Course Code	1008
Course Title	Applied Chemistry Lab
Number of Credits	1 (L-0,T-0, P-2)
Prerequisites	None
Course Category	Basic Science

COURSE OBJECTIVES

There are numerous number of materials used in fabricating and manufacturing devices for the comfort of life. The selection, characterization and suitability assessment of natural raw materials essentially requires principles and concepts of Applied Chemistry for technicians. The course aims to supplement the factual knowledge gained in the lectures by first hand manipulation of processes and apparatus. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering problems.

Course outcome	Details
CO1008.1	To express quantitative measurements accurately.
CO1008.2	To practice and adapt good measuring techniques.
CO1008.3	To use various apparatus for precise measurements.
CO1008.4	To understand and differentiate different methods of quantitative analysis.
CO1008.5	To know and understand principles of quantitative analysis using instruments.

UNIT	Syllabus
	LIST OF PRACTICALS/ACTIVITIES (Minimum 10 practicals must be performed) **Perform any 10 (ten) Laboratory Practical's.** **VOLUMETRIC AND GRAVIMETRIC ANALYSIS:** **1. Identification of Acid and Basic Radicals in a salt.** **2. Preparation of standard solution of oxalic acid or potassium permanganate.**

	3. To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator. **4. To determine the strength of Ferrous Sulphate using standard Ferrous Ammonium Sulphate and Potassium Dichromate as intermediate solution.** **5. To determine ofstrength of Hydrochloric acid solution by titrating against sodium hydroxide using methyl orangeindicator.** **6. Volumetric estimation of total acid number (TAN) of given oil.** **7. Volumetric estimation of** **a) Total hardness of given water sample using standard EDTA solution.** **b) Alkalinity of given water sample using 0.01M sulphuric acid** **8. Proximate analysis of coal** **a) Gravimetric estimation moisture in given coal sample** **b) Gravimetric estimation ash in given coal sample** **INSTRUMENTAL ANALYSIS** **9. Determine the conductivity of given water sample.** **10. Determination of the Iron content in given cement sample using colorimeter.** **11. Determination of calorific value of solid or liquid fuel using bomb calorimeter.** **12. Determination of viscosity of lubricating oil using Redwood viscometer.** **13. Determination of flash and fire point of lubricating oil using Able's flash point apparatus.** **14. To verify the first law of electrolysis of copper sulphate using copper electrode.** **15. Construction and measurement of emf of electrochemical cell (Daniel cell).** **16. Determination of PH values of given samples using digital PH meter.** **17. Determination of melting point and boiling point of compounds using Thiele tube method.** **Teachers should use the following strategies to achieve the various outcomes of the course.** **1. Different methods of teaching and media to be used to attain classroom attention.** **2. Massive open online courses (MOOCs) may be used to teach various topics/sub topics.** **3. 15-20% of the topics which are relatively simpler of descriptive in nature should be given to the students for selflearning and assess the development of competency through classroom presentations.** **4. Micro-projects may be given to group of students for hand-on experiences** **5. Encouraging students to visit to sites such as Railway station and research establishment around the institution.**

Text Books	
1	**1. Text Book of Chemistry for Class XI & XII (Part-I, Part-II); N.C.E.R.T., Delhi, 2017-18.** **2. Dr.G.H.Hugar and Prof A. N. Pathak, Applied Chemistry Laboratory Practices, Vol. I and Vol. II, NITTTR, Chandigarh, Publications, 2013-14.** **3. Agnihotri, Rajesh, Chemistry for Engineers, Wiley India Pvt.Ltd. 2014.** **4. Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi, 2015.**

COMMUNICATION SKILLS IN ENGLISH - LAB

Course Code	1009
Course Title	Communication Skills in English – Lab
Number of Credits	1 (L-0,T-0, P-2)
Prerequisites	None
Course Category	Humanities & Science

COURSE OBJECTIVES

Communication skills play an important role in career development. This lab course aims at actively involving students in various activities to improve their communication skills with an emphasis on developing personality of the students. Thus, the objectives of this course are:

1. To develop listening skills for enhancing communication.
2. To develop speaking skills with a focus on correct pronunciation and fluency.
3. To introduce the need for personality development- focus will be on developing certain qualities which willaid students in handling personal and career challenges, leadership skills etc. for that purpose groupdiscussion, extempore and other activities should be conducted during lab classes.

Course outcome	Details
CO1009.1	**To communicate effectively with an increase in their confidence to read, write and speak English fluently.**
CO1009.2	**They will also demonstrate a significant increase in word power.**
CO1009.3	**The variety of exercises and activities that will be conducted in the Language Lab will develop their skills needed to participate in a conversation like listening carefully and respectfully to others' viewpoints; articulating their own ideas and questions clearly and over all students will be able to prepare, organize, and deliver an engaging oral presentation.** **They will also develop non-verbal communication such as proper use of body language and gestures.**

UNIT	Syllabus
	1. LISTENING SKILLS **1.1 Listening Process and Practice** **1.2 Listening to Recorded Lectures / Dialogues / Poems / Interviews and Speeches etc.** **2. INTRODUCTION TO PHONETICS** **2.1 Sounds: - Consonants, Vowels (Monophthongs and Diphthongs)** **2.2 Transcription of Words (IPA), Syllable Division and Word Stress** **3. SPEAKING SKILLS** **3.1 Formal Speech and Public Speaking** **3.2 Presentation Skills** **3.3 Conversation Practices in various situations such as asking address, enquiries and at places such as retail shop, service centre, bank, customer care, etc. (role-play based)** **4. PROFESSIONAL SKILLS** **4.1 Group Discussion** **4.2 Telephonic Conversation and Video Conferencing** **4.3 Mock Interview** **4.4 Personal Grooming (manners and etiquettes, appearance, hygiene, gestures, postures etc.)** **5. BUILDING VOCABULARY** **5.1 Word-formation** **5.2 Phrasal Verbs, Foreign Phrases, Idioms and Phrases** **5.3 Word Games such as crosswords, scrabble, quiz, spell-it etc. (to enhance self-expression and vocabulary of participants)**

Text Books	
1	**1. Daniel Jones. The Pronunciation of English. Cambridge: Cambridge University Press, 1956.** **2. James Hartman& et al. Ed. English Pronouncing Dictionary. Cambridge: Cambridge University** **3. 3. Kulbhushan Kumar, Effective Communication Skills, Khanna Publishing House, New Delhi (Revised Ed. 2018)** **4. J.D.O'Connor. Better English Pronunciation. Cambridge: Cambridge University Press, 1980.** **5. Lindley Murray. An English Grammar: Comprehending Principles and Rules. London: Wilson and Sons, 1908.**

Semester II

MATHEMATICS- II

Course Code	2001
Course Title	Mathematics-II
Number of Credits	5(L-3, T-2,P-0)
Prerequisites	None
Course Category	Basic Science

COURSE OBJECTIVES

This course is designed to give a comprehensive coverage at an introductory level to the subject of Matrices, Integral Calculus, Coordinate Geometry, Basic elements of vector algebra and First Order Differential Equations.

Course outcome	Details
CO 2001.1	The students are expected to acquire necessary background in Determinants and Matrices so as to appreciate the importance of the Determinants.
CO 2001.2	The Basic concepts of Integration and Differential equations and able to apply them in Engineering problems.
CO 2001.3	The coordinate geometry provides a connection between algebra and geometry through graphs of lines and curves.
CO 2001.4	The concept of Vectors and able to apply them in Engineering problems.

UNIT	Syllabus
UNIT 1	**1. DETERMINANTS AND MATRICES** **1.1 Algebra of matrices.** **1.2 Elementary properties of determinants up to 3rd order.** **1.3 Consistency of equations, Crammer's rule.** **1.4 Inverse of a matrix.** **1.5 Inverse Matrix method to solve a system of linear equations in 3 variables..**
UNIT 2	**2. INTEGRAL CALCULUS AND DIFFERENTIAL EQUATIONS** **2.1 Integration as inverse operation of differentiation.** **2.2 Simple integration by substitution, by parts and by partial fractions (for linear factors only).** **2.3 Use of formulas$\int_0^{\pi/2} \sin^n x \cos^n x\, dx$ for solving problems where m and n are positive integers.** **2.4 Definition of Differential Equation, Order and Degree of Differential Equation**

UNIT 3	**3. TWO-DIMENSIONALCO-ORDINATE GEOMETRY** **3.1 General Introduction, Distance formula and section formula.** **3.2 Equation of straight line in various standard forms.** **3.2.1 Slope form, Intercept form, Perpendicular form.** **3.2.2 One-point slope form, Two-point form, General form (without proof).** **3.3 Angle between two lines, Parallel and perpendicular lines.** **3.4 Perpendicular distance formula.**
UNIT 4	**4. CIRCLE AND CONICS** **4.1 General equation of a circle and its characteristics.** **4.2 To find the equation of a circle, given:** **4.2.1 Centre and radius,** **4.2.2 Three points lying on it** **4.2.3 Coordinates of end points of a diameter**
UNIT 5	**5. VECTOR ALGEBRA** **5.1 Definition notation and rectangular resolution of a vector.** **5.2 Addition and subtraction of vectors.**

Text Books	
1	**REFERENCES:** **1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 40th Edition, 2007.** **2. G. B. Thomas, R. L. Finney, Calculus and Analytic Geometry, Addison Wesley, 9th Edition, 1995.** **3. S.S. Sabharwal, Sunita Jain, Eagle Parkashan, Applied Mathematics, Vol. I & II, Jalandhar.** **4. Comprehensive Mathematics, Vol. I & II by Laxmi Publications, Delhi.** **5. Reena Garg & Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishing House,** **New Delhi**

APPLIED PHYSICS –II

Course Code	2002
Course Title	Applied Physics-II
Number of Credits	4 (L-3,T-1,P-0)
Prerequisites	None
Course Category	Basic Science

COURSE OBJECTIVES

Applied Physics aims to give an understanding of this world both by observation and by prediction of the way in which objects behave. Concrete use of physical principles and analysis in various fields of engineering and technology are given prominence in the course content. The course will help the diploma engineers to apply the basic concepts and principles to solve broad-based engineering problems and to understand different technology based applications.

Teaching Approach

1. Teachers should give examples from daily routine as well as, engineering/technology applications on various concepts and principles in each topic so that students are able to understand and grasp these concepts and principles. In all contents, SI units should be followed.
2. Use of demonstration can make the subject interesting and develop scientific temper in the students. Student activities should be planned on all the topics.
3. Activity- Theory - Demonstrate/practice approach may be followed throughout the course so that learning may be outcome and employability based

Course outcome	Details
CO 2002.1	**Describe waves and wave motion, periodic and simple harmonic motions and solve simple problems. Establish wave parameters: frequency, amplitude, wavelength, and velocity.**
CO 2002.2	**State basic optical laws, establish the location of the images formed by mirrors and thin converging lens, design and assemble microscope using lenses combination.**
CO 2002.3	**Describe refractive index of a liquid or a solid and will be able to explain conditions for total internal reflection.**
CO 2002.4	**Define capacitance and its unit, explain the function of capacitors in simple circuits, and solve simple problems**
CO 2002.5	**Differentiate between insulators, conductors and semiconductors, and define the terms: potential, potential difference, electromotive force.**

