DAV UNIVERSITY, JALANDHAR

Course Scheme & Syllabus

For

B.Tech. in Mechanical Engineering

Batch

2020–2021 Onwards

Syllabus: Batch 2020 Onwards

PROGRAMME OBJECTIVES

1. To develop professional engineers in the field of manufacturing, design, thermal, industrial and automation engineering by imparting elementary sciences and engineering pedagogy.
2. To nurture students towardscreativity and innovation to develop out of the box thinking, respond effectively to the needs of the industry and the ever changing world scenario.
3. To impart the highest quality education to students to build their capacity and enhance their skill to expand their reasoning, communication and problem solving abilities and to make them globally competitive mechanical engineers.
4. To maintain the state of the art research facilities to provide collaborative environment that stimulate faculty, staff and students with opportunities to create, analyse, apply and disseminate knowledge.
5. To provide students with academic environment of excellence, leadership, ethical guidelines and lifelong learning needed for a long productive career, entrepreneurship skills.

LEARNING OUTCOMES:

The department of Mechanical Engineering has adopted Outcomes as its Program outcomes.

These are that our graduates have:

1. An ability to apply knowledge of mathematics, science and engineering.
2. An ability to design and conduct experiments, as well as to analyse and interpret data.
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. An ability to identify, formulate, and solve engineering problems.
5. An understanding of professional and ethical responsibility.
6. An ability to communicate effectively with written, oral, and visual means.
7. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
8. An ability to function on multi- disciplinary teams.

Syllabus: Batch 2020 Onwards

Scheme of Courses
B.Tech. in Mechanical Engineering
Semester-1*

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	MTH151A	Engineering Mathematics-I	4	0	0	4	Core
2	CHE151A	Chemistry	4	0	0	4	Core
3	CSE101A	Computer Fundamentals and Programming	4	0	0	4	Core
4	EVS100A	Environmental Studies	4	0	0	0	AECC
5	MEC101A	Engineering Drawing	2	0	4	4	Core
6	ENG151B	Basic Communication Skills	3	0	0	3	AECC
7	CHE152	Chemistry Lab	0	0	2	1	AECC
8	CSE103	Computer Fundamentals and Programming Lab	0	0	2	1	Core
9	ENG152A	Basic Communication Skills Lab	0	0	2	1	Core
			21	**0**	**10**	**22**	

L: Lectures T: Tutorial P: Practical Cr: Credits

** Before the commencement of the classes of regular courses a three weeks induction program for newly admitted students is proposed as per Annexure-I*

Scheme of Courses
B. Tech. in Mechanical Engineering
Semester-2

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	MTH152A	Engineering Mathematics-II	4	0	0	4	Core
2	PHY151B	Engineering Physics	4	0	0	4	Core
3	MEC103	Mechanical Engineering Fundamentals	4	0	0	4	Core
4	ELE105	Basic Electrical Engineering	4	0	0	4	Core
5	SGS107B	Human Values and General Studies	4	0	0	0	AECC
6	MEC104	Manufacturing Practice	0	0	4	2	Core
7	PHY152A	Engineering Physics Laboratory	0	0	2	1	Core
8	ELE106	Basic Electrical Engineering Laboratory	0	0	2	1	Core
			20	**0**	**8**	**20**	

L: Lectures T: Tutorial P: Practical Cr: Credits

Note: *At the end of the examination of 2nd Semester the students will undergo compulsory internship of swachh bharat abhiyan for a period of 15 days (100 hrs.)duration. Every student will submit the Report on internship within two weeks from the start of teaching for 3rd Semester. The marks for this will be included in the 3rd Semester.*

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Scheme of Courses
B. Tech. in Mechanical Engineering
Semester-3

