NORTH MAHARASHTRA UNIVERSITY,

JALGAON (M.S.)

Bachelor of Engineering

(Mechanical Engineering)

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
(3rd Cycle)

Syllabus Structure & Contents
Of
Second Year of Engineering

Semester-III

w.e.f. 2018 – 19

Subject Group Code and Subject Groups

Sr. No.	GROUP	Category	Breakup of Credits (Total 160)
1	A	Humanities and Social Sciences including Management Courses (HSMC)	10
2	B	Basic Science Courses (BSC)	30
3	C	Engineering Science Courses including workshop, drawing, basics of electrical/mechanical/computer etc. (ESC)	33
4	D	Professional Core Courses (PCC)	53
5	E	Professional Elective Courses relevant to chosen specialization/branch (PEC)	18
6	F	Open subjects – Electives from other technical and /or emerging subjects (OEC)	12
7	G	Project work, seminar and internship in industry or appropriate work place/ academic and research institutions in India/abroad (PROJ)	15
8	H	Mandatory Courses (MC) [Environmental Sciences, Induction program, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)
		Total	171

Syllabus Structure for Second Year Engineering (Semester – III) (Mechanical Engineering) (w.e.f. 2018 – 19)

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
						Theory		Practical		Total	
		Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE	ESE	ICA	ESE		
Biology	B	3	1	--	4	40	60	-	-	100	4
Principles of Management	C	3	--	--	3	40	60	-	-	100	3
Electrical Drives and Controls	C	3	--	-	3	40	60	--	--	100	3
Thermodynamics	D	3	--	-	3	40	60	--	--	100	3
Industrial Psychology	A	3	--	--	3	40	60	-	-	100	3
Electrical Drives and Controls Lab	C	--	--	2	2	--	--	25	25(OR)	50	1
Thermodynamics Lab	D	--	--	2	2	--	--	25	25(OR)	50	1
Computer Graphics Lab	D	1	--	2	3	-	-	25	25(PR)	50	2
		16	1	6	23	200	300	75	75	650	20

ISE: Internal Sessional Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

Syllabus Structure for Second Year Engineering (Semester – IV) (Mechanical Engineering) (w.e.f. 2018 – 19)

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
						Theory		Practical		Total	
		Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE	ESE	ICA	ESE		
Mathematics – III	B	3	1	--	4	40	60	--	--	100	4
Introduction to Engineering Design Principles	C	3	--	--	4	40	60	--	--	100	3
Applied Thermodynamics	D	3	1	--	3	40	60	--	--	100	4
Fluid Mechanics and Fluid Machines	D	3	--	--	3	40	60	--	--	100	3
Industrial Economics	A	3	--	--	3	40	60	--	--	100	3
Applied Thermodynamics Lab	D	--	--	2	2	--	--	25	25(OR)	50	1
Fluid Mechanics and Fluid Machines Lab	D	--	--	2	2	--	--	25	25(OR)	50	1
Metrology and Quality Control Lab	D	1	--	2	3	-	-	25	25(OR)	50	2
Environmental Science*	H	--	--	--	--	--	80	20	--	--	0
		16	2	6	24	200	300	75	75	650	21

ISE: Internal Sessional Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

*: Only for Direct SE admitted students

Biology

COURSE OUTLINE

Course Title:	*Biology*	Short Title:	*Biology*	Course Code:	

Course description:

This course is introduced for learning the basic fundamentals of Life sciences (zoology & Botany) to undergraduate students. The prospectus includes a prior knowledge of Biotechnology. The goals of the course are to understand the basic principles of Biology and its applications in the field of Engineering.

	Hours/week	No. of Weeks	Total hours	Semester credits
Lecture	03	14	42	04
Tutorial	01	14	14	

Prerequisite course(s):

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Course objectives:

1. Students will understand the structures and characteristics or functions of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.
2. Students will learn the basic principles of inheritance at the molecular, cellular and Organism levels.
3. Students will test and deepen their mastery of genetics by applying this knowledge in a variety of problem-solving situations.

Course outcomes:

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

1. Use current techniques and analysis methods in molecular biology and genetics.
2. Understand the current concepts in Cell Biology, Stem Cell Biology and Development.
3. Know the structure/function of the basic components of prokaryotic and eukaryotic cells including macromolecules and organelles.
4. Demonstrate proficiency with at least one instrument commonly used in biological research (microscope, etc).

COURSE CONTENT

Name of the Subject: Biology		Semester:	III
Teaching Scheme:		Examination scheme	
Lectures:	3 hours/week	End semester exam (ESE):	60 marks
		Duration of ESE:	03 hours
		Internal Sessional Exams (ISE):	40 marks

Unit–I: Diversity of Organism and Cell Biology	No. of Lectures: 08 Hours	Marks: 12

Introduction: Living systems, Bio-mimicry, Metabolism, Taxonomy, Concept of species, Structural organization of life, Concepts of modern cell, history of cell, Cell theory, Structure of cell:- Cell shape, size and cell number, Types of cells:- Prokaryotic cells and Eukaryotic cells,

Chemistry of cells.
Cell Division: Cell cycle, mitosis, meiosis, mitotic cell division, cell cycle check points, meiotic cell division, embryonic cell division, cell death.

Unit–II: Plant and Animal Kingdom	No. of Lectures: 08 Hours	Marks: 12

Plant Kingdom:
Introduction to plants, Salient features of major plant groups: Bryophyta, Pteridophyta, Gymnospermae, Angiospermae.
Plant Growth & Development: Introduction, Seed Dormancy, Seed Germination, Phases of growth, Plant growth hormones.
Animal Kingdom:
Animal Classification, Salient features of non-chordates up to phylum level: Phylum porifera, phylum Cnidaria, Phylum Ctenophora, Phylum Platyhelminthes.

Unit–III: Plant Cell and Animal cell culture and Applications	No. of Lectures: 08 Hours	Marks: 12

Plant Cell Culture:
Brief introduction to cell culture with respect to the properties of plant cells, Media requirements, Typical media used, Classification of tissue culture, callus culture, cell suspension culture, Application of callus culture and cell suspension culture, Plant cell cultivation Bioreactors
Animal Cell Culture:
Brief introduction to animal cell culture, Culture medium: Natural and Artificial media, introduction to balanced salt solutions and simple growth medium, Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium, Animal Bioreactors.

Unit–IV: Microbial Culture and Applications	No. of Lectures: 08 Hours	Marks: 12

Introduction, Microbial Culture Techniques, growth curve, Pure culture techniques – microbial culture media, isolation, identification and maintenance of cultures, incidences of microorganisms in soil, water, air, food and sewage, food spoilage organisms, Applications of Microbial Culture Technology.

Unit–V: Biotechnology and its Applications	No. of Lectures: 08 Hours	Marks: 12

Definitions, scope of Biotechnology, Recombinant DNA Technology: Making Recombinant DNA, Tools in Genetic Engineering, Polymerase Chain reaction (PCR).
Applications of Biotechnology:
Bioinformatics, Biomechanics, Biotechnology of waste treatment, Biosensors, Forensic science, Food Biotechnology, Fermentation Technology.

Text Books:

1. B.D. Singh “Genetics” Kalyani Publications Third Edition.
2. C.B. Pawar“Cell Biology” Himalaya Publications, Third Edition.
3. C.B. Pawar“Cell and Molecular Biology” Himalaya Publications.
4. Text book of Zoology by V.K. Agrawal, S. Chand Publication.
5. Text book of Botany by Dr. B.P. Pandey S. Chand Publication.
6. Text book of Biotechnology by R.C. Dubey, S. Chand Publications.

Reference Books:

1. P. K Gupta, Introduction to Biotechnology, Rastogi Publications.
2. B. D. Singh, Biotechnology: Expanding Horizons, Kalyani Publishers, New Delhi, Second Revised Edition, 2008.
3. S. S. Purohit, Biotechnology: Fundamentals and Applications, Agrobios (India), 4th Edition, 2005.
4. Andreas D. Boxevanis, Bioinformatics, Wiley International
5. David W. Mount, Bioinformatics: Sequence and Genome analysis, Cold Spring Harbour.
6. Bruce E Rittmann, Rurry L.Mc carty, Environmental Biotechnology: Principles and Applications, Mcgraw Hill international.
7. B. Sivashankar, Food Processing and Preservation, Prentice Hall ,India
8. Bhojwani, S.S. and Rajdan, Plant Tissue Culture: Theory and Practice, Revised Edition, Elsevier.
9. Freshney, Culture of Animal Cells, 5th Edition, Wiley-Liss, 2005
10. M. J. Pelczar, Jr. E.C.S. Chan and N.R. Krieg, Microbiology 5th Ed., TMH Book Company.

Principles of Management

COURSE OUTLINE

Course Title:	*Principles of Management*	Short Title:	*POM*	Course Code:	

Course description:

This course is designed to be an overview of the major functions of management. Emphasis is on planning, organizing, controlling, directing, and communicating. Upon completion, students should be able to work as contributing members of a team utilizing these functions of management.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	03	14	42	03

Prerequisite course(s):

English

Course objectives:

To understand the principles of management and their application to the functioning of an organization

Course outcomes:

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

1. Get a clear understanding of management functions in an organization
2. Explain strategic management in business operations.
3. Define management, quality management, and project management.
4. Identify relevant issues in human resource management.