UNIT	Syllabus
UNIT 1	**1. WAVE MOTION AND ITS APPLICATIONS** **1.1 Wave motion** **1.2 Transverse and longitudinal waves with examples** **1.3 Definitions of wave velocity, frequency and wave length and their relationship** **1.4 Principle of superposition of waves** **1.5 Stationary waves and Resonance tube** **1.6 Simple Harmonic Motion (SHM):** **1.6.1 Definition.** **1.6.2 Simple harmonic progressive wave and energy transfer**
UNIT 2	**2. OPTICS** **2.1 Basic optical laws** **2.1.1 Reflection and refraction** **2.1.2 Lens formula, power of lens (only formula)** **2.2 Total internal reflection** **2.2.1 Critical angle and conditions for total internal reflection** **2.2.2 Applications of total internal reflection in optical fiber** **2.3 Optical Instruments** **2.3.1 Simple and compound microscope (introduction and uses)**
UNIT 3	**3. ELECTROSTATICS AND CURRENT ELECTRICITY** **3.1 Coulombs law, Unit of charge** **3.2 Electric field, Electric lines of force and their properties** **3.3 Electric flux** **3.4 Electric Current and its units** **3.4.1 Direct and alternating current** **3.5 Kirchhoff's law** **3.6 Wheatstone bridge and its applications (meter bridge)** **3.7 Concept of terminal potential difference and Electro motive force (EMF)**
UNIT 4	**4. ELECTROMAGNETISM** **4.1 Magnetic field and its units** **4.1.1 Magnetic intensity** **4.1.2 Magnetic lines of force** **4.1.3 Magnetic flux and units** **4.2 Concept of electromagnetic induction** **4.2.1 Faraday's Laws and Lenz's law** **4.3 Magnetic Force on moving charge** **4.3.1 Force on current carrying conductor** **4.3.2 Force on rectangular coil placed in magnetic field** **4.4 Moving coil galvanometer:-principle, construction and working** **4.4.1 Conversion of a galvanometer into ammeter and voltmeter**
UNIT 5	**5. SEMICONDUCTOR AND MODERN PHYSICS** **5.1 Energy bands in solids** **5.2 Types of materials (insulator, semi-conductor, conductor)** **5.3 p-n junction** **5.3.1 Junction diode and V-I characteristics** **5.3.2 Types of junction diodes (Zener and Photo Diode)** **5.3.3 Diode as rectifier – half wave and full wave rectifier (centre taped)** **5.4 Lasers:**

	5.4.1 Energy levels, ionization and excitation potentials **5.4.2 Spontaneous and stimulated emission** **5.4.3 Population inversion** **5.4.4 Pumping methods** **5.4.5 Types of lasers (Ruby and He-Ne Laser)** **5.4.6 Laser characteristics** **5.4.7 Engineering and medical applications of lasers** **5.5 Nanoscience and Nanotechnology:** **5.5.1 Introduction only**

Text Books	
1	**1. Text Book of Physics for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi** **2. Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi** **3. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi** **4. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi.** **5. Modern approach to Applied Physics-I and II, AS Vasudeva, Modern Publishers.** **6. A Textbook of Optics, N Subramanyam, Brij Lal, MN Avahanulu, S Chand and Company Ltd.** **7. Introduction to Fiber Optics, AjoyGhatak and K Thyagarajan, Cambridge University Press India Pvt.** **8. Nanoscience and Nanotechnology, KK Choudhary, Narosa Publishing House, Pvt. Ltd. New Delhi.** **9. Nanotechnology: Importance and Applications, M.H. Fulekar, IK International Publishing House Pvt.**

INTRODUCTION TO IT SYSTEMS

Course Code	2003
Course Title	Introduction to IT Systems
Number of Credits	3 (L-3,T-0,P-0)
Prerequisites	None
Course Category	Engineering Science

COURSE OBJECTIVES

This course is intended to make new students comfortable with computing environment - Learning basic computer skills, Learning basic application software tools, Understanding Computer Hardware, Cyber security awareness.

Course outcome	Details
CO 2003.1	**Understanding of various computer components: Block Diagram of Computer**
CO 2003.2	**Define Operating Systems**
CO 2003.3	**Understand the basics of Web Development**
CO 2003.4	**Learn about MS Office and Various Tools involved**
CO 2003.5	**Learn about cyber security and its importance.**

UNIT	Syllabus
UNIT 1	**1. OVERVIEW OF ELECTRONIC COMPONENTS & SIGNALS** **1.1 Passive components and their applications** **1.1.1 Resistors, type of resistors** **1.1.2 Capacitors, type of capacitor** **1.1.3 Inductors , type of inductor** **1.2 Types of waveform** **1.2.1 Sinusoidal waveform as alternating Voltage Signal v(t) = Vmsin(wt)** **1.2.2 Non Sinusoidal alternating waveforms (triangular, rectangular, square) as voltage signals**
UNIT 2	**2. OVERVIEW OF BASIC (ANALOG) & DIGITAL ELECTRONICS** **2.1 Introduction to Semi-Conductors** **2.1.1 Different Semiconductor materials (Si, Ge)** **2.2 Doping (impurities) in Semiconductors** **2.2.1 Intrinsic and Extrinsic Semiconductor** **2.2.2 Atomic structure of Intrinsic and Extrinsic Semiconductor** **2.3 Conductivity** **2.3.1 carrier transport: diffusion & drift current, mobility, resistivity** **2.3.2 generation and recombination of charge carriers, PN junction** **2.4 Active components and their application** **2.4.1 Diodes, VI Characteristics, forward and reverse bias** **2.4.2 Bipolar Junction Transistors (BJT), PNP and NPN BJT, Characteristics.** **2.5 Boolean Algebra** **2.5.1 Logic Gates (NOT, AND, OR, NAND, NOR, EX-OR, EX-NOR)**

	2.5.2 Binary code of a Decimal Number
UNIT 3	**3. ELECTRIC AND MAGNETIC CIRCUITS:** **3.1 EMF, Current, Potential Difference, Power and Energy, Ohm's Law, Combination of resistances** **3.2 M.M.F, magnetic flux** **3.3 Analogy between electric and magnetic circuits**
UNIT 4	**4. A.C. CIRCUITS:** **4.1 Introduction to AC waveform and terminology** **4.1.1 Cycle** **4.1.2 Frequency** **4.1.3 Time Period** **4.1.4 Amplitude** **4.1.5 Angular velocity** **4.1.6 RMS value** **4.1.7 Average value** **4.1.8 Form Factor**
UNIT 5	**5. TRANSFORMERS** **5.1 Principal of operation, emf equation, Construction.** **5.2 Principle of single phase transformer, transformation ratio and step up and step down transformers**

Text Books	
1	**REFERENCES:** **1. R.S. Salaria, Computer Fundamentals, Khanna Publishing House** **2. Ramesh Bangia, PC Software Made Easy – The PC Course Kit, Khanna Publishing House** **3. Online Resources, Linux man pages, Wikipedia** **4. Mastering Linux Shell Scripting: A practical guide to Linux command-line, Bash scripting, and Shell** **programming, by Mokhtar Ebrahim, Andrew Mallett.**

FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	2004
Course Title	Fundamentals of Electrical and Electronics Engineering
Number of Credits	4 (L-2,T-2,P-0)
Prerequisites	None
Course Category	Engineering Science

COURSE OBJECTIVES

To provide basic knowledge of the different elements and concepts of electrical engineering field and to learn basic concepts of various active and passive electronic components, Signals, Op-Amp and their applications, Digital Electronics and their applications to help students deal with electrical and electronics engineering principles and applications in industrial processes of different fields.

Course outcome	Details
CO 2004.1	**Understanding of Electrical component like R,L,C and Circuit form by them and there combination**
CO 2004.2	**Define Operating Systems**
CO 2004.3	**Understand the basics of semiconductor and important properties posses by them**
CO 2004.4	**Understanding of ohms law**
CO 2004.5	**A.C current and its merits**

UNIT	Syllabus
UNIT 1	**1. OVERVIEW OF ELECTRONIC COMPONENTS & SIGNALS** **1.1 Passive components and their applications** **1.1.1 Resistors, type of resistors** **1.1.2 Capacitors, type of capacitor** **1.1.3 Inductors , type of inductor** **1.2 Types of waveform** **1.2.1 Sinusoidal waveform as alternating Voltage Signal v(t) = Vmsin(wt)** **1.2.2 Non Sinusoidal alternating waveforms (triangular, rectangular, square) as voltage signals**
UNIT 2	**2. OVERVIEW OF BASIC (ANALOG) & DIGITAL ELECTRONICS** **2.1 Introduction to Semi-Conductors** **2.1.1 Different Semiconductor materials (Si, Ge)** **2.2 Doping (impurities) in Semiconductors** **2.2.1 Intrinsic and Extrinsic Semiconductor** **2.2.2 Atomic structure of Intrinsic and Extrinsic Semiconductor** **2.3 Conductivity** **2.3.1 carrier transport: diffusion & drift current, mobility, resistivity** **2.3.2 generation and recombination of charge carriers, PN junction** **2.4 Active components and their application** **2.4.1 Diodes, VI Characteristics, forward and reverse bias**

	2.4.2 Bipolar Junction Transistors (BJT), PNP and NPN BJT, Characteristics. **2.5 Boolean Algebra** **2.5.1 Logic Gates (NOT, AND, OR, NAND, NOR, EX-OR, EX-NOR)** **2.5.2 Binary code of a Decimal Number**
UNIT 3	**3. ELECTRIC AND MAGNETIC CIRCUITS:** **3.1 EMF, Current, Potential Difference, Power and Energy, Ohm's Law, Combination of resistances** **3.2 M.M.F, magnetic flux** **3.3 Analogy between electric and magnetic circuits**
UNIT 4	**4. A.C. CIRCUITS:** **4.1 Introduction to AC waveform and terminology** **4.1.1 Cycle** **4.1.2 Frequency** **4.1.3 Time Period** **4.1.4 Amplitude** **4.1.5 Angular velocity** **4.1.6 RMS value** **4.1.7 Average value** **4.1.8 Form Factor**
UNIT 5	**5. TRANSFORMERS** **5.1 Principal of operation, emf equation, Construction.** **5.2 Principle of single phase transformer, transformation ratio and step up and step down transformers**

Text Books	
1	**REFERENCES:** **1. Ritu Sahdev, Basic Electrical Engineering, Khanna Publishing House** **2. Mittle and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN :978-0-07-0088572-5** **3. Saxena, S. B. Lal, Fundamentals of Electrical Engineering, Cambridge University Press, latest edition ISBN : 9781107464353** **4. Theraja, B. L., Electrical Technology Vol – I, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924405** **5. Theraja, B. L., Electrical Technology Vol – II, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924375** **6. Jegathesan, V., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, 2015, ISBN : 97881236529513** **7. Sedha, R.S., A text book of Applied Electronics, S.Chand, New Delhi, 2008, ISBN-13: 978- 8121927833** **8. Malvino, Albert Paul, David, Electronics Principles, McGraw Hill Education, New Delhi,2015,ISBN-13: 0070634244-978** **9. Mehta, V.K., Mehta, Rohit, Principles of Electronics, S. Chand and Company, New Delhi, 2014,ISBN-13-9788121924504** **10. Bell Devid, Fundamental of Electronic Devices and Circuits, Oxford University Press,**

	New Delhi2015 ISBN : 9780195425239

ENGINEERING MECHANICS

Course Code	2005
Course Title	Engineering Mechanics
Number of Credits	4 (L-3,T-1,P-0)
Prerequisites	None
Course Category	Engineering Science

COURSE OBJECTIVES

Following are the objectives of this course:

1. To obtain resultant of various forces
2. To calculate support reactions through conditions of equilibrium for various structures
3. To understand role of friction in equilibrium problems
4. To know fundamental laws of machines and their applications to various engineering problems

Course outcome	Details
CO 2005.1	**Identify the force systems for given conditions by applying the basics of mechanics**
CO 2005.2	**Determine unknown force(s) of different engineering systems.**
CO 2005.3	**Apply the principles of friction in various conditions for useful purposes.**
CO 2005.4	**Find the centroid and centre of gravity of various components in engineering systems**
CO 2005.5	**Select the relevant simple lifting machine(s) for given purposes**

UNIT	Syllabus
UNIT 1	**1. BASICS OF MECHANICS AND FORCE SYSTEM** **1.1 Significance and relevance of Mechanics** **1.1.1 Applied mechanics** **1.1.2 Statics** **1.1.3 Dynamics** **1.2 Definitions of Space, time, mass, particle, flexible body and rigid body** **1.3 Scalar and vector quantity ,Units of measurement (SI units)** **1.3.1 Fundamental units** **1.3.2 Derived units** **1.4 Force** **1.4.1 Unit** **1.4.2 Representation as a vector and by Bow's notation** **1.4.3 Characteristics and effects of a force** **1.5 Law of parallelogram**