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	MEC201	Kinematics of Machines	3	1	0	4	Core
2	MEC207	Mechanics of Solids-I	3	1	0	4	Core
3	MEC208	Applied Thermodynamics	3	1	0	4	Core
4	MEC209	Manufacturing Processes	3	0	0	3	Core
5	MEC210	Engineering Materials and Metallurgy	3	0	0	3	Core
6	MEC211A	Machine Drawing	2	0	4	3	Core
7	MEC212	Mechanics of Solids Laboratory - I	0	0	2	1	Core
8	MEC213	Thermodynamics Laboratory - I	0	0	2	1	Core
9	MEC215	Engineering Materials and Metallurgy Laboratory	0	0	2	1	Core
10	MEC220	Swachh Bharat Summer Internship*	0	0	0	2	AECC
			17	**3**	**10**	**26**	

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of Courses
B. Tech. in Mechanical Engineering

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	MEC250A	Production & Operation Management	3	0	0	3	Core
2	MEC251A	Dynamics of Machines	3	1	0	4	Core
3	MEC257A	Mechanics of solids-II	3	1	0	4	Core
4	MEC258A	I C Engines	3	1	0	4	Core
5	MEC259	Metal Cutting and Machine Tools	3	0	0	3	Core
6	MEC260	Mechanical Measurement	3	0	0	3	Core
7	MEC261A	Dynamics of Machines Laboratory	0	0	2	1	Core
8	MEC263	I C Engines Laboratory	0	0	2	1	Core
9	MEC264	Manufacturing Technology Laboratory	0	0	2	1	Core
10	MEC265	Mechanical Measurement Laboratory	0	0	2	1	Core
			18	**3**	**8**	**25**	

Semester-4

L: Lectures T: Tutorial P: Practical Cr: Credits

Note: *At the end of the examination of 4th Semester the students will undergo compulsory industrial training for a period of 4 weeks duration in reputed industries. Every student will submit the Training Report within two weeks from the start of teaching for 5thSemester. The marks for this will be included in the 5th Semester.*

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Scheme of Courses
B. Tech. in Mechanical Engineering
Semester-5

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	MEC303B	Heat Transfer	3	1	0	4	Core
2	MEC306B	Mechanics of Fluids	3	1	0	4	Core
3	MEC307A	Design of Machine Elements	3	0	2	4	Core
4	MEC308B	Non-Conventional Machining Processes	3	0	0	3	Core
5	MEC309B	Industrial Engineering	3	0	0	3	Core
6	MEC310	Industrial Engineering Lab	0	0	2	1	Core
7	MEC311	Mechanics of Fluids Lab	0	0	2	1	Core
8	MEC313	Heat Transfer Lab	0	0	2	1	Core
9	MEC300	Industrial Training	0	0	0	2	SEC
			15	**2**	**8**	**23**	

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of Courses
B. Tech. in Mechanical Engineering
Semester-6

L: Lectures T: Tutorial P: Practical Cr: Credits

Note:

- *Department specific elective-I should be from the basket of "Department Specific Elective-I".*

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	ENG352	Professional Communication	3	0	0	3	AECC
2	MEC358A	Optimization Techniques	3	1	0	4	Core
3	MEC359	Automobile Engineering	3	0	0	3	Core
4	MEC360A	Fluid Machinery	3	1	0	4	Core
5		Department Specific Elective-I #	4	0	0	4	DSE-I
6		Open Elective-I#	4	0	0	4	Open Elective -I
7	MEC361	Fluid Machinery Lab	0	0	2	1	Core
8	MEC363	Automobile Engineering Lab	0	0	2	1	Core
			20	**2**	**4**	**24**	

- *Department specific elective-I should be from the basket of "Department Specific Elective-I".*
- *Open elective-I should be from the "Open Elective Basket"*
- *At the end of the examination of 6th Semester the students will undergo compulsory industrial training for a period of 6 weeks duration in reputed industries. Every student will submit the training report within two weeks from the start of teaching of 7th Semester. The marks for this will be included in the 7th semester.*

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Scheme of Courses
B. Tech. in Mechanical Engineering
Semester-7