COURSE CONTENT

Principles of Management		Semester:	*III*
Teaching Scheme:		Examination scheme	
Lectures:	3 hours/week	End semester exam (ESE):	60 marks
		Duration of ESE:	03 hours
		Internal Sessional Exams (ISE):	40 marks

Unit–I: Management & Organization	No. of Lectures: 08 Hours	Marks: 12

Definition of management, science or art, manager vs. entrepreneur; Types of managers-managerial roles and skills; Evolution of management- scientific, human relations, system and contingency approaches; Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management.

Unit–II: Planning & Decision Making	No. of Lectures: 08 Hours	Marks: 12

Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Decision making steps & processes.

Unit–III: Human Resource Management	No. of Lectures: 08 Hours	Marks: 12

Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management.		
Unit–IV: Motivation & Jab Satisfaction	No. of Lectures: 08 Hours	Marks: 12
Directing, individual and group behaviour, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, Effective communication.		
Unit–V: Process Control Techniques	No. of Lectures: 08 Hours	Marks: 12
Controlling, system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.		
Text Books:		
1. Tripathy PC & Reddy PN, Principles of Management, Tata McGraw Hill, 1999. 2. Principal and Practice of Management, by L.M. Prasad. 3. Business Organisation & Management, R.K. Sharma. 11. Business Organisation & Management, C.B. Gupta.		
Reference Books:		
1. Hellriegel, Slocum & Jackson, ' Management - A Competency Based Approach', Thomson South Western, 10th edition, 2007. 2. Harold Koontz, Heinz Weihrich and Mark V Cannice, 'Management - A global 3. Robins S.P. and Couiter M., Management, Prentice Hall India, 10th ed., 2009. 4. Stoner JAF, Freeman RE and Gilbert DR, Management, 6th ed., Pearson Education		

Electrical Drives and Controls					
COURSE OUTLINE					
Course Title:	*Electrical Drives and Controls*	Short Title:	*EDC*	Course Code:	

Course description:

This course is an advanced level of Basic Electrical Engineering which will further strengthen the knowledge of the students. The course explores on understanding of construction, basic principles and operation of electrical machines, performance and characteristic of electrical machines. It also gives the platform to understand adoptability of different drives for different type of load characteristic in industrial applications.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	03	14	42	03

Prerequisite course(s):

Knowledge of subject Introduction to Electrical Engineering at first year.

Course objectives:

The object of syllabus to impart the fundamental knowledge of DC and AC Machines. Students will able to develop their ability to apply the specific procedures for comprehensive treatment of rotating machines. In the earlier stage the machine worked in isolation and its simple analysis was sufficient. Now the electric machines form an integral part of large system comprising of other components as well. The object is not great depth, but presentation through enough to give theory at a level that can be understood by undergraduate. With this beginning, the students will have the foundation to continue his education and able to do better in professional duties in the field of manufacturing, testing operation and control.

Course outcomes:

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

1. Apply basic knowledge of science and engineering to understand electrical machines.
2. Understand construction, concepts, principles of operation and application of DC and AC motors.
3. Understand the behaviour of DC and DC Machines and analyze data for qualitative and quantitative parameters to determine characteristics of machines by performing practical.
4. Apply knowledge of drives for different application of load in industrial sectors.
5. Perform professional duties in team of manufacturing, testing, operation and maintenance with the sense of safety precautions.
6. Do higher studies and able to use updated software and tools for continuous updating of knowledge.

COURSE CONTENT			
Electrical Drives and Controls	Semester:	*III*	
Teaching Scheme:		Examination scheme	
Lectures:	3 hours/week	End semester exam (ESE):	60 marks
		Duration of ESE:	03 hours
		Internal Sessional Exams	40 marks

		(ISE):	
Unit–I: DC Machines	No. of Lectures: 08 Hours		Marks: 12
DC Generator: Constructional features, basic principle of working, EMF equation, type of DC generators, applications of different types of generators. DC Motors: Principle, Significance of back EMF, Starter, classification of motors, torque & speed equation, speed control, applications of motors.			
Unit–II: Induction Motor	No. of Lectures: 08 Hours		Marks: 12
Construction of 3-phase squirrel cage and phase wound rotor, Operation, types, production of rotating magnetic fields, principle of operation, torque equation under starting & running condition, condition for maximum torque, torque – slip characteristics, applications of induction motor. Single Phase Induction Motors: principle of operation, construction, types and application, types of single phase induction motors (Capacitor start and split phase only)			
Unit–III: Transformer	No. of Lectures: 08 Hours		Marks: 12
Single Phase Transformers: Constructional features, basic principle of working, arrangements of core and coils in shell type and core type transformer, EMF equation, General phasor diagrams of transformer on no load and load, Losses, Efficiency and maximum efficiency. Three Phase Transformers: Constructional features, basic principle of working, EMF equation.			
Unit–IV: Special purpose motors	No. of Lectures: 08 Hours		Marks: 12
Construction, basic principle of working, applications of servomotor, permanent magnet DC Motor Stepper motor, Brush less DC motor.			
Unit–V: Electrical Drives	No. of Lectures: 08 Hours		Marks: 12
Advantages and disadvantages of Electric Drives, Type of motors used for electric drives, selection of electric drive, status of DC and AC drives, classification of electric drive, type of load and load torque, Starting, Reversing and braking of DC and AC motors, Size and rating of motor, Class of Duty, load equalization & use of flywheel, Mechanical consideration like enclosures, bearing, noise, type of transmission and choice.			
Text Books:			
1. A. E. Fitzgerald & C. Kingsley & S. D. Umans, "Electric Machinery", Tata McGraw Hill, New Delhi 2. A.E. Clayton & N. N. Nancock, "The performance & Design of DC Machines"' CBC Publications & Distributors, Delhi 3. Nagrath I. J., Kothari D. P. , 'Electric Machines', Tata McGraw-Hill, New Delhi 4. Ashfaq Husain, 'Electrical Machines', Dhanpat Rai & Co. 5. B L Theraja, "Electrical Technology Vil-II", S Chand Publication. 6. R K Rajput, "Utilization of Electrical Pawar", Laxmi Publication Pvt Ltd, New Delhi. 7. G. K. Dubey , "Fundamentals of Electrical Drives", Narosa Publishing House. 8. *http://nptel.iitm.ac.in*			

Thermodynamics

COURSE OUTLINE

Course Title:	*Thermodynamics*	Short Title:	*THERMO*	Course Code:	

Course description:

It provides insights to the basic principles of classical thermodynamics. The system and surrounding interactions involving work and heat transfer associated with the change in property is included. Zeroth law, First Law, Second Law and Significance of Entropy are the key areas of the study in this course. It will help students to apply in everyday life and in industrial applications.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	03	14	42	03

Prerequisite course (s):

1. Physics
2. Chemistry

Course objectives:

1. To learn about work and heat interactions, and balance of energy between system and its surroundings.
2. To learn about application of I law to various energy conversion devices.
3. To evaluate the changes in properties of substances in various processes.
4. To understand the difference between high grade and low grade energies and II law limitations on energy conversion.

Course outcomes:

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

1. After completing this course, the students will be able to apply energy balance to systems and control volumes, in situations involving heat and work interactions.
2. Students can evaluate changes in thermodynamic properties of substances.
3. The students will be able to evaluate the performance of energy conversion devices.
4. The students will be able to differentiate between high grade and low grade energies.

COURSE CONTENT

Thermodynamics		Semester:	*III*
Teaching Scheme:		Examination scheme	
Lectures:	3 hours/week	End semester exam (ESE):	60 marks
		Duration of ESE:	03 hours
		Internal Sessional Exams (ISE):	40 marks

Unit–I: Fundamentals of Thermodynamics	No. of Lectures: 08 Hours	Marks: 12

Introduction to Thermodynamics, Macroscopic & Microscopic aspects, System & Control Volume, properties, processes and cycles, thermodynamic equilibrium, Quasi static process, Temperature, Zeroth law of thermodynamics, thermal equilibrium, Measurement of temperature, temperature scales, liquid in glass thermometer, electrical resistance thermometer, thermocouples Work- Thermodynamic definition of Work, p-dv work or displacement work, path function ,

point function, electrical work, Shaft work, Flow work, magnetic, gravitational , spring work, Heat transfer, path function, specific heat, latent heat, comparison of heat transfer and work transfer phenomenon, examples of heat and work interactions.

Unit–II: First Law of Thermodynamics	No. of Lectures: 08 Hours	Marks: 12

First law for non flow processes or closed system, Joule's experiment, Energy –a property of the system, different forms of the stored energy, internal energy, concept of total energy, specific heats, Enthalpy,

First law for flow process or open system, steady flow process, general steady flow energy equations, Application of SFEE to Nozzle and diffuser, throttling device, Turbine and compressor, heat exchanger, pumps, variable flow process, system technique and control volume technique, discharging and charging a tank.