UNIT 2	**2. EQUILIBRIUM** **2.1 Equilibrium and Equilibrant** **2.1.1 Free body and Free body diagram** **2.2 Lami's Theorem – statement and explanation** **2.2.1 Application for various engineering problems** **2.3 Types of beam** **2.4 Types of supports (simple, hinged, roller and fixed)** **2.5 Types of loads acting on beam (vertical and inclined point load, uniformly distributed load, couple)**
UNIT 3	**3. FRICTION** **3.1 Friction and its relevance in engineering** **3.1.1 Types and laws of friction** **3.1.2 Limiting equilibrium** **3.1.3 Limiting friction** **3.1.4 Co-efficient of friction** **3.1.5 Angle of friction (only theoy)** **3.1.6 Angle of repose (only theoy)** **3.1.7 Relation between co-efficient of friction and angle of friction** **3.2 Equilibrium of bodies on level surface subjected to** **3.2.1 Force parallel to plane** **3.2.2 Force inclined to plane**
UNIT 4	**4. CENTROID AND CENTRE OF GRAVITY** **4.1 Center of gravity of : Square , Rectangle, Triangle, Circle, Semi-circle and Quarter circle(No derivation)** **4.2 Centroid of composite figures composed of not more than three geometrical figures** **4.3 Centre of Gravity of Cube, Cuboid, Cone, Cylinder, Sphere and hemisphere (No derivation)**
UNIT 5	**5. SIMPLE LIFTING MACHINE** **5.1 Simple lifting machine** **5.1.1 Related terms: load, effort, mechanical advantage** **5.1.2 Applications and advantages.** **5.1.3 Velocity ratio** **5.1.4 Efficiency of machines** **5.2 Law of machine** **5.3 Ideal machine** **5.3.1 Friction in machine** **5.3.2 Maximum Mechanical advantage and efficiency**

Text Books	
1	**1. Engineering Statics (in Hindi) Gokhru&Soni** **2. Applied Mechanics (in Hindi) A. R. Paage** **3. Engineering Mechanics D. S. Kumar** **4. Applied MechanicsS. Chand & Co. New Delhi. R.S. Khurmi** **5. Engineering Mechanics A. R. Basu**

	6. Engineering Mechanics, Khanna Publications, New Delhi (2008) D.S. Bedi, **7. A text book of Engineering MechanicsLaxmi Publications. Bansal R K** **8. Engineering Mechanics S. Chand & Co. New Delhi. Ramamrutham** **9. Fundamental of Applied Mechanics Pune VidhyarthiGruh. Dhade, Jamadar &Walawelkar**

APPLIED PHYSICS II LAB

Course Code	2006
Course Title	Applied Physics II Lab
Number of Credits	1 (L-0,T-0,P-2)
Prerequisites	None
Course Category	Basic Science

COURSE OBJECTIVES

Concrete use of physical principles and analysis in various fields of engineering and technology is very prominence. The course aims to supplement the factual knowledge gained in the lecture by first hand manipulation of apparatus. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering and technology based problems. In addition, students get necessary confidence in handling equipment and thus learn various skills in measurement.

Course outcome	Details
CO 2006.1	**Apply coneptsof SHM to find out the gravitational accleration**
CO 2006.2	**Verify optical laws; reflection, refraction from plane interfaces and surfaces.**
CO 2006.3	**Apply knowledge of optics to determine focal length and magnifying power of optical lenses.**
CO 2006.4	**Understand uses of electrical components and meters and verify Ohm's law for flow of current.**
CO 2006.5	**Quantify resistances and verify laws of series and parallel combination of resistances.**

UNIT	Syllabus
UNIT 1	**LIST OF PRACTICALS/ACTIVITIES: (To perform minimum 10 Practicals)** **1. To determine acceleration due to gravity using simple pendulum.** **2. To verify laws of reflection from a plane mirror/ interface.** **3. To verify laws of refraction (Snell's law) using a glass slab.** **4. To determine focal length and magnifying power of a convex lens.** **5. To verify Ohm's law by plotting graph between current and potential difference.** **6. To verify laws of resistances in series and parallel combination.** **7. To determine specific resistance of material using meter bridge.** **8. To determine internal resistance of a primery cell using potentiometer.** **9. To compare EMF of two primary cells using potentiometer.** **10. To find resistance of a galvanometer by half deflection method.** **11. To convert a galvanometer into an ammeter.**

	12. To convert a galvanometer into a voltmeter. **13. To draw V-I characteristics of a semiconductor diode (Ge, Si) and determine its knee voltage.** **SUGGESTED STUDENT ACTIVITIES & STRATEGIES** **Apart from classroom and laboratory learning following are the suggested student related activities which can be undertaken to accelerate the attainment of various outcomes of the course.** **1. Survey of different physical products and compare the following points** **1.1 Measurements of dimensions** **1.2 Properties** **1.3 Applications** **2. Library survey regarding engineering materials/products used in different industries** **3. Seminar on any relevant topic. Teachers should use the following strategies to achieve the various outcomes of the course** **4. Different methods of teaching and media to be used to attain classroom attention.** **5. Massive open online courses (MOOCs) may be used to teach various topics/sub topics.** **6. 15-20% of the topics which are relatively simpler or descriptive in nature should be given to the students for self-learning and assess the development of competency through classroom presentations/projects.** **7. Micro-projects on relevant may be given to group of students for hand-on experiences.**

Text Books	
1	**RECOMMENDED BOOKS:** **1. Text Book of Physics for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi** **2. Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi** **3. Practical Physics by C. L. Arora, S. Chand & Company Ltd.** **4. e-books/e-tools/ learning physics software/you Tube videos/ websites etc.**

INTRODUCTION TO IT SYSTEMS LAB

Course Code	2007
Course Title	Introduction to IT Systems
Number of Credits	2 (L-0,T-0,P-4)
Prerequisites	None
Course Category	Engineering Science

COURSE OBJECTIVES

This Lab course is intended to practice whatever is taught in theory class of 'Introduction of IT Systems' and become proficient in using computing environment - basic computer skills, basic application software tools, Computer Hardware, cyber security features, etc.

COURSE OUTCOMES

At the end of the course student will be able to comfortably work on computer, install and configure OS, assemble a PC and connect it to external devices, write documents, create worksheets, prepare presentations, protect information and computers from basic abuses/attacks.

Course outcome	Details
CO 2007.1	**student will be able to comfortably work on computer, install and configure OS**
CO 2007.2	**create worksheets, prepare presentations**
CO 2007.3	**protect information and computers from basic abuses/attacks**

UNIT	Syllabus
1	**Read Wikipedia pages on computer hardware components, look at those components in lab, identify them, recognise various ports/interfaces and related cables, etc.**
2	**Connect various peripherals (printer, scanner, etc.) to computer, explore various features of peripheral and their device driver software.**
3	**Browser features, browsing, using various search engines, writing search queries.**
4	**Visit various e-governance/Digital India portals, understand their features and services offered.**
5	**Install Windows operating system on lab machine and explore various options.**

6	**Install Linux operating system on lab machine and explore various options.**
7	**Practice various HTML tags.**
8	**Make your own Webpage using HTML tags.**
9	**Explore features of Open Office Writer and practice to create documents.**
10	**Explore features of Open Office Calc and practice to create spreadsheets.**
11	**Explore features of Open Office Impress and practice to create presentations.**
12	**Explore security features of Operating Systems and Tools.**
13	**Demonstration of various digital payment methods (Net Banking, Digital Wallet, UPI etc.)**

Text Books	
1	**REFERENCES:** **1. Online resources, Linux man pages, Wikipedia.** **2. R.S. Salaria, Computer Fundamentals, Khanna Publishing House.** **3. Ramesh Bangia, PC Software Made Easy – The PC Course Kit, Khanna Publishing House.** **4. Mastering Linux Shell Scripting: A practical guide to Linux command-line, Bash scripting, and Shell programming, by Mokhtar Ebrahim, Andrew Mallett.** **5. IT Essentials PC Hardware and Software Companion Guide, Davis Anfinson and Ken Quamme, CISC Press, Pearson Education.** **6. PC Hardware and A+ Handbook, Kate J. Chase PHI (Microsoft)**

FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING LAB

Course Code	2008
Course Title	Fundamentals of Electrical and Electronics Engineering Lab
Number of Credits	2 (L-0,T-0,P-4)
Prerequisites	None
Course Category	Engineering Science

COURSE OBJECTIVES

Suggested Practicals/Exercises:

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

Course outcome	Details
CO 2008.1	**Understand basic principle and operation of electric circuits and machines.**
CO 2008.2	**Solve basic problems related to electrical circuits and machines.** **Explain the operation of different electrical technologies.**
CO 2008.3	**Demonstrate an understanding of the control systems.**
CO 2008.4	**Understand the basic circuit elements**
CO 2008.5	**Understand logic gates and apply them in various electronic circuits**

UNIT	Syllabus
UNIT 1	**LIST OF PRACTICALS/ACTIVITIES** **1. Study of Symbol, Specification of Common Electrical Accessories, Tools and Wires & Cables.** **2 . (A) Electric safety precaution and use of fire fighting equipment** **(B) Study of basic Electricity Rules for a Domestic Consumer.** **3. Use ofPhase Tester, Series Test Lamp, Tong Tester and Megger in Testing of Electrical Installation** **4. Measurement of current, voltage, power and energy in AC and DC circuits.** **5. reparation of Wiring Diagram, Wiring,Testing,Fault Finding &Costing for :** **5.1 Control of one LED Lamp by one Switch (using casing capping & Flush type switch)**

	5.2 Control of Stair Case Wiring **5.3 Control of one Bell Buzzer and Indicator by one switch** **Prepare one Switch Board as per requirement** **(using Flush type Switches, Sockets, Ceiling rose,Lamp holder, MCB, Etc.)** **6. Prepare one Switch Board as per requirement** **(using Flush type Switches, Sockets, Ceiling rose,Lamp holder, MCB, Etc.)** **7. Study, Connecting, Testing and Fault Finding of Fluorescent Tube and its Accessories** **8. Study, Connecting, Testing and Fault Finding of Ceiling Fan with Electronic Regulator** **9. Connect single phase transformer. Measure input and output quantities determine its transformation** **ratio.** **10. Prepare a Potential Divider and Measure Resistance of a Filament Lamp Using Voltmeter and Ammeter.** **11. Study and functioning of automatic electric iron.** **12. Study and functioning of electric water pump and air cooler.** **13. Sketching of different Electronic Components Symbol on Drawing Sheet.** **14. Identify various passive electronic components in the given circuit** **9.1 Resistors-Fixed Resistors and Variable Resistors** **9.2 Capacitors- Electrolytic Capacitors and Ceramic Capacitors** **9.3 Inductors** **15. Soldering of different passive component combination on general purpose PCB.** **16. Testing of the following electronic components using digital multimeter.** **10.1Resistor** **10.2 PN Junction Diode** **10.3 Bipolar Junction Transistor** **17. Study of devices used in electronic workshop.** **11.1 Function Generator** **11.2 CRO** **11.3 LCR Meter** **18. Use of LCR meter to measure the value of given Capacitor and Inductor.** **19. Measurement of amplitude and frequeny of a sinusoidal signal using CRO.** **20. Measurement of amplitude and frequeny of a Non-sinusoidal signal using CRO.** **21. Test the performance of PN Junction Diode and Zener Diode** **22. Test the performance of Transistor Amplifier Circuirt.** **23. Verify the truth tables of different logic gates** **24. Verification of Ohm's law using Resistive Circuit and Analog/ Digital Meters**

ENGINEERING MECHANICS LAB.