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1		Department Specific Elective-II #	4	0	0	4	DSE-II
		Open Elective-II#	4	0	0	4	Open Elective –II
2	MTH256A	Numerical Methods	3	0	0	3	Core
3	MEC451	Maintenance and Reliability	3	0	0	3	Core
4	MEC461B	Robotics and Automation	3	0	0	3	Core
5	MEC471	Robotics and Automation Lab	0	0	2	1	Core
6	MTH257B	Numerical Methods Lab	0	0	2	1	Core
7	MEC400	Industrial Training	0	0	0	2	SEC
8	MEC450A	Seminar	0	0	4	2	SEC
			17	**0**	**8**	**23**	

L: Lectures T: Tutorial P: Practical Cr: Credits

Note:

- *Department specific elective-II should be from the basket of "Department Specific Elective-II".*
- *Open elective-II should be from the "Open Elective Basket"*

Scheme of Courses
B. Tech. in Mechanical Engineering

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1		Department Specific Elective-III#	4	0	0	4	DSE-III
2		Department Specific Elective-IV#	4	0	0	4	DSE-IV
3		Open Elective-III#	4	0	0	4	Open Elective-III
4	MEC404	CAD/CAM	3	0	0	3	Core
5	MEC462B	Inspection and Quality Control	3	0	0	3	Core
6	MEC414	CAD/CAM Lab	0	0	2	1	Core
7	MEC499A	Project	0	0	8	4	Core
			18	**0**	**10**	**23**	

Semester-8

L: Lectures T: Tutorial P: Practical Cr: Credits

Note:

- *Department specific elective-III & IV should be from the basket of "Department Specific Elective-III & IV" respectively.*
- *Open elective-III should be from the "Open Elective Basket"*

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Syllabus: Batch 2020 Onwards

Department Specific Elective-I

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	MEC457	Finite Element Method	4	0	0	4	Design
2	MEC422	Tool Design	4	0	0	4	Manufacturing
3	MEC421A	Total Quality Management	4	0	0	4	Industrial
4	MEC356	Refrigeration and Air Conditioning	4	0	0	4	Thermal

Department Specific Elective-II

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	MEC402	Mechanical Vibrations	4	0	0	4	Design
2	MEC424A	Flexible Manufacturing System	4	0	0	4	Manufacturing
3	MEC425	Entrepreneurship Development &Management	4	0	0	4	Industrial
4	MEC434	Gas Dynamics	4	0	0	4	Thermal

Department Specific Elective-III

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	MEC432	Tribology	4	0	0	4	
2	MEC427	Advanced Materials	4	0	0	4	Design
3	MEC455A	Non Destructive Testing	4	0	0	4	Manufacturing
4	MEC453A	Industrial Safety	4	0	0	4	Industrial
5	MEC456	Non-Conventional Energy Resources	4	0	0	4	Thermal

Department Specific Elective-IV

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	MEC445	Mechanical Behaviour of Materials	4	0	0	4	Design
2	MEC452A	Product Design and Development	4	0	0	4	Manufacturing
3	MEC446	Ergonomics and Workplace Design	4	0	0	4	Industrial
4	MEC447	Power Plant Engineering	4	0	0	4	Thermal

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Open Elective Basket

S.NO.	Paper Code	Course Title	L	T	P	Cr
1	ELE801	Electro-Mechanical Energy Conversion	4	0	0	4
2	ELE802	Transducers and Signal Conditioning	4	0	0	4
3	CHL801	Industrial Pollution Control	4	0	0	4
4	CHL802	Fuel Cell Technology	4	0	0	4
5	MEC801	Industrial Engineering Techniques	4	0	0	4
6	MEC802	Energy Resources	4	0	0	4
7	CSE801	Software Engineering & Project Management	4	0	0	4
8	CSE802	Computer Networks	4	0	0	4
9	**CSE372**	**Artificial Intelligence**	**4**	**0**	**0**	**4**
10	**CSE803**	**Machine Learning**	4	0	0	4
11	ECE801	Communication and Media Foundations	4	0	0	4
12	ECE802	Electronic Displays	4	0	0	4
13	ECE803	Everyday Electronics	4	0	0	4
14	CIV801	Construction Materials and Techniques	4	0	0	4
15	CIV802	Railway and Tunnel Engineering	4	0	0	4
16	MGT001	Fundamentals of Management	4	0	0	4
17	MGT002	Fundamentals of Advertising	4	0	0	4
18	MGT003	Fundamentals of Stock Market	4	0	0	4
19	MGT004	Fundamentals of Research Methods	4	0	0	4
20	ECE457A	Sensors and transducers	4	0	0	4
21	MGT455	Fundamentals of Marketing	4	0	0	4