Unit–III: Second Law of Thermodynamics	No. of Lectures: 08 Hours	Marks: 12

Introduction, Limitations of First Law, Energy reservoirs, Heat Engine, Refrigerator, Heat Pump, Kelvin-Plank statement, Clausius's Statement, equivalence of Kelvin –Plank and Clausius's statement, Reversibility and Irreversibility, Causes of irreversibility, Conditions for irreversibility, Carnot cycle, Carnot Theorem, Absolute Temperature scale.

Entropy: Introduction, Entropy Principle, Clausius's theorem, Entropy is a property, Temperature Entropy plot, Clausius's inequality, Entropy change in an irreversible process, Entropy and Disorder.

Unit–IV: Ideal & Real Gases	No. of Lectures: 08 Hours	Marks: 12

Introduction, The equation of State, p-v-T surface, Internal energy, Enthalpy, Specific heats, Real gases.

Pure Substances: Definition, Phase change phenomenon, p-T chart, p-v-T surface, phase change terminology and definitions, Formation of steam, critical point, triple point, dryness fraction, Dry, Wet and Superheated steam, Vapour process, Use of steam table, Mollier Charts.

Unit–V: Availability and Irreversibility	No. of Lectures: 08 Hours	Marks: 12

Quality of Energy, Available and unavailable energy, Availability, surrounding work, reversible work and Irreversibility, Availability in a closed system, Availability in SSSF process in an open system, Second law efficiencies of Processes of Turbine, Compressor and Heat Exchanger.

Thermodynamic cycles: Basic Rankine Cycle, Basic Brayton Cycle, Basic Vapour Compression Cycle and comparison with Carnot cycle.

Text Books:

1. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.
2. R K Rajput, 2016, A Textbook of Engineering Thermodynamics, Laxmi Publication, 5th edition.
3. Domkunwar,2016,A Course in Thermal Engineering, Dhanpat Rai & Co., 6th edition
4. Y.V.C.Rao, (2004), An Introduction to Thermodynamics, Universities Press.
5. C. P. Arora, (2005) Thermodynamics, Tata McGraw-Hill Publishing Company Ltd.
6. David R. Gaskell, (2003), Introduction to Thermodynamics of Materials, Taylor and Francis Publisher.
7. M. Achuthan, (2004), Engineering Thermodynamics, Prentice Hall India Limited.

8. Eastop, (2004), Applied Thermodynamics for Engineering Technologies, Addison Wesley Logman Limited.

Reference Books:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edit ion, *Fundamentals of Thermodynamics*, John Wiley and Sons.
2. Jones, J. B. and Duggan, R. E., 1996, *Engineering Thermodynamics*, Prentice-Hall of India.
3. Moran, M. J. and Shapiro, H. N., 1999, *Fundamentals of Engineering Thermodynamics*, John Wiley and Sons.
4. Yunus A. Cengel, (2005), Thermodynamics: An Engineering Approach, Tata McGraw-Hill Publishing Company Ltd.

Industrial Psychology

COURSE OUTLINE

Course Title:	*Industrial Psychology*	Short Title:	*IP*	Course Code:	

Course description:

This course will provide an Introduction to Industrial and Organizational Psychology, a scientific discipline that studies human behavior in the workplace. Organizational psychologists help institutions hire, manage, develop, support employees and align employee efforts with business needs.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	3	14	42	3

Prerequisite course (s):

English, Science

Course objectives:

1. The emergence of Industrial and Organizational Psychology.
2. The work done in Industrial and Organizational Psychology.
3. The significance of training, performance appraisal, leadership models.
4. The importance of Engineering Psychology.
5. To acquaint the students with work motivation, Attitudes, Job Satisfaction, Leadership, Communication.

Course outcomes:

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

1. To Identify major theoretical concepts in psychology
2. To Exhibit effective communication skills
3. To Understand importance of motivation
4. To Demonstrate knowledge of the topics listed in the course outline
5. To Think critically about concepts and issues in industrial psychology
6. To Understand and apply the different concepts in industrial psychology

Introduction to Industrial Psychology

COURSE CONTENT

Industrial Psychology		Semester:	III
Teaching Scheme:		Examination scheme	
Lectures:	3 hours/week	End semester exam (ESE):	60 marks
		Duration of ESE:	03 hours
		Internal Sessional Exams (ISE):	40 marks

Unit–I: Introduction to Industrial Psychology	No. of Lectures: 08 Hours	Marks: 12

Nature and Meaning of Industrial Psychology, Psychology as a science. Personality: Definition, types of personality, Measurement of Personality. Type 'A' Personality, Anger scale, wellbeing scales. Behaviour Modification: Perception, Motivation, and Learning, Relaxation Techniques, Assertive Training, and Desensitization Procedures Role of Industrial Psychology, Organizational Attitude, Groups & work teams, managing Work-force diversity, improving quality and productivity, improving people skills, Empowering peoples, Group formation & development, stimulating innovation and change Group Behaviour, productive & Counterproductive behaviour.

Unit–II: Application of Psychology	No. of Lectures: 08 Hours	Marks: 12
Industry: Selection, Training, motivation and Productivity, Team building, Stress-management. Marketing: Consumer Behaviour and Advertising; Self Development: Application of Psychology in building memory and creativity, occupational health psychology. Motivation & Decision making :Motivation & work behaviour, Theories of Employee Motivation, Theory X and Y, McClelland's, Need Theory, Herzberg's Two Factor Theory, Cultural, Differences in Motivation, leadership and power in organization, Decision making process, individual influences, group decision process.		
Unit–III: Communication in Organization	No. of Lectures: 08 Hours	Marks: 12
Communication process: barriers in communications, Communication technology: management information systems, telecommunication and Interpersonal communication, factors involved in interpersonal communication, communication networks, And improving communications. Leadership: Leadership vs. Management, Leadership Theories, Emerging issues in Leadership		
Unit–IV : Personnel Selection and Training	No. of Lectures: 08 Hours	Marks: 12
Job Profile, job analysis and Recruitment techniques, Interviews, psychological testing and Needs assessment for training, Psychological Principles in training and training for knowledge and skill, Evaluation of Training Programme.		
Unit–V : Job Evaluation and satisfaction	No. of Lectures: 08 Hours	Marks: 12
Uses of performance evaluation: Downsizing, promotion, seniority, Appraisal rating systems: Graphic rating scales and rating errors, Non-rating evaluation methods: Checklists and comparison methods. Job satisfaction as a job attitude, Components of job satisfaction: Satisfaction with work, with pay and with Supervision, Measuring job satisfaction: Job Descriptive Index, Minnesota Satisfaction, feelings about work		
Text Books: 1. Michael G. Aamodt A textbook on Applied Industrial/ Organizational Psychology. 2. Richard Cyert and James March, A Behavioural Theory of The Firm, Blackwell Publishers. 3. Paul Spector, Industrial and organizational Psychology, Wiley		
Reference Books: 1. Aamodt, M.G. (2007). Industrial and organizational psychology: An applied approach. US:Thomson & Wadsworth. 2. Berry, L.M. (1998), reprint 2010. Psychology at work: An introduction to Industrial and Organizational Psychology. N.Y.: McGraw-Hill International Editions. 3. Luthans, F. (1995). Organizational behavior (7th ed). New York: McGraw- Hill, inc. Corporate Social Responsibility – Madhumita Chattergi – Oxford University Press 4. Khanna O.P. : Industrial Engineering obbins, Stephen, Organizational Behavior, Prentice Hall, India. 5. Aswathappa K. (2008). Human Resource Management (fifth edition) New Delhi: Tata McGraw Hill.		

Electrical Drives and Controls					
LAB COURSE OUTLINE					
Course Title:	*Electrical Drives and Controls Lab*	Short Title:	*EDC Lab*	Course Code:	

Course description:

In this laboratory, course emphasis on imparting the practical knowledge and understanding of basic principles, characteristic , performance and testing of Machines, Speed control and use of other measuring equipment with electrical safety standards. It also give the platform to selection of motor based on type of drives

Laboratory	Hours/week	No. of weeks	Total hours	Semester credits
	02	*14*	*28*	*01*

End Semester Exam (ESE) Pattern:	*Oral (OR)*

Prerequisite course(s):

Knowledge of HSC and First year Engineering.

Course objectives:

The objective of the laboratory is to impart the fundamental knowledge of Machines and drives. Students will able to develop their ability to apply the specific procedures for analyze the experimental results. The students will able to understand the characteristic of machines and application in process and manufacturing. It also gives the platform to understand adoptability of different drives for different type of load characteristic in industrial applications. In this lab course, students will be familiar with the use of different equipments, safety precautions on work place. This makes bridge on theoretical knowledge and practical practices.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Understand constructional details of dc electrical machines and transformer.
2. Understand specifications of machines.
3. Conduct practical for determination of characteristics of different type of generator, motors and transformers.
4. Able to analyze the test data for practical for applications, design and manufacturing processes.
5. Understand methods of speed control and starters for dc motors.
6. Select motor and transformer based on technical specifications, safety precautions and application.
7. Do professional duties in technical field for economical development.

LAB COURSE CONTENT

Electrical Drives and Controls Lab		Semester:	*III*
Teaching Scheme:		Examination scheme	
Practical:	2 hours/week	End semester exam (ESE):	*25 marks*
		Internal Continuous Assessment (ICA):	*25 marks*

Note: Lab file should consist of minimum Eight experiments.