Course Code	2009
Course Title	Engineering Mechanics Lab
Number of Credits	1 (L-0,T-0,P-2)
Prerequisites	None
Course Category	Engineering Science

COURSE OBJECTIVES

Following are the objectives of this course:

1. To obtain resultant of various forces
2. To calculate support reactions through conditions of equilibrium for various structures
3. To understand role of friction in equilibrium problems
4. To know fundamental laws of machines and their applications to various engineering problems

Course outcome	Details
CO 2009.1	**Identify the force systems for given conditions by applying the basics of mechanics.**
CO 2009.2	**Determine unknown force(s) of different engineering systems.**
CO 2009.3	**Apply the principles of friction in various conditions for useful purposes.**
CO 2009.4	**Find the centroid and centre of gravity of various components in engineering systems.**

Syllabus

LIST OF PRACTICAL TO BE PERFORMED

1. Verification of the Law of Parallelogram and Polygon of Forces

1.1 By using Force Board

1.2 By using Force Table

2. Determination of Reactions in Case of Simply Supported Beams.

3. To Determine Coefficient of Friction between two Surfaces on

3.1 Horizontal Plane 3.2 Inclined Plane.

4. Determination of Mechanical Advantage, Velocity Ratio and Efficiency of Simple Wheel and Axle

5. Determination of Mechanical Advantage, Velocity Ratio and Efficiency of differential Wheel and Axle

6. Determination of Mechanical Advantage, Velocity Ratio and Efficiency of Single Purchase Crab

7. Determination of Mechanical Advantage, Velocity Ratio and Efficiency of Double Purchase Crab

8. Determination of Mechanical Advantage, Velocity Ratio and Efficiency of Worm and Worm Wheel

9. Determination of Mechanical Advantage, Velocity Ratio and Efficiency of Screw Jack

10. Determination of Mechanical Advantage, Velocity Ratio and Efficiency of First System of Pulleys

11. Determination of Mechanical Advantage, Velocity Ratio and Efficiency of Second System of Pulleys

ENVIRONMENTAL SCIENCE

Course Code	2010
Course Title	ENVIRONMENTAL SCIENCE
Number of Credits	2 (L-2,T-0,P-0)
Prerequisites	None
Course Category	Basic Science

COURSE OBJECTIVES

Technicians working in industries or elsewhere essentially require the knowledge of environmental science so as to enable them to work and produce most efficient, economical and eco-friendly finished products.

1. Solve various engineering problems applying ecosystem to produce eco – friendly products.
2. Use relevant air and noise control method to solve domestic and industrial problems.
3. Use relevant water and soil control method to solve domestic and industrial problems.
4. To recognize relevant energy sources required for domestic and industrial applications.
5. Solve local solid and e-waste problems.

Course outcome	Details
CO 2010.1	**Understand the ecosystem and terminology and solve various engineering problems applying ecosystem knowledge to produce eco – friendly products.**
CO 2010.2	**Understand the suitable air, extent of noise pollution, and control measures and acts.**
CO 2010.3	**Understand the water and soil pollution, and control measures and acts.**
CO 2010.4	**Understand different renewable energy resources and efficient process of harvesting.**
CO 2010.5	**Understand solid Waste Management, ISO 14000 & Environmental Management.**

UNIT	Syllabus
UNIT 1	**1. 1. ECOSYSTEM** **1.1 Structure of ecosystem** **1.1.1 Biotic & Abiotic components** **1.2 Food chain and food web** **1.3 Global warming** **1.3.1 Causes** **1.3.2 Effects** **1.3.3 Process** **1.3.4 Green House Effect** **1.3.5 Ozone depletion**

UNIT 2	**2. AIR AND NOISE POLLUTION** **2.1 Definition of pollution and pollutant** **2.2 Natural and manmade sources of air pollution (Refrigerants, A.C., Boiler)** **2.3 Air Pollutants:** **2.3.1 Types** **2.3.2 Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator)** **2.4 Noise pollution:** **2.4.1 sources of pollution** **2.4.2 measurement of pollution level** **2.4.3 Effects of Noise pollution**
UNIT 3	**3. WATER AND SOIL POLLUTION** **3.1 Water pollution** **3.1.1 Sources of water pollution** **3.1.2 Types of water pollutants** **3.1.3 Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids** **3.2 Waste Water Treatment:** **3.2.1 Primary methods: sedimentation, froth floatation** **3.2.2 Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor** **3.2.3 Tertiary Method: Membrane separation technology, RO (reverse osmosis)** **3.3 3.4 Soil pollution:** **3.3.1 Causes** **3.3.2 Effects** **3.3.3 Preventive measures of Soil Pollution**
UNIT 4	**4. RENEWABLE SOURCES OF ENERGY** **4.1 Solar Energy:** **4.1.1 Basics of solar energy** **4.2 Applications** **4.2.1 Solar pond** **4.2.2 Solar water heater** **4.2.3 Solar dryer** **4.3 Biomass:** **4.3.1 Overview of biomass as energy source** **4.3.2 Thermal characteristics of biomass as fuel** **4.3.3 Anaerobic digestion** **4.3.4 Utilization and storage of biogas** **4.4 Wind energy:** **4.4.1 Current status and future prospects of wind energy** **4.4.2 Wind energy in India** **4.5 Applications of** **4.5.1 Hydrogen energy** **4.5.2 Ocean energy resources**

UNIT 5	**5. 5. SOLID WASTE MANAGEMENTISO 14000 & ENVIRONMENTAL MANAGEMENT** **5.1 Solid waste generation** **5.2 Sources and characteristics of** **5.2.1 Municipal solid waste** **5.2.2 E- waste** **5.2.3 Biomedical waste** **5.3 Collection and disposal:** **5.3.1 MSW (3R, principles, energy recovery, sanitary landfill),** **5.3.2 Hazardous waste** **5.4 Different environmental acts** **5.4.1 Air quality act 2004** **5.4.2 Air pollution control act 1981** **5.4.3 Water pollution and control act1996**

Text Books	
1	**REFERENCES:** **1. S.C. Sharma & M.P. Poonia, Environmental Studies,Khanna Publishing House,NewDelhi** **2. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.** **3. Arceivala, Soli Asolekar, Shyam, Waste Water Treatment for Pollution Control and** **4. Reuse, Mc-Graw Hill Education India Pvt. Ltd., New York, 2007, ISBN:978-07-062099-** **5. Nazaroff, William, Cohen, Lisa, Environmental Engineering Science, Willy, New York, 2000, ISBN** **10: 0471144940.** **6. O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi** **7. Rao, C. S., Environmental Pollution Control and Engineering, New Age International Publication,** **2007, ISBN: 81-224-1835-X.** **8. Rao, M. N.Rao, H.V.N, Air Pollution, Tata Mc-Graw Hill Publication, New delhi, 1988, ISBN: 0-07-** **451871-8.** **9. Frank Kreith, Jan F Kreider, Principles of Solar Engineering, McGraw-Hill, New York ; 1978, ISBN:** **9780070354760.** **10. Aldo Vieira, Da Rosa, Fundamentals of renewable energy processes, Academic Press Oxford, UK;** **2013. ISBN: 9780123978257.** **11. Patvardhan, A.D, Industrial Solid Waste, Teri Press, New Delhi, 2013, ISBN:978-81-7993-502-6** **12. Metcalf & Eddy, Waste Water Engineering, Mc-Graw Hill, New York, 2013, ISBN: 077441206.** **13. Keshav Kant, Air Pollution & Control, Khanna Publishing House, New Delhi (Edition 2018)**

	Open source software and website address: **1. www.eco-prayer.org** **2. www.teriin.org** **3. www.cpcp.nic.in** **4. www.cpcp.gov.in** **5. www.indiaenvironmentportal.org.in** **6. www.whatis.techtarget.com** **7. www.sustainabledevelopment.un.org** **8. www.conserve-energy-future.com)**

Semester III

BASIC MECHANICAL ENGINEERING

Course Code	:	**ME 3001 (Same as MA/MP 3001)
Course Title	:	BASIC MECHANICAL ENGINEERING
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites (Course code)	:	NIL
Course Category	:	PC

COURSE OBJECTIVES

1. To understand General Principles of Mechanical Engineering.
2. To understand laws of thermodynamics, thermal and thermodynamic Processes.
3. To understand working principles of power developing and power absorbing devices.
4. To understand basic materials and manufacturing processes.

Course outcome	Details
CO 3001.1	Understand basics of thermodynamics and components of a thermal power plant
CO 3001.2	Understand basics of heat transfer, refrigeration and internal combustion engines
CO 3001.3	Understand mechanism of thermal power plant and boiler operation
CO 3001.4	To Identify engineering materials, their properties, manufacturing methods encountered in engineering practice

UNIT	Syllabus
UNIT 1	**1. INTRODUCTION TO THERMODYNAMICS** **1.1 Role of Thermodynamics in Engineering and Science.** **1.2 Basic Concept of thermodynamic laws** **1.2.1 Types of system, Thermodynamic Equilibrium, properties (basic Concept only)** **1.2.2 Elementary introduction to Zeroth Law, First Law, Heat and work** **1.2.3 Second laws of thermodynamics Kelvin-Planck and Clausius Statements** **1.2.4 Concept of Heat Engine, Heat Pump & Refrigerator, Efficiency/COP** **1.2.5 Carnot Cycle, Carnot Efficiency, T-S and P-V Diagrams**

UNIT 2	**2. HEAT TRANSFER & THERMAL POWER PLANT** **2.1 Modes of Heat Transfer** **2.2 Conduction:** **2.2.1 Composite Walls and Cylinders** **2.3 Simple Numerical Problems** **2.4 Thermal Power Plant Layout** **2.5 Fire Tube and Water Tube boilers (only working principal and types)**
UNIT 3	**3. STEAM TURBINES** **3.1 Impulse and Reaction Turbines;** **3.2 Condensers: Jet & Surface Condensers (only working principal of both type)** **3.3 Cooling Towers(only working principal and types)**
UNIT 4	**4. MATERIAL AND MANUFACTURING PROCESSES` ``** **4.1 Engineering Materials** **4.1.1 Classification and their Properties** **4.2 Metal Casting: Moulding, Patterns** **4.3 Metal Working process: Hot and Cold working (Introduction only)** **4.4 Metal Forming processes (Introduction Only)** **4.5 Press Working process (Introduction and working)** **4.5.1 Press Working operations: - Cutting, bending, Drawing,** **4.5.2 Punch, blanking, piercing, notching, lancing** **4.5.3 effect of clearance.**
UNIT 5	**5. SUPER FINISHING AND METAL COATING PROCESSES** **5.1 Finishing by grinding: (basic concept only and no mathematical formulation)** **5.1.1 Honing,** **5.1.2 Lapping,** **5.1.3 Super finishing;** **5.2 Electroplating: Basic principles and applications;** **5.3 Hot dipping: Galvanizing, Tin coating** **5.4 Metal spraying: (Basic Principle);** **5.5 Finishing specifications.**

Text Books	
1	**REFERENCES:** **1. Basic Mechanical Engineering – M.P. Poonia& S.C. Sharma, Khanna Publishing House, Delhi** **2. Elements of Mechanical Engineering – M. L. Mathur, F. S. Mehta and R. P. Tiwari, Jain Brothers, New Delhi** **3. Engineering Heat Transfer – Gupta & Prakash, Nem Chand & Brothers, New Delhi** **4. Workshop Technology (Vol. 1 and 2) – B. S. Raghuvanshi, Dhanpath Rai and Sons, New Delhi.** **5. Basic Mechanical Engineering – J Benjamin** **6. Elements of Mechanical Engineering – Roy and Choudhary** **7. Engineering Thermodynamics – Spalding and Cole**

MATERIAL SCIENCE & ENGINEERING

Course Code	:	*ME 3002 (Same in MA 3002)
Course Title	:	MATERIAL SCIENCE & ENGINEERING
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PC

COURSE OBJECTIVES:

- To understand crystal structures and atomic bonds.
- To understand the properties of different types of ferrous metals and alloys.
- To understand the properties of different types of non-ferrous metals and alloys.
- To understand various metallic failures and acquire the knowledge of testing of materials.
- To understand the concept of corrosion and its prevention.

Course outcome	Details
CO 3002.1	Explain about crystal structures and atomic bonds.
CO 3002.2	Describe about classification of ferrous metals and their properties.
CO 3002.3	Explain about non-ferrous metals, cutting tool materials and composites along with their properties.
CO 3002.4	Describe about the various metallic failures and knowledge in testing of materials.
CO 3002.5	Explain the principle of corrosion, their types and its prevention methods along with the various surface engineering processes.