1. Load test on DC Shunt generator and determination of voltage regulation.
2. Study of three point starter for DC Shunt Motor and Reversing the direction of rotation of DC Shunt motor.

3. Speed control of DC Shunt motor (a) Armature Voltage Control Method (b) Field Current Control Method.
4. Load Test on DC Shunt Motor.
5. Load Test on Single Phase Transformer and determination of Voltage regulation.
6. Load Test on Three Phase Induction motor.
7. Study of AC motor starter and Reversing of Three Phase Induction motor.
8. Load Test on single Phase Induction motor.
9. Study of Motors Enclosures and their applications.
10. Study of different type of drives.

Text Books:

1. A. E. Fitzgerald & C. Kingsley & S. D. Umans, "Electric Machinery", Tata McGraw Hill, New Delhi.
2. A.E. Clayton & N. N. Nancock, "The performance & Design of DC Machines"' CBC Publications & Distributors, Delhi.
3. Nagrath I. J., Kothari D. P., 'Electric Machines', Tata McGraw-Hill, New Delhi.
4. Ashfaq Husain, 'Electrical Machines', Dhanpat Rai & Co.
5. B L Theraja, "Electrical Technology Vil-II", S Chand Publication.
6. R K Rajput, "Utilization of Electrical Pawar", Laxmi Publication Pvt. Ltd, New Delhi.
7. G. K. Dubey, "Fundamentals of Electrical Drives", Narosa Publishing House.
8. *http://nptel.iitm.ac.in*

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guidelines for ESE:

In ESE evaluation will be based on continuous evaluation and oral examination.

Thermodynamics Lab

LAB COURSE OUTLINE

Course Title:	*Thermodynamics Lab*	Short Title:	*Thermo Lab*	Course Code:	

Course description:

This course provides the students with comprehensive study of domestic Refrigerator, Air conditioner, Four stroke engine, Two stroke engine, various Nozzles, Centrifugal pump, Air compressor and Heat exchangers.

Laboratory	Hours/week	No. of weeks	Total hours	Semester credits
	02	14	28	01

End Semester Exam (ESE) Pattern:	*Oral (OR)*

Prerequisite course(s):

Physics

Course objectives:

1. To understand the construction and working of thermal appliances.
2. To analysis the performance.
3. To study uses and applications of these thermal devices.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Describe the construction and working of thermal appliances.
2. Explain thermal systems.
3. Apply the thermal principles.

LAB COURSE CONTENT

Thermodynamics Lab		Semester:	*III*
Teaching Scheme:		Examination scheme	
Practical:	2 hours/week	End semester exam (ESE):	*25 marks*
		Internal Continuous Assessment (ICA):	*25 marks*

1. Demonstration and study of domestic Refrigerator.
2. Demonstration and study of Air conditioner.
3. Demonstration and study of Four stroke engine.
4. Demonstration and study of Two stroke engine.
5. Demonstration and study of various Nozzles.
6. Demonstration and study of Centrifugal pump.
7. Demonstration and study of Air compressor.
8. Demonstration and study of Heat Exchanger.

Text Books:

1. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.
2. R K Rajput, 2016, A Textbook of Engineering Thermodynamics, Laxmi Publication, 5th edition.

3. Domkunwar, (2016), A Course in Thermal Engineering, Dhanpat Rai & Co., 6th edition
4. Y.V.C.Rao, (2004), An Introduction to Thermodynamics, Universities Press.
5. C. P. Arora, (2005), Thermodynamics, Tata McGraw-Hill Publishing Company Ltd.
6. David R. Gaskell, (2003), Introduction to Thermodynamics of Materials, Taylor and Francis Publisher.
7. M. Achuthan, (2004), Engineering Thermodynamics, Prentice Hall India Limited.
8. Eastop, (2004), Applied Thermodynamics for Engineering Technologies, Addison-Wesley Logman Limited.

Reference Books:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edit ion, *Fundamentals of Thermodynamics*, John Wiley and Sons.
2. Jones, J. B. and Duggan, R. E., 1996, *Engineering Thermodynamics*, Prentice-Hall of India
3. Moran, M. J. and Shapiro, H. N., 1999, *Fundamentals of Engineering Thermodynamics*, John Wiley and Sons.
4. Yunus A. Cengel, (2005), Thermodynamics: An Engineering Approach, Tata McGraw-Hill Publishing Company Ltd.

Guide lines for ICA:

Students must submit ICA in the form of journal. Each assignment should be well documented. Faculty in charge will assess the assignments continuously and grade or mark each assignment on completion date declared for each assignments.

Guidelines for ESE:

ESE will be based on the laboratory assignments submitted by the students in the form of journal. Evaluation will be based on the understanding and execution.

Computer Graphics lab					
COURSE OUTLINE					
Course Title:	*Computer Graphics lab*	Short Title:	*CG*	Course Code:	
Course description:					
This course includes design and drafting related to mechanical elements. Lab's related to elementary level knowledge of drafting and Auto-LISP program. Sketching and computer aided design tools are used to create the various types of views needed for design and documentation.					

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	01	14	14	*2*
Laboratory	02	14	28	

Prerequisite course (s):
Engineering Graphics, Essential Computer Knowledge Required.

Course objectives:

1. Learn to sketch and take field dimensions.
2. Learn to take data and transform into the graphics drawing
3. Learn basic AutoCAD skills.
4. Learn basic engineering drawing formats
5. *To* model the object using Wireframe, surface and solid modeling techniques

Course outcomes:

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

1. Demonstrate and understand the basic concepts of geometric modeling and computer graphics.
2. Drafting of mechanical elements.
3. Programs for mechanical elements in Auto-LISP.
4. Solve numerical on transformation.

COURSE CONTENT

Computer Graphics		Semester:	*III*
Teaching Scheme:		Examination scheme	
Lectures:	1 hours/week	End semester exam (ESE):	25 marks
		Internal Class Assessment (ICA):	25 marks
Unit–I: Overview of Computer Graphics covering		No. of Lectures: 02 Hours	

Introduction to CAD. Advantages and Applications of CAD. Difference between conventional drafting methods and CAD. Introduction to Auto-CAD and Details of various menu bars and tool bars, Drawing Area etc. Demonstrating knowledge of the theory of CAD software such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Cross hairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects	
Unit–II: Customization & CAD Drawing	No. of Lectures: 02 Hours
Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles. Annotations, layering & other functions covering: Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers	
Unit–III: Transformations in Graphics	No. of Lectures: 04 Hours
Two Dimensional transformation, Homogeneous transformation, Concatenate co ordinate transformation, Translation, Rotation, Scaling, Mirror, Reflection, Inverse coordinate transformation, clipping, 3D transformation, View Port, Windowing and clipping	
Unit–IV: Computer-Aided Design (CAD)	No. of Lectures: 02 Hours
Requirement of Geometric Modeling, Salient features of Geometric Model, Geometric Model Construction Method: Wire Frame Modeling, Surface Modeling, Solid Modeling, and Introduction to Bezier curve.	
Unit–V: Auto-LISP Programming	No. of Lectures: 04 Hours
Introduction to Auto - LISP programming, Advantages and Applications of Auto-LISP . Auto-LISP commands, Auto-LISP Programs for simple geometric shapes-line, circle, rectangle, etc Auto-LISP Programs for elements geometric shapes such as circle in rectangle, triangle in rectangle, etc.	

LAB COURSE CONTENT			
Computer Graphics Lab		Semester:	*III*
Teaching Scheme:		Examination scheme	
Practical:	2 hours/week	End semester exam (ESE):	*25 marks*
		Internal Continuous Assessment (ICA):	*25 marks*
List of Practical's and Assignments			

1. Two Dimensional Sketch of any mechanical component using AutoCAD software.
2. Isometric Drawing of any Mechanical Component using AutoCAD software.
3. AutoLisp Programming for any two components such as rectangular Plate, rectangular plate with hole, triangular plate etc.

Assignment:

1. Assignments on introduction to AutoCAD
2. Assignments on introduction to Auto LISP programming

Text Books:

1. AutoCAD reference manual
2. A text book on Computer Graphics Including CAD, AutoCAD & 'C' by. A. M. Kuthe , S. Chand Publications.
3. A text book on CAD/CAM and Automation by R. B. Patil, Tech. max Publication.
4. Auto-LISP Developer's Guide.
5. A text book on CAD CAM and Automations by Farazdak Haidri.
6. H.G. Phakatkar, Engineering Graphics, Nirali publication.

Reference Books:

1. Ibrahim Zeid and R. Sivasubramanian - CAD/CAM – Theory and Practice Tata McGraw Hill Publishing Co. 2009
2. Rao P.N., Introduction to CAD/CAM Tata McGraw Hill Publishing Co.
3. P. Radhkrishnan, S. Subramanyam, V. Raju ,"CAD/CAM/CIM" , New Age Publication.
4. Mikell P. Grover, Emory W. Zimmers ,"Computer Aided Design and manufacturing", P.H.I.

Guide lines for ICA:

Students must submit ICA in the form of journal. Each assignment should be well documented. Faculty in charge will assess the assignments continuously and grade or mark each assignment on completion date declared for each assignments.

Guidelines for ESE:

ESE will be based on the laboratory assignments submitted by the students in the form of journal. Evaluation will be based on the understanding and execution.

NORTH MAHARASHTRA UNIVERSITY,

JALGAON (M.S.)

Bachelor of Engineering

(Mechanical Engineering)

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
(3rd Cycle)

Syllabus Structure & Contents
Of
Second Year of Engineering
Semester-IV
w.e.f. 2018 – 19

Mathematics-III

COURSE OUTLINE

Course Title:	Mathematics - III	Short Title:	M-III	Course Code:	

Course description: Basic Science course :
This course provides the elementary level knowledge of first order and second order partial Differential Equations, Statistics and Probability Distributions. Course includes solution of 2nd order partial differential equations, solution of one dimensional wave equation and heat diffusion and vibration problems.

Lecture 03 Tutorial 01	Hours/week	No. of weeks	Total hours	Semester credits
	4	14	56	4

Prerequisite course(s):
mathematics- I and mathematics- II

Course objectives:

1. To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering.
2. To provide an overview of probability and statistics to engineers.

Course outcomes:

Upon completion of this course, students will be able to solve field problems in engineering involving PDEs. They can also formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data.

COURSE CONTENT

Mathematics - III		Semester:	IV
Teaching Scheme:		Examination scheme	
Lectures:03	3 hours/week	End semester exam (ESE):	60 marks
Tutorial:01	1 hours/week	Duration of ESE:	03 hours
		Internal Sessional Exams (ISE):	40 marks

Unit–I: Laplace Transform	No. of Lectures: 8 Hours	Marks: 12

Properties of Laplace Transform. Inverse Laplace transform & Properties. Convolution theorem. Evaluation of integrals by Laplace transform.

Unit–II: Partial Differential Equations	No. of Lectures: 08 Hours	Marks: 12

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method

Unit–III: Application of LT and PDE	No. of Lectures: 08 Hours	Marks: 12

1) Application of Laplace Transform
Solving ordinary differential equations by Laplace Transform.
2)Application Of PDE:
Initial and boundary conditions. wave equation; one dimensional heat flow equation, Two dimensional heat flow equation.

Unit–IV: Statistics	No. of Lectures: 08 Hours	Marks: 12

Measures of Central tendency, Moments, skewness and Kurtosis ,Probability distributions: Binomial, Poisson and Normal. Correlation and regression. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas

Unit–V: **Test of significance**	No. of Lectures: 08 Hours	Marks: 12

Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances - Chi-square test for goodness of fit.

Text Books:

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010, ninth edition 2016.
2. H.K.DASS "Advance Engineering Mathematics" S. Chand publications.
3. S. C. Gupta "Fundamentals of Statistics",Himalaya Publishing House
4. Debashis Datta "Textbook of Engineering Mathematics''New Age International Publication. Revised second edition

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010, 9th edition 2016.
3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
4. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Introduction to Engineering Design Principles

COURSE OUTLINE

Course Title:	*Introduction to Engineering Design Principles*	Short Title:	*IEDP*	Course Code:	

Course description:

Introduction to Engineering Design Principles (IEDP) is a course that is appropriate for students who are interested in design and engineering. The major focus of the IEDP course is to expose students to design process, research and analysis, teamwork, communication methods, global and human impacts, engineering standards, and technical documentation. It also allows students to develop strategies to enable and direct their own learning, which is the ultimate goal of education.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	03	*14*	*42*	*03*

Prerequisite course (s):

Knowledge of Engineering Drawing, Basic Elements of Mechanical Engineering.

Course objectives:

1. To introduce design as engineer's basic role in society and introduce them to various frontiers of engineering
2. To introduce various steps in engineering design and understand design parameters and constraints
3. To apply scientific knowledge to offer solution to problems
4. To provide context for curriculum studies and to motivate students to develop interest in engineering

Course outcomes:

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

1. Identify needs and formulate design problem
2. Follow engineering design process with due consideration to all requirements and constraints and make decisions
3. Apply scientific principles to design problem
4. Work in a team and communicate design output
5. Relate curricular courses to real life engineering

COURSE CONTENT

Introduction to Engineering Design Principles		Semester:	*IV*
Teaching Scheme:		Examination scheme	
Lectures:	3 hours/week	End semester exam (ESE):	60 marks
		Duration of ESE:	03 hours
		Internal Sessional Exams (ISE):	40 marks

Unit–I: Introduction to Engineering Design	No. of Lectures: 08 Hours	Marks: 12

What is design, Engineering design process, It's importance, Types of design- Innovative, adaptive, redesign, selection. Design as iterative problem solving methodology, Considerations of a good design, CAE, Designing to codes and standards.

Unit–II: Problem Definition and Need Identification	No. of Lectures: 08 Hours	Marks: 12
Identification of need, gathering information, Design and analysis of survey instrument, technical literature, internet, patent literature, scientific base, product design specifications.		
Unit–III: Generation and Evaluation of Alternative Concepts and Decision Making	No. of Lectures: 08 Hours	Marks: 12
Data and information sources, Concept generation: Creative thinking, creativity and problem solving, Refinement and evaluation of ideas, Biomimetic design, Functional decomposition and synthesis, Concept evaluation process.		
Unit–IV: Product Life Cycle	No. of Lectures: 08 Hours	Marks: 12
Product architecture, Industrial design, Human factors design, Life cycle design, Design for Sustainability and the environment, Prototyping and modelling, Testing.		
Unit–V: Detailed Design	No. of Lectures: 08 Hours	Marks: 12
Activities and decisions in detailed design, Make/Buy decision, Complete engineering drawings, Communicate design and manufacturing, Design for sustainability, Reporting		
Text Books:		
1. Kosky P.G.,Wise G., Balmer R.G., Keat W.D., "Exploring Engineering: An Introduction for Freshman to Engineering and to the Design Process", Academic Press Publication, Fourth Edition 2016. 2. Dieter George, Schmit Linda, "Engineering Design", McGraw Hill Publication -Fifth Edition. 3. Dym Clive, Little Patrick, Orwin Elizabeth, "Engineering Design: A Project-Based Introduction", Wiley Publication, Fourth Edition.		
Reference Books:		
1. Ken Hurst "Engineering Design Principles" Elsevier Publication - 1st Edition -		

Applied Thermodynamics

COURSE OUTLINE

Course Title:	Applied Thermodynamics	Short Title:	AT	Course Code:	

Course description:

This course is designed to introduce students with basic concepts of thermodynamic systems and their application in real life including Steam Power Plant, Air Compressors and its different component. The course will help students to understand the dynamics of energy through the air, gas or other media and build students' ability to solve thermodynamic problems and understand other basic properties of gases, liquids, vapours with energy and energy transfer mechanisms, enthalpies/analysis of systems. The course also includes vapour and gas cycles theories of energy generating systems, such as boilers and the use of steam tables and mollier chart to study energy properties of the steam at different conditions. Students will also familiarize with the SI and English Units commonly used in the field of thermodynamics.

Lecture	Hours/week	Tutorial/ week	No. of weeks	Total hours	Semester credits
	03	01	*14*	*56*	*04*

Prerequisite course (s):-

- Applied Physics
- Fundamentals of Thermodynamics

Course Objectives:

1. To learn about of I law for reacting systems and heating value of fuels.
2. To learn about gas and vapour cycles and their first law and second law efficiencies.
3. To understand about the properties of steam and its applications in steam operated devices.
4. To learn about gas dynamics of air flow and steam through nozzles.
5. To learn the about reciprocating compressors with and without inter-cooling.
6. To analyse the performance of steam turbines.

Course Outcomes:

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

1. After completing this course, the students will get a good understanding of various practical power cycles and heat pump cycles.
2. They will be able to analyse energy conversion in various thermal devices such as engines, nozzles, diffusers, steam turbines and reciprocating compressors.
3. They will be able to comprehend the phenomena of Boiler performance system.
4. They will be able to understand phenomena occurring in high speed compressible flows.