UNIT	Syllabus
UNIT 1	**1. CRYSTAL STRUCTURES AND BONDS** **1.1 Unit cell and space lattice:** **1.2 Crystal system:** **1.2.1 The seven basic crystal systems** **1.2.2 Atomic radius and atomic radius for Simple Cubic, BCC and FCC;** **1.2.3 Atomic Packing Factor for Simple Cubic, BCC, FCC and HCP;** **1.3 Simple problems on finding number of atoms for a unit cell.** **1.3.1 Bonds in solids:Primary and secondary bond (Introduction)** **1.3.2 Types of primary bonds: Ionic, Covalent and Metallic Bonds** **1.3.3 Types of secondary bonds: Dispersion bond, Dipole bond and Hydrogen bond.**

UNIT 2	**2. PHASE DIAGRAMS, FERROUS METALS AND ITS ALLOYS** **2.1 Isomorphs, eutectic and eutectoid systems;** **2.2 Iron-Carbon binary diagram;** **2.3 Iron and Carbon Steels;** **2.4 Flow sheet for production of iron and steel** **2.5 Iron ores** **2.6 Pig iron:** **2.6.1 classification** **2.6.2 composition and effects of impurities on iron;** **2.7 Cast Iron:** **2.7.1 Classification** **2.7.2 Composition. properties and uses;** **2.8 Wrought Iron** **2.8.1 properties, uses/applications of wrought Iron;** **2.9 Comparison of cast iron, wrought iron and mild steel and high carbon steel;** **2.10 standard commercial grades of steel as per BIS and AISI;** **2.11 Alloy Steels – Types and uses;** **2.11.1 Stainless Steels – Types and uses**
UNIT 3	**3. NON-FERROUS METALS AND ITS ALLOYS** **3.1 Properties of Non-Ferrous metals** **3.2 Copper alloys: Brasses, bronzes – composition, properties and uses;** **3.3 Aluminium alloys: properties and uses;** **3.4 Nickel alloys: properties and uses.** **3.5 Types of Anti-friction/Bearing alloys:** **3.5.1 Standard commercial grades as per BIS/ASME.**
UNIT 4	**4. FAILURE ANALYSIS & TESTING OF MATERIALS** **4.1 Introduction to failure analysis** **4.2 Fatigue,** **4.2.1 endurance limit** **4.2.2 characteristics of fatigue fracture** **4.2.3 variables affecting fatigue life** **4.3 creep** **4.3.1 creep curve;** **4.3.2 creep fracture;** **4.4 Destructive testing (Introduction only)** **4.4.1 Tensile testing** **4.4.2 compression testing** **4.4.3 bend test;** **4.4.4 torsion test;** **4.4.5 fatigue test;** **4.4.6 creep test.** **4.4.7 Hardness testing** **4.4.8 Brinell** **4.4.9 Rockwell** **4.5 Non-destructive testing:** **4.5.1 Visual Inspection;**

	4.5.2 magnetic particle inspection; **4.5.3 liquid penetrant test;** **4.5.4 ultrasonic inspection;** **4.5.5 radiography.**
UNIT 5	**5. SURFACE ENGINEERING** **5.1 Surface engineering processes:** **5.1.1 Coatings and surface treatments; Cleaning and mechanical finishing of surfaces;** **5.1.2 Organic coatings;** **5.1.3 Electroplating and** **5.1.4 Special metallic plating;** **5.1.5 Electro polishing and photo-etching ;**

Text Books	
1	**REFERENCES:** **1. A Text Book of Material Science & Metallurgy – O.P. Khanna, Dhanpath Rai and Sons, New Delhi. 2003.** **2. Material Science & Engineering – R.K. Rajput, S.K. Kataria& Sons, New Delhi, 2004.** **3. Material Science – R.S. Khurmi, S. Chand & Co. Ltd., New Delhi, 2005.**

FLUID MECHANICS & HYDRAULIC MACHINERY

Course Code	:	**ME 3003(Same as MA/MP 3003)
Course Title	:	FLUID MECHANICS & HYDRAULIC MACHINERY
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	NIL
Course Category	:	PC

COURSE OBJECTIVES:

- To understand fluid flow & related machinery for power generation, water supply and irrigation.
- To Select and use appropriate flow measuring device.
- To Select and use appropriate pressure measuring device.
- To understand and analyze the performance of pumps and turbines.

Course outcome	Details
CO 3003.1	Measure various properties such as pressure, velocity, flow rate using various instruments.
CO 3003.2	Calculate different parameters such as co-efficient of friction, power, efficiency etc of various Systems.
CO 3003.3	Describe the construction and working of turbines and pumps.
CO 3003.4	Test the performance of turbines and pumps.
CO 3003.5	Plot characteristics curves of turbines and pumps.

UNIT	Syllabus
UNIT 1	1. Introduction of basic Properties of fluid 1.1 Surface tension, Capillarity, 1.2 Fluid Pressure & Pressure Measurement: 1.2.1 Fluid pressure, Pressure head, Pressure intensity 1.2.2 Concept of vacuum and gauge pressures, atmospheric pressure, absolute pressure, 1.2.3 Simple and differential manometers, 1.2.4 Bourdan pressure gauge, 1.2.5 Concept of Total pressure on immersed bodies, center of pressure, 1.2.6 Simple problems on Manometers.
UNIT 2	2. FLUID FLOW: 2.1 Types of fluid flows, 2.2 Continuity equation, 2.3 Bernoulli's theorem, 2.4 Principle of operation of Venturimeter, 2.5 Orifice meter 2.6 Pitot tube

	2.7 Numerical problems. **2.8 Minor and major losses in pipes, Hydraulic gradient and total gradient line,** **2.9 Numerical problems to estimate major and minor losses**
UNIT 3	**3. IMPACT OF JETS** **3.1 Impact of jet on fixed and vertical flat plates,** **3.2 Impact of jet on curved vanes,** **3.3 Simple Numericals on work done and efficiency.**
UNIT 4	**4. HYDRAULIC TURBINES** **4.1 Layout of hydroelectric power plant (Basic Concept)** **4.2 Classification and selection of hydraulic turbines,** **4.3 Construction and working principle of Pelton wheel,** **4.4 Francis and Kaplan turbines (Derivation for work and efficiency)** **4.5 Draft tubes – types and construction,** **4.6 Concept of cavitation in turbines,** **4.7 Simple problem related to Calculation of Work done, Power, efficiency of turbines,** **4.8 Unit quantities**
UNIT 5	**5. CENTRIFUGAL PUMPS** **5.1 Principle working and applications of centrifugal pump (with Derivation for work done and efficiency),** **5.2 Numericals on calculations of overall efficiency and power required to drive pumps** **5.3 Reciprocating Pumps:** **5.3.1 working principle and applications of reciprocating pumps,** **5.4 Concept of Slip,** **5.5 Cavitation and separation.**

Text Books	
1	**REFERENCES:** **1. Fluid Mechanics & Hydraulic Machines, S.S. Rattan, Khanna Publishing House, New Delhi** **2. Hydraulic, fluid mechanics & fluid machines – Ramamrutham S, Dhanpath Rai and Sons, New Delhi.** **3. Hydraulics and fluid mechanics including Hydraulic machines – Modi P.N. and Seth S.M., Standard Book House. New Delhi** **4. One Thousand Solved Problems in Fluid Mechanics – K. Subramanya, Tata McGraw Hill.** **5. Hydraulic, fluid mechanics & fluid machines – S. Ramamrutham, Dhanpat Rai and Sons, New Delhi** **6. Fluid Mechanics and Hydraulic Machines – R. K. Bansal, Laxmi Publications, New Delhi**

MANUFACTURING ENGINEERING-I

Course Code	:	*ME 3004 (Same in MA 3004)
Course Title	:	MANUFACTURING ENGINEERING-I
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	Basic Mechanical Engineering
Course Category	:	PC

COURSE OBJECTIVES:

- To understand the importance of cutting fluids & lubricants in machining.
- To study various types of basic production processes. To select, operate and control the appropriate processes for specific applications.
- To understand the concept of gear making and list various gear materials.
- To understand the importance of press tools and understand various die operations.
- To understand Grinding and finishing processes.

Course outcome	Details
CO 3004.1	Know and identify basic manufacturing processes for manufacturing different components.
CO 3004.2	Operate & control different machines and equipments.
CO 3004.3	Produce jobs as per specified dimensions and inspect the job for specified dimensions.
CO 3004.4	Select the specific manufacturing process for getting the desired type of output.
CO 3004.5	Adopt safety practices while working on various machines.

UNIT	Syllabus
UNIT 1	**1. Cutting Fluids & Lubricants:** **1.1 Introduction;** **1.2 Types of cutting fluids and coolants,** **1.3 Classification, properties and applications of lubricants** **Lathe Operations:** **1.4 Basic parts and their functions** **1.5 Types of lathes,** **1.6 Lathe Operations– Facing,Turning, step turning, taper turning, parting off, Knurling, Boring, drilling, threading,**
UNIT 2	**2. BROACHING MACHINES:** **2.1 Introduction and Types of broaching machines;** **2.2 Elements of broach tool, Nomenclatureand Tool materials** **Drilling:** **2.3 Basic study of Drill machine with specification;** **2.4 Types of operations;**

	2.5 Types of drills and reamers.
UNIT 3	**3. WELDING:** **3.1 Classificationof Gas welding techniques and Types of welding flames;** **3.2 Introduction of different types of ARC welding** **3.3 Resistance welding -** **3.3.1 Spot welding,** **3.3.2 Seam welding,** **3.3.3 Projection welding;** **3.4 Welding defects;** **3.5 Brazing and soldering: Principles and Applications.**
UNIT 4	**1. MILLINGAND GEAR MAKING:** **4.1 Introduction and Types of milling machines** **4.1.1 constructional details, specifications of milling machine** **4.1.2 Milling operations: simple, compound and differential indexing** **4.1.3 Milling cutters** **4.1.4 Tool & work holding devices** **4.2 Manufacture of gears by – (Basic concept of process Only)** **4.2.1 Casting,** **4.2.2 Moulding,** **4.2.3 Stamping,** **4.2.4 Coining** **4.2.5 Extruding,** **4.2.6 Rolling,** **4.2.7 Machining;** **4.3 Gear generating methods:** **4.3.1 Gear Shaping with pinion cutter & rack cutter;** **4.3.2 Gear hobbing;**
UNIT 5	**5 GRINDING PROCESSES:** **5.1 Principles of metal removal by Grinding;** **5.2 Factors affecting the selection of grind wheels:** **5.3 Standard marking systems** **5.4 Grinding machines classificationand Construction details;**

Text Books	
1	**REFERENCES:** **1. Manufacturing technology – P N Rao, Tata McGraw-Hill Publications** **2. Elements of workshop Technology (Volume I & II) – S. K. HajraChaudary, Bose & Roy, Media Promoters and Publishers Limited.** **3. Production Technology (Volume I & II) – O. P. Khanna & Lal, Dhanpat Rai Publications.** **4. Fundamental of metal cutting and machine tools– B. L. Juneja, New age international**

	limited. **5. Manufacturing Technology, Metal Cutting & Machine tools– P. N. Rao, Tata McGraw-Hill Publications** **6. Production Technology – R.B. Gupta, Satya Prakashan, New Delhi**

THERMAL ENGINEERING - I

Course Code	:	ME 3005
Course Title	:	THERMAL ENGINEERING - I
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	Basic Mechanical Engineering
Course Category	:	PC

COURSE OBJECTIVES:

- To give a good understanding of and thorough insight into all important aspects of thermal systems, energy control and the general issue of energy.
- To understand the principles & working of various power producing & power absorbing devices.
- To study, analyze and evaluate the operation and the performance of I.C. engines, compressors and refrigerators, to apply pinch technology and to critically analyze and describe the global behavior of integrated thermal systems.