COURSE CONTENT

Applied Thermodynamics		Semester:	*IV*
Teaching Scheme:		Examination scheme	
Lectures:	3 hours/week	End semester exam (ESE):	60 marks
Tutorials:	1 hours/week	Duration of ESE:	03 hours
		Internal Sessional Exams	40 marks

	(ISE):	
Unit–I: Chemical Thermodynamics	No. of Lectures: 08 Hours	Marks: 12
Introduction to solid, liquid and gaseous fuels– Stoichiometry, exhaust gas analysis – Orsat apparatus and Gas Chromatography, Actual Air-Fuel Ratio, Excess air supplied, First law analysis of combustion reactions- Heat calculations using enthalpy tables- Adiabatic flame temperature- Chemical equilibrium and equilibrium composition calculations using free energy, Joule–Thomson effect.		
Unit–II: Steam Generators (Boiler) and its Analysis	No. of Lectures: 09 Hours	Marks: 12
Steam Power Plant layout, Classification and selection of boilers, IBR act. Boiler performance - Equivalent evaporation, boiler efficiency. Numerical on boiler performance. Energy balance for a boiler. Numerical on Energy balance for a boiler. Boiler Draught - Natural & Artificial draught. Derivation of Height & Diameter of Chimney and Numerical. Draught losses, Condition for maximum discharge through chimney- Numerical.		
Unit–III: Power Cycles	No. of Lectures: 07 Hours	Marks: 12
Vapour power cycles- Rankine cycle with superheat, reheat and regeneration, use of mollier chart, Super-critical and ultra-super-critical Rankine cycle, Gas power cycles - analysis of air standard Otto, Diesel and Dual Cycles, Air standard Brayton cycle –Analysis and effect of reheat, regeneration and inter-cooling, Analysis of steam turbines, velocity and pressure compounding of steam turbines.		
Unit–IV: Compressible Fluid Flows	No. of Lectures: 08 Hours	Marks: 12
Basics of compressible flow, Stagnation properties, Mach number, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows, normal shocks- use of ideal gas tables for isentropic flow and normal shock flow- Flow of steam and refrigerant through nozzle, supersaturation- compressible flow in diffusers, efficiency of nozzle and diffuser.		
Unit–V : Air Compressors	No. of Lectures: 08 Hours	Marks: 12
Applications of Compressed Air, Classification of Compressors, reciprocating compressors: with clearance, without clearance, staging of reciprocating compressors, optimal stage pressure ratio, effect of inter-cooling, minimum work for multistage reciprocating compressors, free air delivered (FAD), Volumetric efficiency and Isothermal efficiency.		
Text Books:		
1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons. 2. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India 3. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons. 4. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd 5. R. P. Yadav, Applied Thermodynamics & Heat Engines –Vol II, 5th edition, 2012 6. M M Rathod, “Thermal Engineering”, Tata McGraw Hill.		

Reference Books:

1. R K Rajput, “Thermal Engineering”, Laxmi Publication New Delhi.
2. Domkundwar and Kothandaraman,“Thermal Engineering”, Dhanpat Rai & Co.
3. Onkar Singh, “Applied thermodynamics”, New Age International Publisher.
4. Y A Cengel and M A Boles, “Thermodynamics: an Engineering Approach”, Tata McGraw Hill.
5. P L Ballaney, “Thermal Engineering”, Khanna Publishers, New Delhi.
6. Venkanna, Swati,“Applied Thermodynamics”,PHI.
7. D.S. Kumar, “Thermal Science & Engineering”, S.K. Kataria & Sons
8. P K Nag,“Power Plant Engineering”, Tata McGraw Hill.
9. T. D. Eastop and A. McConkey, “Applied Thermodynamics for Engineering Technologists”, Pearson Education India

Fluid Mechanics And Fluid Machines

COURSE OUTLINE

Course Title:	*Fluid Mechanics And Fluid Machines*	Short Title:	*FM*	Course Code:	

Course Description:

The primary aim of this course is to provide students with a first introduction to continuum mechanics, in general and theoretical fluid mechanics in particular. Course is deal with understanding and hence predicting the properties of liquid and gases under external forces. Course provides introduction to principle concepts and method of fluid mechanics. Topics covered in the course include pressure, hydrostatics and buoyancy. Mass conservation and momentum conservation for moving fluids; viscous fluid flow, flow through pipes, dimensional analysis. Students will work to formulate and developed the problem solving skills essential to good engineering practice of fluid mechanics in practical applications.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	3	*14*	*42*	*3*

Prerequisite course (s):

Engineering Mechanics, Applied Physics, Mathematics

Course objectives:

1. To learn about the application of mass and momentum conservation laws for fluid flows
2. To understand the importance of dimensional analysis
3. To obtain the velocity and pressure variations in various types of simple flows
4. To analyse the flow in water pumps and turbines.
5. To understand fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.
6. To implement basic laws and equations used for analysis of static and dynamic fluid.

Course outcomes:

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

1. Upon completion of this course, students will be able to mathematically analyze simple flow situations
2. They will be able to evaluate the performance of pumps and turbines.
3. Understand Euler's equation of motion hence to reduce Bernoulli's equation and its application in fluid mechanics.
4. Examine energy losses in pipes transitions and Evaluate pressure drop in pipe flow using Hagen-Poiseuille's equation.

COURSE CONTENT

Fluid Mechanics And Fluid Machines		Semester:	*IV*
Teaching Scheme:		Examination scheme	
Lectures:	3 hours/week	End semester exam (ESE):	60 marks
		Duration of ESE:	03 hours
		Internal Sessional Exams (ISE):	40 marks

Unit–I: Fundamental of Fluid Mechanics	No. of Lectures: 09 Hours	Marks: 12

Properties of fluid: -Definition of fluid, Newton's law of viscosity, Units and Dimensions- Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, Control volume- application of continuity equation and momentum

equation, Incompressible flow
Fluid Statics:- Pascal's law, pressure at a point, Hydrostatic law derivation , Total pressure and centre of pressure for vertical , horizontal, inclined curve surface it's derivation, concepts of buoyancy, metacentre and floatation.

Unit–II: Fluid Kinematics & Dynamics	No. of Lectures: 09 Hours	Marks: 12

Kinematics: - Eulerian and langrangian approach to solution, Definition of streamlines, Path line, steak line, Different types of flow; steady and unsteady flow, uniform and non- uniform flow, Laminar, Turbulent, compressible, incompressible, rotational, irrotational flows.
Fluid Dynamics: - continuity equation for flow, Euler's equation, Bernoulli's equation along stream line for incompressible flow. Practical application of Bernoulli's equation: Pitot tube, venture meter, Orifice meter.

Unit–III: Laminar flow and Dimensional Analysis.	No. of Lectures: 08 Hours	Marks: 12

Laminar flow: - Definition of Laminar flow relation between pressure and shear stress, laminar flow through circular pipe, fixed plate.
Exact flow solutions in channels and ducts, Couette and Poisuielle flow, laminar flow through circular conduits and circular annuli- concept of boundary layer – measures of boundary layer thickness
Need for dimensional analysis – methods of dimension analysis – Similitude – types of similitude Dimensionless parameters – application of dimensionless parameters – Model analysis.

Unit–IV: Fundamental of Fluid Machines & Flow Through Pipes	No. of Lectures: 08 Hours	Marks: 12

Euler's equation – theory of Rotodynamic machines – various efficiencies – velocity components at entry and exit of the rotor, velocity triangles – Centrifugal pumps, working principle, work done by the impeller, performance curves – Cavitation in pumps- Reciprocating pump – working principle.
Flow through Pipes. TEL, HGL, Energy losses through pipes. Darcy- weisbach Equation. Minor losses in pipes. friction factor, Moody's diagram

Unit–V: Hydraulic Turbines	No. of Lectures: 08 Hours	Marks: 12

Classification of water turbines, heads and efficiencies, velocity triangles- Axial, radial and mixed flow turbines- Pelton wheel, Francis turbine and Kaplan turbines, working principles – draft tube- Specific speed, unit quantities, performance curves for turbines – governing of turbines.

Text Books:

1. Textbook of fluid mechanics and hydraulics machine, Dr. R.K. Bansal, Laxmi publication New Delhi.
2. Textbook of fluid mechanics and hydraulics machine, R.K. Rajput, S Chand and Co. Delhi.
3. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.
4. R. Subramanian, Strength of Materials, Oxford University Press, 2007.
5. Ferdinand P. Been, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGraw Hill Publishing Co. Ltd., New Delhi 2005.

Reference Books:

1. Introduction to fluid mechanics, S. K. Som and G. Biswas, Tata McGraw Hill Publisher Pvt. Ltd.
2. Hydraulics and Fluid Mechanics, P.N. Modi and S.M. Seth, Standard book house Delhi.
3. Fluid Mechanics Victor Lyle Streeter, E. Benjamin Wylie, Tata McGraw-Hill Publisher Pvt. Ltd.
4. Fluid Mechanics by Frank. M. White, Tata McGraw-Hill Publisher Pvt. Ltd

Industrial Economics

COURSE OUTLINE

Course Title:	Industrial Economics	Short Title:	*IE*	Course Code:	

Course Description:

Principles of Microeconomics: - To provide an overview of microeconomic issues - the behavior of individual household, firm & market in respect of demand, supply & price for goods and services; demand, supply & price determination.

Principles of Macroeconomics: - To provide an overview of macroeconomic issues – national income & economic growth, inflation, international trade, rate of exchange, balance of payment, monetary & fiscal policy.

Business & Managerial Economics: - To provide an overview of actual demand forecasting & price determination in practice

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	3	*14*	*42*	*3*

Prerequisite course (s):

Principles of Managements

Course objectives:

The student after studying this subject will learn about :-

1. The basic objectives & concepts of micro economics
2. The concept of economy & economic laws.
3. The concept of demand, supply & price, their inter-relation & their elasticity.
4. The concept of demand forecasting.
5. The basic objectives & concepts of macroeconomics.
6. The concepts of national income, economic growth & inflation
7. The concept of international trade policy, rate of exchange, trade, deficit, monetary & fiscal policy.

Course outcomes:

After completing this course the student will be able to: -

1. Confidently apply for the post of Purchase or Sales Engineer
2. Look for suitable projects & scope for entrepreneurship

COURSE CONTENT

Industrial Economics		Semester: IV	
Teaching Scheme:		Examination scheme	
Lectures:	3 hours/week	End semester exam (ESE):	60 marks
		Duration of ESE:	03 hours
		Internal Sessional Exams (ISE):	40 marks

Unit–I: Introduction to economics	No. of Lectures: 08 Hours	Marks: 12

Definition, importance, issues, micro & macroeconomics, Concept of Economy – 2 & 4 sector model, capitalist, socialist & mixed economy, Economic laws – their nature, limitation, importance & application. Law of diminishing return / marginal utility

Unit–II: Demand and Supply	No. of Lectures: 08 Hours	Marks: 12

Meaning, individual & market demand, factors effecting demand, Law of demand, demand curve, Price elasticity of demand & its measurement, demand forecasting, Supply – meaning, individual & market supply, factors effecting supply, Law of supply, supply curve, Price elasticity of supply & its measurement.		
Unit–III: Production	No. of Lectures: 08 Hours	Marks: 12
Short run, long run, very long run; issues, short run production curve, marginal & average production, Laws of production; cost concepts, economies of scale, Concept of market, market equilibrium & equilibrium price, Price determination in different types of market, Price determination in practice.		
Unit–IV: Macro-economics	No. of Lectures: 10 Hours	Marks: 12
Definition, importance & scope, National Income – definition & methods of measurement, Economic Growth – definition, factors affecting growth, Inflation – definition, measurement method, effects; demand-pull, cost-push & other factors.		
Unit–V: International Trade	No. of Lectures: 08 Hours	Marks: 12
Law of Reciprocal demand, free trade, trade protection policy, Concepts of Rate of Foreign Exchange, Balance of Payment, Monetary & Fiscal Policy – objectives, instruments, limitations		
Text Books:		

1. Principles of Economics by Frank and Bernanke – Tata McGraw hill publication
2. Principles of Economics by D.N. Dwivedi – Vikas Publishing House
3. Managerial Economics by D.M. Mithani - Himalaya Publishing House
4. Managerial Economics by Dr. H.L. Ahuja - S. Chand
5. Business Economics by Gillespe – Oxford University Press
6. Microeconomics by D.N. Dwivedi - Pearson
7. Macro Economics -A South Asian Perspective by W. McEachern , A. Indira, Cengage Learning

Applied Thermodynamics Lab					
COURSE OUTLINE					
Course Title:	*Applied Thermodynamics Lab*	Short Title:	AT Lab	Course Code:	

Course description:

In this laboratory, course emphasis is on the understanding of basic principles, working of Orsat apparatus, Bomb calorimeter, Reciprocating air compressors, different components of Steam Power Plant. The learner can use this knowledge and apply in various industries as required.

Laboratory	Hours/week	No. of weeks	Total hours	Semester credits
	02	*14*	*28*	*01*

Prerequisite course (s):-

- Basic principles and theories
- Fundamentals of Thermodynamics

Course Objectives:

This course is intended to provide engineering students with an application of important concepts, principles of Engineering Thermodynamics and emphasis on those areas considered most relevant in an engineering context with practical applications in engineering and technology.

1. To impart knowledge of basic concepts in applied Thermodynamics and implementation to various engineering fields.
2. To provide the knowledge and methodology necessary for solving problems in the field of engineering.

Course Outcomes:

After successful completion of this lab course the student will be able to:

1. Comprehend the Performance parameters of 4-Stroke petrol/diesel engine
2. Analyze the Calorific value of fuel sample by using Bomb calorimeter.
3. Investigate the Flue Gas analysis using gas analyzer.
4. Conduct a trial on air compressor.
5. Understand the difference parameters of boiler performance and properties of steam.

LAB COURSE CONTENT

Applied Thermodynamics Lab	Semester:	*IV*
Teaching Scheme:	Examination scheme	
Practical: 2 hours/week	End semester exam (ESE):	*25 marks*
	Internal Continuous Assessment (ICA):	*25 marks*

(Any 5 Practical)

1. Determination of Calorific value of a solid / liquid fuel using Bomb Calorimeter.
2. Determination of Exhaust gas analysis using Gas Analyser.
3. Determination of Isothermal and Volumetric efficiency of single/multi-stage reciprocating air compressor.
4. Determination of the p-V diagram and the performance of a 4-stroke diesel engine.
5. Determination of the performance of 4-stroke petrol engine test rig.
6. To find out dryness fraction of steam using combined separating and throttling calorimeter.
7. Visit to the any Thermal Power plant station.

Text Books:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.
2. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India.
3. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.
4. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd
5. R. P. Yadav, Applied Thermodynamics & Heat Engines –Vol. II, 5th edition, 2012.
6. M M Rathod, "Thermal Engineering", Tata McGraw Hill.

Reference Books:

1. R K Rajput, "Thermal Engineering", Laxmi Publication New Delhi.
2. Domkundwar and Kothandaraman, "Thermal Engineering", Dhanpat Rai & Co.
3. Onkar Singh, "Applied thermodynamics", New Age International Publisher.
4. Y A Cengel and M A Boles, "Thermodynamics: an Engineering Approach", Tata McGraw Hill.
5. P L Ballaney, "Thermal Engineering", Khanna Publishers, New Delhi.
6. Venkanna, Swati, "Applied Thermodynamics", PHI.
7. D.S. Kumar, "Thermal Science & Engineering", S.K. Kataria & Sons
8. P K Nag,"Power Plant Engineering", Tata McGraw Hill.
9. T. D. Eastop and A. McConkey, "Applied Thermodynamics for Engineering Technologists", Pearson Education India.

Guide lines for ICA:

Students must submit ICA in the form of journal. Each assignment should be well documented. Faculty in charge will assess the assignments continuously and grade or mark each assignment on completion date declared for each assignments.

Guidelines for ESE:

ESE will be based on the laboratory assignments submitted by the students in the form of journal. Evaluation will be based on the understanding and execution.

Fluid Mechanics Lab					
COURSE OUTLINE					
Course Title:	Fluid Mechanics Lab	Short Title:	FM Lab	Course Code:	

Course description:

The primary aim of this course is to provide students with basic fundamentals of fluid mechanics through experimentations. Course provides introduction to principle concepts and method of fluid mechanics. Topics covered in the course include pressure, hydrostatics and buoyancy. Mass conservation and momentum conservation for moving fluids; viscous fluid flow, flow through pipes, dimensional analysis.

Laboratory	Hours/week	No. of weeks	Total hours	Semester credits
	02	*14*	*28*	*01*

Prerequisite course (s):-

Engineering Mechanics, Applied Physics, Mathematics

Course Objectives:

1. To learn about the application of mass and momentum conservation laws for fluid flows
2. To obtain the velocity and pressure variations in various types of simple flows
3. To analyze the flow in water pumps and turbines.
4. To understand fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.
5. To implement basic laws and equations used for analysis of static and dynamic fluid.

Course Outcomes:

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

1. Upon completion of this course, students will be able to mathematically analyze simple flow situations
2. They will be able to evaluate the performance of pumps and turbines.
3. Understand Euler's equation of motion hence to reduce Bernoulli's equation and its application in fluid mechanics.
4. Examine energy losses in pipes transitions and Evaluate pressure drop in pipe flow using Hagen-Poiseuille's equation.

LAB COURSE CONTENT

Fluid Mechanics Lab	Semester:	*IV*
Teaching Scheme:	Examination scheme	
Practical: 2 hours/week	End semester exam (ESE):	*25 marks*
	Internal Continuous Assessment (ICA):	*25 marks*

Note: Lab file should contain at list EIGHT experiments from below mentioned list.

1. To find the viscosity of a given oil by using Red wood viscometer.
2. To verify the Bernoulli's theorem

3. Measurement of Coefficient of Discharge of given Orifice and Venturi meters.
4. Experiment on determination of major and minor losses for flow through pipes
5. Determination of the performance characteristics of a centrifugal pump.
6. Determination of the performance characteristics of Pelton Wheel
7. Determination of the performance characteristics of a Francis Turbine
8. Determination of the performance characteristics of a Kaplan Turbine
9. Determination of the density & viscosity of an oil and friction factor of oil flow in a pipe
10. To study the flow patterns by using Reynolds's apparatus
11. Study of velocity distribution in boundary layer and its thickness

Text Books:

1. Textbook of fluid mechanics and hydraulics machine, Dr. R.K. Bansal, Laxmi publication New Delhi.
2. Textbook of fluid mechanics and hydraulics machine, R.K. Rajput, S Chand and Co. Delhi.
3. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.
4. R. Subramanian, Strength of Materials, Oxford University Press, 2007.
5. Ferdinand P. Been, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGrawHill Publishing Co. Ltd., New Delhi 2005.

Reference Books:

1. Introduction to fluid mechanics, S. K. Som and G. Biswas, Tata McGraw Hill Publisher Pvt. Ltd.
2. Hydraulics and Fluid Mechanics, P.N. Modi and S.M. Seth, Standard book house Delhi.
3. Fluid Mechanics Victor Lyle Streeter, E. Benjamin Wylie, Tata McGraw-Hill Publisher Pvt. Ltd.
4. Fluid Mechanics by Frank. M. White, Tata McGraw-Hill Publisher Pvt. Ltd

Guide lines for ICA:

Students must submit ICA in the form of journal. Each assignment should be well documented. Faculty in charge will assess the assignments continuously and grade or mark each assignment on completion date declared for each assignments.