Course outcome	Details
CO 3005.1	**Know various sources of Energy and their applications.**
CO 3005.2	**Classify I.C. engines and understand their working and constructional features.**
CO 3005.3	**Draw the energy flow diagram of an I.C. engine and evaluate its performance.**
CO 3005.4	**Describe the constructional features of air compressor and working of different air compressors.**
CO 3005.5	**Know the applications of refrigeration and Classify air-conditioning systems.**

UNIT	Syllabus
UNIT 1	**1. SOURCES OF ENERGY:** **1.1 Brief description and classification of energy Sources:** **1.2 Solar Energy applications (Basic introduction for concept only)** **1.3 Wind Energy (Basic introduction for concept only)** **1.4 Tidal Energy, Ocean Thermal Energy, Geothermal Energy (Basic introduction for concept only);** **1.5 Biogas, Biomass, Bio-diesel(Basic introduction for concept only)** **1.6 Hydraulic Energy, Nuclear Energy(Basic introduction for concept only)** **1.7 Fuel cell. (Basic introduction for concept only)**
UNIT 2	**2. INTERNAL COMBUSTION ENGINES:** **2.1 Assumptions made in air standard cycle analysis;** **2.2 Brief description of Carnot, Otto and Diesel cycles with P-V and T-S diagrams;** **2.3 Difference between Internal and external combustion engines;** **2.4 advantages of I.C. engines over external combustion engines;** **2.5 classification of I.C. engines;**

	2.6 Working with neat sketch of I.C. engine indicating component part and function of parts **2.7 Working of four-stroke and two-stroke petrol and diesel engines;** **2.8 Comparison of two stroke and four stroke engines;** **2.9 Comparison of C.I. and S.I. engines;** **2.10 Valve timing and port timing diagrams for four stroke and two stroke engines.**
UNIT 3	**3. I.C. ENGINE SYSTEMS:** **3.1 Fuel system of Petrol engines;** **3.2 Fuel system of Diesel engines;** **3.3 Cooling system -** **3.4 Ignition systems –** **3.5 Types of lubricating systems used in I.C. engines;** **3.6 Types of governing of I.C. engines;** **3.7 Objective of super charging.**
UNIT 4	**4. PERFORMANCE OF I.C. ENGINES:** **4.1 Performance parameters in IC Engine** **4.2 Performance test;** **4.3 Morse test;** **4.4 Heat balance sheet;** **4.5 Methods of determination of B,P., I.P. and F.P.** **4.6 Simple numerical problems on performance of I.C. engines.**
UNIT 5	**5. AIR COMPRESSORS:** **5.1 Functions of air compressor;** **5.2 Uses of compressed air;** **5.3 Types of air compressors;** **5.4 Single stage reciprocating air compressor - its construction and working (with line diagram) using P-V diagram;** **5.5 Multi stage compressors – Advantages over single stage compressors;** **5.6 Rotary compressors:** **5.6.1 Centrifugal compressor,** **5.6.2 axial flow type compressor and** **5.6.3 vane type compressors**

Text Books	
1	**REFERENCES:** **1. Introduction to Renewable Energy – Vaughn Nelson, CRC Press** **2. Thermal Engineering – P.L. Ballaney, Khanna Publishers, 2002** **3. A Course in Thermal Engineering – S. Domkundwar& C.P. Kothandaraman, Dhanpat Rai.** **4. Thermal Engineering – R.S. Khurmi and J.K. Gupta, 18th Edition, S. Chand & Co, NewDelhi.** **5. Thermal Engineering – R. K. Rajput,8th Edition, Laxmi publications Pvt Ltd, New Delhi.**

MANUFACTURING ENGINEERING-ILAB

Course Code	:	*ME 3006 (Same in MA 3006)
Course Title	:	MANUFACTURING ENGINEERING-I LAB
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Nil
Course Category	:	PC

COURSE OBJECTIVES:

- To Practice the casting principles and operations in foundry.
- To Practice the operation of Lathe.
- To Practice the joining of metals using different Welding techniques.

Course outcome	Details
CO 3006.1	**Prepare a mould sand mix and molten metal and calculate the amount of metal to be poured in the mould**
CO 3006.2	**Centre the job and select the proper tool to perform the job on lathe machine.**
CO 3006.3	**Calculate the taper angle and practice different taper turning methods on lathe.**
CO 3006.4	**Prepare the edges for welding and select the suitable electrode, voltage and current.**
CO 3006.5	**Operate the welding transformer and generator to perform various weld joint operations.**

UNIT	Syllabus	
UNIT 1	**S.No.**	**Topics for Practice**
	1	Moulding& casting of (i) Connecting rod (ii) Solid bearing (iii) V-Pulley/Gear Pulley
	2	Arc welding (i) Lap Joint (ii) Butt Joint (iii) T- Joint
	3	Gas welding (i) Lap Joint (ii) Butt Joint
	4	Spot welding (i) Lap Joint
	5	Turning Exercise (i) Facing, Step Turning & Chamfering (ii) Step Turning & Taper Turning (iii) Step Turning & Groove Cutting (iv) Step Turning && Knurling (v) Step Turning & Thread Cutting (vi) Turning and Drilling
	6	Grinding the Lathe Cutting tools to the required angles
	7	Study of Lathe, Drilling machine, shaping machine and slotting machine
	8	The dismantling some of the components of lathe and then assemble the same
	9	List the faults associated with lathe and its remedies
	10	The routine and preventive maintenance procedure for lathe

Text Books	
1	**REFERENCE BOOKS:** 1. **Elements of Workshop Technology (Volume I & II) – HajraChowdry&Bhattacharaya, Media Promoters, 11th Edition, 2007** 2. **Introduction of Basic Manufacturing Processes and Workshop Technology – Rajendersingh, New age International (P) Ltd. NewDelhi, 2006** 3. **Workshop Technology – Raghuwanshi, Khanna Publishers. Jain &Gupta, New Delhi, 2002** 4. **Production Technology – Jain & Gupta, Khanna Publishers, New Delhi, 2006.** 5. **Production Technology –HMT, 18th edition, Tata McGraw Hill, New Delhi** 6. **Manufacturing process –Myro N Begman, 5th edition, Tata McGraw Hill, New Delhi**

FLUID MECHANICS & HYDRAULIC MACHINERY LAB

Course Code	:	*ME 3007 (Same in MA 3007)
Course Title	:	FLUID MECHANICS & HYDRAULIC MACHINERY LAB
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Fluid Mechanics & Hydraulic Machinery
Course Category	:	PC

COURSE OBJECTIVES:

- To calibrate the given flow measuring device.
- To apply the knowledge acquired in theory subject.
- To analyse the performance of turbines and pumps

Course outcome	Details
CO 3007.1	**Measure various properties such as pressure, velocity, flow rate using various instruments.**
CO 3007.2	**Calculate different parameters such as co-efficient of friction, power, efficiency etc. of various systems.**
CO 3007.3	**Understand the need and importance of calibration of pressure gauges.**
CO 3007.4	**Describe the construction and working of turbines and pumps.**
CO 3007.5	**Test the performance of turbines and pumps and Plot characteristics curves.**

UNIT	Syllabus
UNIT 1	**Topics for practice**
1	**Verification of Bernoulli's theorem.**
2	**Determination of Coefficient of Discharge of Venturimeter.**
3	**Determination of Coefficient of Discharge, coefficient of contraction and coefficient of velocity of Orificemeter.**
4	**Determination of coefficient of friction of flow through pipes.**
5	**Determination of force exerted by the jet of water on the given vane.**
6	**Determination of minor losses of flow through pipes.**
7	**Calibration of pressure gauge using dead weight pressure gauge tester.**
8	**Trial on centrifugal pump to determine overall efficiency.**
9	**Trial on reciprocating pump to determine overall efficiency.**
10	**Trial on Pelton wheel to determine overall efficiency.**
11	**Trial on Francis/Kaplan turbine to determine overall efficiency.**

Text Books	
1	**REFERENCES:** **N. Kumara Swamy, Fluid Mechanics and Machinery Laboratory Manual, Charotar Publishing House Pvt. Ltd., ANAND 388 001, Ed. 2008**

THERMAL ENGINEERING-I LAB

Course Code	:	ME 3008
Course Title	:	THERMAL ENGINEERING-I LAB
Number of Credits	:	1 (L:0; T:0; P:2)
Prerequisites	:	Thermal Engineering – I
Course Category	:	PC

COURSE OBJECTIVES:

- To understand the importance of fuel properties and learn the methods of determination of various properties of fuels.
- To understand the working principles of various methods used in determination of properties of fuels.
- To observe different parts of I.C. engine and understand their working.
- To identify the physical differences between S.I. and C.I. engines and 2-S and 4-S engines.

Course outcome	Details
CO 3008.1	**Understand the determination of flash and fire point of a given sample of fuel using given apparatus(Abels, Cleveland & Penesky martin)**
CO 3008.2	**Understand the determination of Viscosity of a given sample of oil using given apparatus.**
CO 3008.3	**Understand the determination of Calorific value of a given sample of fuel using given apparatus.**
CO 3008.4	**Understand the determination of amount of carbon residue of a given sample of petroleum product.**
CO 3008.5	**Draw VTD /PTD of given I.C. Engine and understand how the processes are controlled during its operation.**

UNIT	Syllabus
UNIT 1	

S.No.	Topics for practice
1	Flash & Fire point tests using Able's/Cleveland/Pensky Martin Apparatus
2	Viscosity measurement usi/Saybolt viscometer
3	Calorific value tests using Bomb Calorimeter (Solid and Liquid fuels) and Junkers Gas Calorimeter (Gaseous fuels)
4	Carbon residue test using Conradson's apparatus.
5	Assembling and disassembling of I.C. Engines
6	Port timing diagram of Petrol engine
7	Port timing diagram of Diesel engine
8	Valve timing diagram of Petrol engine
9	Valve timing diagram of Diesel engine
10	Study of petrol and diesel engine components and Models

Text Books	
1	**REFERENCES:** 1. **Thermal Engineering – P.L. Ballaney, Khanna Publishers, 2002** 2. **A Course in Thermal Engineering – S. Domkundwar& C.P. Kothandaraman, Dhanpat Rai & Publication New Delhi** 3. **Thermal Engineering – R.S. Khurmi and J.K. Gupta, 18th Edition, S. Chand & Co, NewDelhi**

COMPUTER AIDED MACHINE DRAWING PRACTICE

Course Code	:	*ME 3009 (Same in MA 3009)
Course Title	:	COMPUTER AIDED MACHINE DRAWING PRACTICE
Number of Credits	:	2 (L: 0, T: 0, P: 4)
Prerequisites (Course code)	:	Engineering Graphics
Course Category	:	PC

COURSE OBJECTIVES:

- To use computer aided drafting,
- To prepare geometrical model of various machine elements
- To draw the different views of machine elements
- To interpret the drawing in engineering field and illustrate three dimensional objects.

Course outcome	Details
CO 3009.1	Understand the representation of materials used in machine drawing
CO 3009.2	Draw the development of surfaces for sheet metal working applications.
CO 3009.3	Draw the machine elements including keys, couplings, cotters, riveted, bolted and welded joints.
CO 3009.4	Construct an assembly drawing using part drawings of machine components
CO 3009.5	Represent tolerances and the levels of surface finish of machine elements.

Syllabus

1. **Introduction to CAD software.**
2. **Drawing aids and editing commands.**
3. **Basic dimensioning, hatching, blocks and views.**
4. **Isometric drawing, printing and plotting**
5. **Machine Drawing practice using Auto CAD:**

Detailed drawings of following machine parts are to be given to the students to assemble and draw the sectional or plain elevations, plans and side views with dimensioning and bill of materials using cad software (12 exercises).

Sleeve & Cotter Joint
Spigot & Cotter Joint
Knuckle Joint
Stuffing Box
Screw Jack
Foot Step Bearing
Universal Coupling
Plummer Block
Simple Eccentric 5.10Machine Vice 5.11Connecting Rod
5.12Protected Type Flanged Coupling.

Text Books	
1	**REFERENCES:** 2. **Bhatt, N.D., Machine Drawing, Charotar Publishing House, 2003.** 3. **Sidheswar, N., Kannaiah, P. and Sastry, V.V.S., Machine Drawing, Tata McGraw Hill Book Company, New Delhi, 2000.** 4. **Kannaih, P., Production Drawing, New Age International , 2009**

IV SEMESTER

MEASUREMENTS & METROLOGY

Course Code	:	*ME 4001(Same in MA 4001)
Course Title	:	MEASUREMENTS & METROLOGY
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	NIL
Course Category	:	PC

COURSE OBJECTIVES:

- To study advances in technology, measurement techniques, types of instrumentation devices, innovations, refinements.
- To study the principles of instrumentation, transducers & measurement of non-electrical parameters like temperature, pressure, flow, speed, force and stress.

Course outcome	Details
CO 4001.1	Define accuracy, precision, calibration, sensitivity, repeatability and such relevant terms in metrology.
CO 4001.2	Distinguish between various types of errors.
CO 4001.3	Understand the principle of operation of an instrument and select suitable measuring device for a particular application.
CO 4001.4	Appreciate the concept of calibration of an instrument.
CO 4001.5	Analyze and interpret the data obtained from the different measurements processes and present it inthe graphical form, statistical form.

UNIT	Syllabus
UNIT 1	**1. INTRODUCTION TO MEASUREMENTS** **1.1 measurement and its Significance.** **1.2 Standards of measurements: Primary & Secondary.** **1.6 Factors influencing selection of measuring instruments.** **1.7 Terms applicable to measuring instruments: Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, calibration.(Definition only)** **1.8 Errors in Measurements.** **1.9 Surface finish measurements**
UNIT 2	**2. TRANSDUCERS AND STRAIN GAUGES** **2.1 Introduction and Transducers** **2.2 Strain gauge** **2.3 Force measurement**

	2.4 Torque measurement **2.5 Pressure measurement: Mcloed gauge**
UNIT 3	**3. APPLIED MECHANICAL MEASUREMENTS** **3.1 Speed measurement** **3.2 Displacement measurement** **3.3 Flow measurement** **3.4 Temperature measurement** **3.5 Miscellaneous measurements** **3.5.1 Humidity measurement: hair hygrometer** **3.5.2 Density measurement: hydrometer** **3.5.3 Liquid level measurement: sight glass, Float gauge** **3.5.4 Biomedical measurement: Sphygmo monometer**
UNIT 4	**4 LIMITS, FITS & TOLERANCES** **4.1 Concept of Limits, Fits, and Tolerances** **Selective Assembly** **Interchangeability** **Hole and Shaft Basis System** **Taylor's Principle** **Design of Plug** **Ring Gauges** **Concept of multi gauging and inspection** **Angular Measurement** **Working and Use of Universal Bevel Protractor, Sine Bar, Spirit Level** **Principle of Working of Clinometers** **Angle Gauges (With Numerical on Setting of Angle Gauges)** **Screw thread Measurements** **Two wire method** **Thread gauge micrometer** **Working principle of floating carriage dial micrometer**
UNIT 5	**5. GEAR MEASUREMENTAND TESTING** **Analytical and functional inspection** **Rolling test** **Measurement of tooth thickness (constant chord method)** **Gear tooth vernier** **Errors in gears such as backlash, runout, composite** **Machine tool testing** **Parallelism** **Straightness** **Squareness** **Coaxiallity** **Roundness** **Run out** **Alignment testing of machine tools as per IS standard procedure**

Text Books	
1	**REFERENCE BOOKS:** 1. **Mechanical measurements – Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.** 2. **Metrology & Measurement – Anand K Bewoor,Vinay kulakarni, Tata McGraw Hill, New Delhi, 2009** 3. **Principles of Industrial instrumentation and control systems – Channakesava. R. Alavala, DELMAR cenage learning, 2009.** 4. **Principles of Engineering Metrology – Rega Rajendra, Jaico publishers, 2008** 5. **Dimensional Metrology – Connie Dotson, DELMAR, Cenage learning, 2007** 6. **Instrumentation measurement and analysis – B.C. Nakara, K.K. Chaudary, second edition, Tata Mcgraw Hill, 2005.** 7. **Engineering Metrology – R.K. Jain, Khanna Publishers, New Delhi, 2005.** 8. **A text book of Engineering Metrology – I.C. Gupta, Dhanpat Rai and Sons, New Delhi, 2005** 9. **Metrology for Engineers – J.F.W. Galyer and C. R. Shotbolt, ELBS** 10. **Engineering Metrology – K. J. Hume, Kalyani publishers**

STRENGTH OF MATERIALS

Course Code		**ME 4002 (Same in MA/MP 4002)
Course Title		STRENGTH OF MATERIALS
Number of Credits		3 (L: 2, T: 1, P: 0)
Prerequisites		Engineering Mechanics (2005)
Course Category		PC

COURSE OBJECTIVES:

- To understand the concept of Simple Stresses and Strains.
- To understand the concept of Strain Energy.
- To understand the concept of Shear Force and Bending Moment Diagrams.
- To understand the concept of Theory of Simple Bending and Deflection of Beams.
- To understand the concept of Torsion in Shafts and springs.
- To understand the concept of Thin Cylindrical Shells.

Course outcome	Details
CO 4002.1	Compute stressand strain values and find the changes in axial, lateral and volumetric dimensions of bodies of uniform section and of composite section under the influence of normal forces.
CO 4002.2	Calculate thermal stresses, in bodies of uniform section and composite sections.
CO 4002.3	Define resilience, proof – resilience and modulus of resilience and obtain expressions for instantaneous stress developed in bodies subjected to different loads.
CO 4002.4	Compute shear force and bending moment at any section of beam and draw the S.F. & B.M diagrams of for UDL and Point loads.
CO 4002.5	Calculate the safe load, safe span and dimensions of cross section.

UNIT	Syllabus
UNIT 1	**1 SIMPLE STRESSES AND STRAINS** **1.1 Types of forces; Stress, Strain and their nature** **1.2 Mechanical properties of common engineering materials** **1.3 Significance of various points on stress – strain diagram for M.S. and C.I. specimens** **1.4 Significance of factor of safety** **1.5 Relation between elastic constants** **1.6 Stress and strain values in bodies of uniform section and of composite section under the influence of normal forces** **1.7 Thermal stresses in bodies of uniform section and composite sections** **1.8 Related numerical problems on the above topics**

	1.9 Strain Energy and its significance **1.10 Derivation of strain energy for the following cases: Gradually applied load, Suddenly applied load,** **Impact/shock load**
UNIT 2	**2. SHEAR FORCE & BENDING MOMENT DIAGRAMS** **2.1 Types of beams** **2.2 Types of Loads** **2.3 SFD and BM Diagram for various types of beams** **2.4 Analytical method for SF and BM of Simply supported beam** **2.5 Over hanging beam with point loads,** **2.6 Combination of point and UDL for the above; Related numerical problems**
UNIT 3	**3. THEORY OF SIMPLE BENDING AND DEFLECTION OF BEAMS** **3.1 Explanation of terms: Neutral layer, Neutral Axis, Modulus of Section, Moment of Resistance,Bending stress, Radius of curvature(Definition only)** **3.3 Problems involving calculations of bending stress, modulus of section and moment of resistance** **3.4 Calculation of safe loads and safe span and dimensions of cross- section** **3.5 Definition and explanation of deflection as applied to beams(Standard cases only)** **3.6 Related numerical problems**
UNIT 4	**4. TORSION IN SHAFTS AND SPRINGS** **4.1 Definition and function of shaft** **4.2 Calculation of polar M.I. for solid and hollow shafts** **4.3 Assumptions in simple torsion** **4.4 Problems on design of shaft based on strength and rigidity** **4.5 Numerical Problems related to comparison of strength and weight of solid and hollow shafts** **4.6 Classification of springs** **4.7 Deflection formula for closed coil helical spring (without derivation)** **4.8 Stiffness of spring** **4.10 Numerical problems on closed coil helical spring to find safe load, deflection, size of coil and number of coils**
UNIT 5	**5. THIN CYLINDRICAL SHELLS** **5.1 Explanation of longitudinal and hoop stresses in the light of circumferential and longitudinal failure of shell** **5.2 Derivation of expressions for the longitudinal and hoop stress for seamless and seam shells** **5.3 Related numerical Problems for safe thickness and safe working pressure**

Text Books	
1	**REFERENCE BOOKS:** **1. Strength of Materials – D.S. Bedi, Khanna Book Publishing Co. (P) Ltd., Delhi, 2017.** **2. Strength of Materials – B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications, New Delhi, 2013.** **3. Strength of Materials – S. Ramamrutham, Dhanpat Rai & Publication New Delhi.** **4. Strength of Materials – R.S. Khurmi, S.Chand Company Ltd. Delhi.** **5. A Text Book strength of Material– R.K. Bansal, Laxmi Publication New Delhi.**

THERMAL ENGINEERING-II

Course Code	:	ME 4003
Course Title	:	THERMAL ENGINEERING - II
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Thermal Engineering - I (ME 3005)
Course Category	:	PC

COURSE OBJECTIVES:

- To understand the working and applications of Gas turbines & Jet Propulsion.
- To understand the methods of computing various properties of steam.
- To understand the working of various Steam Boilers, functions of various accessories and mountings of boilers.
- To understand the Working of Steam Nozzles and Steam turbines.
- To understand the necessity of compounding and governing of a turbine.

Course outcome	Details
CO 4003.1	**Explain the working cycle of gas turbines, and the working of Jet and Rocket Engines apart from identifying the fuels used for Jet and Rocket propulsion.**
CO 4003.2	**Compute the work done, enthalpy, internal energy and entropy of steam at given conditions using steam tables and Mollier chart.**
CO 4003.3	**Distinguish between water tube and fire-tube boilers and explain the function all the mountings and accessories.**
CO 4003.4	**Calculate Velocity of steam at the exit of nozzle in terms of heat drop analytically and by using Mollier chart.**
CO 4003.5	**State the necessity of governing and compounding of a turbine.**

UNIT	Syllabus
UNIT 1	**1. GAS TURBINES** **1.1 Introduction and Derivation for work and efficiency ofAir-standard Brayton cycle** **1.2 Gas turbines Classification** **1.3 Comparison of gas turbine with reciprocating I.C. engines and steam turbines** **1.4 Applications and limitations of gas turbines**
UNIT 2	**2. PROPERTIES OF STEAM** **2.1 Brief Descriptions of different type of steam boilers and Classification of steam boilers** **2.2 Definitions of properties of steam**

	2.4 Determination of properties of steam using steam tables and Mollier chart applied in various applications **2.5 Simple direct problems on the above using tables and charts** **2.6 Steam calorimeters**
UNIT 3	**3. STEAM GENERATORS** **3.1 Brief Descriptions of different type of steam boilers and Classification of steam boilers** **3.2 Comparison of water tube and fire tube boilers** **3.3 Description with line sketches and working of modern high pressure boilers** **3.3.1 Lamont and** **3.3.2 Benson boilers** **3.4 Boiler mountings:** **3.5 Boiler accessories:**
UNIT 4	**4. STEAM NOZZLES** **4.1 Flow of steam through nozzle** **4.2 Velocity of steam at the exit of nozzle in terms of heat drop using analytical method and** **Mollier chart** **4.3 Discharge of steam through nozzles** **4.4 Critical pressure ratio** **4.5 Methods of calculation of cross-sectional areas at throat and exit for maximum discharge** **4.6 Effect of friction in nozzles** **4.7 Super saturated flow in nozzles** **4.8 Working steam jet injector** **4.9 Simple numerical problems**
UNIT 5	**5. STEAM TURBINES** **5.1 Classification of steam turbines with examples** **5.2 Difference between impulse & reaction turbines** **5.3 Principle of working of a simple De-lavel turbine with line diagrams** **5.4 Velocity diagrams** **5.5 Expression for work done, axial thrust, tangential thrust, blade and diagram efficiency, stage efficiency, nozzle efficiency** **5.6 Methods of reducing rotor speed** **5.7 Compounding for velocity, for pressure or both pressure and velocity** **5.8 Working principle with line diagram of a Parson's Reaction turbine** **5.9 Velocity diagrams** **5.10 Simple problems on single stage impulse turbines (without blade friction) and reaction turbine including data on blade height.** **5.11 Bleeding, re-heating and re-heating factors (Problems omitted)** **5.12 Governing of steam turbines:** **5.12.1 Throttle** **5.12.2 By-pass &** **5.12.3 Nozzle control governing**

Text Books	
1	**REFERENCE BOOKS:** **1. A Course in Thermal Engineering – S. Domkundwar & C.P. Kothandaraman, Dhanpat Rai & Publication, New Delhi.** **2. Thermal Engineering – R.K. Rajput, Laxmi Publication New Delhi.** **3. Thermal Engineering – P.L. Ballaney, Khanna Publishers, 2002.** **4. Treatise on Heat Engineering in MKS and SI Units – V.P. Vasandani & D.S. Kumar, Metropolitan Book Co. Pvt. Ltd, New Delhi.**

AUTOMOBILE ENGINEERING

Course Code	:	ME 40041
Course Title	:	AUTOMOBILE ENGINEERING
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PE

COURSE OBJECTIVES:

- To understand the basic structure and components of an automobile.
- To understand the concepts of cooling and lubricating systems.
- To understand the concepts of Ignition and transmission and steering systems.
- To understand the classification and necessity of suspension system.
- To identify different special vehicles.