Guidelines for ESE:

ESE will be based on the laboratory assignments submitted by the students in the form of journal. Evaluation will be based on the understanding and execution.

Metrology and Quality Control					
COURSE OUTLINE					
Course Title:	*Metrology and Quality Control*	Short Title:	*MQC*	Course Code:	

Course description:

This course introduces undergraduate students to Metrology and Quality Control. The background required includes a sound knowledge to Measurements, (calculus), applied thermodynamics, Industrial management

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	01	*14*	*14*	*02*
Laboratory	*02*	*14*	*28*	

Prerequisite course (s):

A sound knowledge to Measurements, (calculus), Applied Thermodynamics, Industrial management

Course objectives:

The course aims at imparting knowledge of metrology and quality control. The course aims at to familiarize to understand the principles metrology of screw threads, gear measurement, study of measuring machines, recent trends in engineering metrology. Learn to use standard practices and standard data, learn to use statistical concept, control chart for variables, control chart for attributes, acceptance sampling.

Course outcomes:

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

1. Explain the principals involved in measurement and inspection.
2. Select and use appropriate measurement instrument for a given application.
3. Apply the basics of sampling in the context of manufacturing.
4. Select and apply the seven basic quality tools in well-defined applications.

COURSE CONTENT

Metrology and Quality Control		Semester:	*IV*
Teaching Scheme:			
Lectures:	1 hours/week		

Unit–I: Metrology	No. of Lectures: 03 Hours

Definition: Measurement, precision, accuracy, sensitivity, Classification of method of measuremen.t
Linear Measurement: -Standards, line standards, end standards, classification of standards, precision measurement, precision measuring instruments and their characteristics, slip gauge
Straightness, flatness and squareness:-Surface plates, measurement of straightness, flatness testing,

squareness testing, roundness testing, machine tool metrology, Measurement by light wave interference:- Basic principle, sources of light, optical					
Unit–II: Design of gauges &Metrology			No. of Lectures: 03 Hours		
Design of gauges: - Types of gauges, limits, fits, tolerances, Taylor's principle Comparators: -Characteristics, application, types, construction and working of different mechanical, optical, electrical, pneumatic comparators Angle measurement:-Sine bars, Sine centers, Use of sine bar, angle gauges, autocollimator angle dekkor, constant deviation prism, Measurement of surface finish:-Types of Surface texure, elements of surface texture, measuring surface finish by stylus probe, Tomlinson & Taly-surf , Pressure Measurment					
Unit–III: Metrology of Screw thread, Gear & recent trend in metrology.			No. of Lectures: 03 Hours		
Metrology of screw threads: -Terminology, errors and their effects, thread gauges, measurement of elements of external and internal threads, Gear measurement: - calipers measurements, involutes testing, roller measurements, tool maker's microscope, profile projectors Study of measuring machines:-Universal measuring machine, coordinate measuring machine, Errors in CMM, electronic inspection and measuring machine, Recent trend in engineering metrology:-precision instrument based on laser, probes, telemetric systems, Isometric viewing of surface defects, Machine vision					
Unit–IV: Quality control			No. of Lectures: 02 Hours		
Introduction to quality:- Factors controlling quality of design and conformance, balance between cost of quality and value of quality, Introduction to quality tools: Demings PDCA,PDSA cycles & Juran quality approach, Seven quality tools, Pareto					
Unit–V: Statistical Quality Control			No. of Lectures: 03 Hours		
Statistic concept: -Concept of variation, variable & attribute data, the frequency distribution, quantitative description of distribution, normal curve, concept of six sigmas, Control chart for variables: -definition of control chart, objective of control chart, R chart, Problems on X & R chart Control chart for attributes:-practical limitations of the control charts for variables charting chart, Problems on P & C chart					
Metrology and Quality Control Lab					
COURSE OUTLINE					
Course Title:	Metrology and Quality Control Lab	Short Title:	MQC Lab	Course Code:	
Course description:					
This course introduces undergraduate students to Metrology and Quality Control. The background required includes a sound knowledge to Measurements, (calculus), applied thermodynamics, Industrial management					

Laboratory	Hours/week	No. of weeks	Total hours	Semester credits
	02	*13*	*26*	*01*

Prerequisite course (s): -
A sound knowledge to Measurements, (calculus), Applied Thermodynamics, Industrial management

Course Objectives:

The course aims at to familiarize to understand the principles metrology of screw threads, gear measurement, study of measuring machines, recent trends in engineering metrology. Learn to use standard practices and standard data, learn to use statistical concept, control chart for variables, control chart for attributes, acceptance sampling.

Course Outcomes:

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

1. Explain the principles involved in measurement and inspection.
2. Select and use appropriate measurement instrument for a given application
3. Apply the basics of sampling in the context of manufacturing
4. Select and apply the seven basic quality tools in well-defined applications.

LAB COURSE CONTENT

Metrology and Quality Control Lab	Semester:	*IV*

Teaching Scheme:	Examination scheme	
Practical: 2 hours/week	End semester exam (ESE):	25 marks
	Internal Continuous Assessment (ICA):	25 marks

Note: Lab file should contain at list EIGHT experiments from below mentioned list.

1. Determination of linear/angular dimensions of part using precision & non precision instrument.
2. Machine tool alignment tests on any machine tool like Lathe, Drilling, Milling
3. Interferometer-Study of surfaces using optical flat.
4. Surface finish measurement.
5. Measurement of roundness/circularity using mechanical comparator.
6. Measurement of screw parameters
7. Measurement of Gear parameters i) gear tooth thickness ii) constant chord iii)PCD
8. Study and applications of tool makers microscope
9. Use of profile projector
10. Study and use of control charts

Text Books:

1. R.K. Jain: Engineering Metrology: Khanna Publishers.
2. Handbook To Industrial Metrology: ASTME: Printice Hall Pub.
3. G.M. Juran: Handbook of Quality Control, Mcgraw Hill Pub.
4. M. Mahajan: Statistical Quality Control.
5. K.C. Jain: TQM & ISO 9000; Khanna Publishers.

Guide lines for ICA:

Students must submit ICA in the form of journal. Each assignment should be well documented. Faculty

in charge will assess the assignments continuously and grade or mark each assignment on completion date declared for each assignments.
Guidelines for ESE:
ESE will be based on the laboratory assignments submitted by the students in the form of journal. Evaluation will be based on the understanding and execution.

Environmental Science

COURSE OUTLINE

Course Title:	Environmental Science	Short Title:	EVS	Course Code:	

Course description:

The course aims to percolate the importance of environmental science and environmental studies.

COURSE CONTENT

Environmental Studies	Semester:	IV
	Examination scheme	
	End Semester Exam (ESE):	80 marks
	Duration of ESE:	03 hours
	Internal Continuous Assessment (ICA):	20 marks

Unit–I:	No. of Lectures: 02 Hours	

Multidisciplinary nature of environmental studies
Definition, scope and importance
Need for public awareness.

Unit–II:	No. of Lectures: 08 Hours	

Natural Resources :
Renewable and non-renewable resources
Natural resources and associated problems.

a. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
b. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
c. Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
d. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e. Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.
f. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

• Role of an individual in conservation of natural resources.
• Equitable use of resources for sustainable lifestyles.

Unit–III:	No. of Lectures: 06 Hours	

Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession.
- Food chains, food webs and ecological pyramids.

- Introduction, types, characteristic features, structure and function of the following ecosystem :-
  a. Forest ecosystem
  b. Grassland ecosystem
  c. Desert ecosystem
  d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit–IV:	No. of Lectures: 08 Hours	

Biodiversity and its conservation

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

Unit–V:	No. of Lectures: 08 Hours	

Environmental Pollution
Definition

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

Unit–VI:	No. of Lectures: 07 Hours	

Social Issues and the Environment

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

- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Public awareness.

Unit–VII:	No. of Lectures: 06 Hours	

Human Population and the Environment

- Population growth, variation among nations.
- Population explosion – Family Welfare Program
- Environment and human health.
- Human Rights.
- Value Education.
- HIV/AIDS.
- Women and Child Welfare.
- Role of Information Technology in Environment and human health.
- Case Studies.

Unit–VIII:		

Field work

- Visit to a local area to document environmental assets, river/forest/grassland/hill/mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5lecture hours)

Guide lines for ICA:

Students must submit ICA in the form of journal. Each assignment should be well documented. Faculty in charge will assess the assignments continuously and grade or mark each assignment on completion date declared for each assignments.

Reference Books:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001,Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R)
8. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev.,Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay NaturalHistory Society, Bombay (R)
10. Heywood, V.H &Waston, R.T. 1995. Global Biodiversity Assessment.Cambridge Univ. Press 1140p.

11. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws.Himalaya Pub. House, Delhi 284 p.
12. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems &Solutions, Web enhanced edition. 639p.
13. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
15. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
16. Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ.Co. Pvt. Ltd. 345p.
17. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
18. Survey of the Environment, The Hindu (M)
19. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)