Course outcome	Details
CO 40041.1	Identify the components of an automobile with their working
CO 40041.2	Explain the concepts of cooling and lubricating systems.
CO 40041.3	Explain the concepts of Ignition and Transmission and steering systems
CO 40041.4	Identify different suspension systems and their applications.
CO 40041.5	Differentiate the special vehicles according to the usage.

UNIT	Syllabus
UNIT 1	**UNIT-I: INTRODUCTION TO AN AUTOMOBILE** **Classification of Automobiles, Chassis and body, Components of vehicle – basic structure, power unit, transmission system, accessories, superstructure. (Basic functions and arrangements) , Layout of conventional type vehicle (front engine rear wheel drive), Vehicle dimensions, minimum ground clearance, minimum turning radius.**
UNIT 2	**UNIT-II: FRAME AND BODY** **Chassis, Frame, Function of frame, loads or frame, Frame construction, Frame less construction), Main features – strength, stiffness, space air drag, stream lining , weight, vibration, protection against weather, corrosion, safety and economy considerations, Body alignment**

UNIT 3	**UNIT-III: TRANSMISSION AND STEERING SYSTEM:** **General arrangement and Principle of friction clutches; Constructional details of Single plate clutch; Constructional details of multi-plate clutch; Constructional details of centrifugal clutch; Necessity for gear ratios and type of gear box,** **Working of sliding mesh gear box; Working of propeller shaft and universal joint;Types of rear axle; working and type of steering system.**
UNIT 4	**UNIT-IV:SUSPENSION AND BRAKEING SYSTEM** **Types and working of suspension system,Leaf spring and coil spring suspension system; Working of telescopic shock absorber; Functions of brakes and Types of brakes; Working of internal expanding brake; Working of disc brake**
UNIT 5	**UNIT-V: WHEELS AND TYRES** **Wheels and Tyres (Requirements of wheel, Types- pressed steel disc, wire, light alloy cast wheels, Tyres-Types (Tubed, Tubeless, Cross ply, Radial ply), Specification of tyres, Tyre maintenances, tyre trouble and repair**

Text Books	
1	**REFERENCE BOOKS:** **1. Automobile Engineering Vol I, II, Kirpal Singh, Standard Publishers Distributors, Delhi. 2012.** **2. Automobile Mechanics, A.K. Babu, S.C. Sharma, Khanna Publications, New Delhi** **3. Automotive Mechanics: Principles and Practices, Joseph Heitner, East West Press** **4. Automotive Mechanics, S. Srinivasan, 2nd Edition, Tata McGraw Hill** **5. Automobile Engineering Vol I and Vol II, K. M. Gupta, Umesh Publications.** **6. Automotive Engineering, Jain and Asthana, Tata McGraw Hill.**

COMPUTER INTEGRATED MANUFACTURING

Course Code	:	ME 40052
Course Title	:	COMPUTER INTEGRATED MANUFACTURING
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PE

COURSE OBJECTIVES:

- To understand General Principles of Mechanical Engineering.
- To understand laws of thermodynamics, thermal and thermodynamic Processes
- To understand working principles of power developing and power absorbing devices
- To understand basic materials and manufacturing processes

Course outcome	Details
CO 40052.1	**Understand the formulation of Liner Programming**
CO 40052.2	**Analyze and Convert the problem into a mathematical model.**
CO 40052.3	**Understand the dual LP and Primal Dual relation problems**
CO 40052.4	**Understand and implement the transportation problems at workplace**
CO 40052.5	**Solve the assignment problems, solving linear programming approach using software**

UNIT	Syllabus
UNIT 1	**UNIT-I** **Concept of Computer Integrated Manufacturing (CIM); Basic components of CIM; Distributed database system; distributed communication system, computer networks for manufacturing; future automated factory; social and economic factors**
UNIT 2	**UNIT-II** **Computer Aided Design (CAD): CAD hardware and software; product modelling, automatic drafting; engineering analysis; FEM design review and evaluation; Group Technology Centre.**

UNIT 3	**UNIT-III** **Computer Aided Manufacturing (CAM), Computer assisted NC part programming; Computer assisted robot programming; computer aided process planning (CAPP); computer aided material requirements planning (MRP)**
UNIT 4	**UNIT-IV** **Computer aided production scheduling; computer aided inspection planning; computer aided inventory planning, Flexible manufacturing system (FMS); concept of flexible manufacturing.**
UNIT 5	**UNIT-V** **Integrating NC machines, robots, AGVs, and other NC equipment; Computer aided quality control; business functions, computer aided forecasting; office automation**

Text Books	
1	**REFERENCE BOOKS:** **1. CAD, CAM, CIM - P.Radhakrishnan and S.Subramanyan, New Age International Publishers.** **2. Computer Integrated Manufacturing - Paul G. Rankey, Prentice Hall.** **3. Robotics Technology and Flexible Automation – S.R. Deb, Tata McGraw Hill.**

MATERIAL TESTING LAB

Course Code	*ME 4006 (Same in MA 4006)
Course Title	MATERIAL TESTING LAB
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Material Science & Engineering (ME 3002) Strength of Materials (ME 4002)
Course Category	PC

COURSE OBJECTIVES:

- To identify the type of material based on its grain structure
- To learn the procedure for identifying the cracks in the material
- To understand various material testing methods to determine mechanical properties such as yield stress, Ultimate stress, percentage elongation, Young's Modulus etc.

Course outcome	Details
CO 4006.1	**Identify the given specimen by viewing the micro structure using metallurgical microscope**
CO 4006.2	**Identify the cracks in the specimen using different techniques**
CO 4006.3	**Determine the various types of stress and plot the stress strain diagram for mild steel.**
CO 4006.4	**Determine the torsion, bending, impact and shear values of given materials**
CO 4006.5	**Determine the modulus of rigidity, strain energy, shear stress and stiffness of coil spring**

UNIT	Syllabus
UNIT 1	**PRACTICALS:** **1. Prepare a specimen and examine the microstructure of the Ferrous and Non-ferrous metals using the Metallurgical Microscope.** **2. Detect the cracks in the specimen using** **(i) Visual inspection and ring test (ii) Die penetration test (iii) Magnetic particle test.** **3. Determination of Rockwell's Hardness Number for various materials like mild steel, high carbon steel, brass, copper and aluminium.** **4. Finding the resistance of materials to impact loads by Izod test and Charpy test.** **5. Torsion test on mild steel – relation between torque and angle of twist determination of shear modulus and shear stress.** **6. Finding Young's Modulus of Elasticity, yield points, percentage elongation and percentage reduction in area, stress strain diagram plotting, tests on mild steel.** **7. Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open & Closed coil spring)** **8. Single or double Shear test on M.S. bar to finding the resistance of material to shear load.**

Text Books	
1	**REFERENCE BOOKS:** **1. Measurement system (Application and Design) – Ernest O Doebelin.** **2. Strength of Materials – R.S. Khurmi, S.Chand Company Ltd. Delhi** **3. A Text Book strength of Material– R.K. Bansal, Laxmi Publication New Delhi**

MEASUREMENTS & METEOROLOGY LAB

Course Code	:	*ME 4007 (Same in MA 4007)
Course Title	:	MEASUREMENTS & METEOROLOGY LAB
Number of Credits	:	1 (L:0, T:0 , P:2)
Prerequisites	:	Measurements & Meteorology (ME 4001)
Course Catergory	:	PC

COURSE OBJECTIVES:

- To understand techniques for precise measurement of the dimensions of various objects and shapes.

Course outcome	Details
CO 4007.1	Measure various component of linear measurement using Vernier calipers and Micrometre.
CO 4007.2	Measure various component of angle measurement using sine bar and bevelProtractor
CO 4007.3	Measure the geometrical dimensions of V-thread and spur gear

UNIT	Syllabus
UNIT 1	**PRACTICALS:** **1. Measure the diameter of a wire using micrometre and compare the result with digital Micrometer.** **2. Measure the angle of the machined surface using sine bar with slip gauges.** **3. Measure the angle of a V-block / Taper Shank of Drill / Dovetail using universal bevel protractor.** **4. Measure the dimensions of ground MS flat/cylindrical bush using Vernier Calliper compare with Digital/Dial Vernier Calliper.** **5. Measure the geometrical dimensions of V-Thread using thread Vernier gauge.** **6. Measure the thickness of ground MS plates using slip gauges.**

Text Books	
1	**REFERENCE BOOKS:** **1. Engineering Metrology – R. K. Jain** **2. Engineering precision metrology – R. C. Gupta** **3. A Hand book of Industrial Metrology – ASME**

THERMAL ENGINEERING LAB-II

Course Code	:	ME 4008
Course Title	:	THERMAL ENGINEERING LAB-II
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Thermal Engineering - I (ME 3005) Thermal Engineering - II (ME 4003)
Course Category	:	PC

COURSE OBJECTIVES:

- To understand the working of boilers, compressors and IC engines.
- To observe various parts of engines and understand their functions.
- To perform various tests on IC engines and calculate performance parameters.
- To understand economical and optimum running conditions of the engines.

Course outcome	Details
CO 4008.1	Evaluate the performance characteristics of single cylinder diesel/petrol engine at different loads and draw the heat balance sheet.
CO 4008.2	Find the indicated power of individual cylinders of an engine by using morse test.
CO 4008.3	Evaluate the performance characteristics Multi stage air compressor
CO 4008.4	Evaluate the co efficient of performance of refrigerator
CO 4008.5	Find the thermal conductivity of material

UNIT	Syllabus
UNIT 1	**PRACTICALS:** **1. Study of high pressure boiler with model.** **2. Study of boiler mountings and accessories.** **3. Conduct performance test on VCR test rig to determine COP of the refrigerator.** **4. Conduct performance test on multi stage reciprocating compressor.** **5. Conduct Morse test to determine the indicated power of individual cylinders.** **6. Conduct Performance test on 2-S CI/SI engine.** **7. Conduct Performance test on 4-S CI/SI engine.** **8. Conduct Heat balance test on CI/SI engine.** **9. Conduct Economical speed test on 4-S CI/SI engine.** **10. Thermal conductivity test on** **1) Thick slab 2) Composite wall 3) Thick cylinder** **11. Leak detection of refrigeration equipment.** **12. Conduct performance test on A/C test rig to determine COP of the refrigerator.**

Text Books	
1	**REFERENCE BOOKS:** **1. Thermal Engineering – P.L. Ballaney, Khanna Publishers, 2002** **2. A Course in Thermal Engineering – S. Domkundwar & C.P. Kothandaraman, Dhanpat Rai & Publication New Delhi** **3. Thermal Engineering – R.S. Khurmi and J.K. Gupta, 18th Edition, S. Chand & Co, NewDelhi**