 # - MOOC courses

Students can also pursue MOOC courses of equivalent credits floated by NPTEL, SWAYAM in place of Elective courses provided content of such MOOC courses should not match with regular subjects. MOOC chosen against departmental elective has to be a technical course related to mechanical engineering and for open elective course has to be from any other domain except mechanical engineering.

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B Tech Course Structure

CBCS	Nature of Courses	Core	Elective Courses			Ability Enhancement Courses		Total Credits
Year	Course Structure	Core	Dissertation/ Project	Open Elective	Discipline Specific Elective	Ability Enhancement Compulsory Courses	Skill Enhancement Courses	
2019	Mechanical	139	4	12	16	9	6	186

Core	Basic Sciences (BS) including Mathematics, Physics, Chemistry, Biology	Engineering Sciences (ES) including Materials, WS, ED, Basics of EE/ME/CSE	Interdisciplinary Core	Discipline Core	Total Credits
139	18-26	20	04-24	80-100	142

Detailed Syllabus

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Course Title: Engineering Mathematics-I

Paper Code: MTH151A

L	T	P	Credits
4	0	0	4

Objective: The aim of this course is to familiarize the students with the theory of matrices which are used in solving equations in mechanics and the other streams. This course also provides a comprehensive understanding of the origin and development of ideas to exhibit the techniques origin and development of ideas to exhibit the techniques of solving ordinary differential equations.

Unit-A

(15 Hrs.)

Rank of matrices, Inverse of Matrices, Gauss Jordan Method, reduction to normal form, Consistency and solution of linear algebraic system of equations, Gauss Elimination Method, Eigen values and Eigen vectors, Diagonalisation of Matrix, Cayley Hamilton theorem. Orthogonal, Hermition and unitary matrices.

Unit-B **(14 Hrs.)**

Concept of limit and continuity of a function of two variables, Partial derivatives, Homogenous Function , Euler's Theorem, Total Derivative, Differentiation of an implicit function, chain rule, Change of variables,Jacobian, Taylor's and McLaurin'sseries. Maxima and minima of a function of two and three variables: Lagrange's method of multipliers.

Unit-C **(14 Hrs.)**

Formation of ordinary differential equations, solution of first order differential equations by separation of variables, Homogeneous equations, Reduce to Homogenous, exact differential equations, equations reducible to exact form by integrating factors, equations of the first order and higher degree, clairaut's equation.

Unit-D **(13 Hrs.)**

Solution of differential equations with constant coefficients: method of differential operators. Non – homogeneous equations of second order with constant coefficients: Solution by method of variation of parameters, Simultaneously Linear differential equation.

References:

1. Grewal, BS. *Higher Engineering Mathematics*. New Delhi: Khanna Publication, 2009. Print.

2. Kreyszig, Erwin. *Advanced Engineering Mathematics*. New Delhi: Wiley Eastern Ltd., 2003.Print.
3. Jain, R K, and K Iyengar S R. *Advanced Engineering Mathematics*, New Delhi: Narosa Publishing House, 2003. Print.
4. Thomas, George B. and Finney Ross L. *Calculus and Analytic Geometry*, New Delhi: Addison Wesley, 1995. Print.

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Course Title: Chemistry

Course Code: CHE151A

L	T	P	Credits
4	0	0	4

Course Objectives:

- The objective of the Engineering Chemistry is to acquaint the student with the basic phenomenon/concepts of chemistry for the development of the right attitudes by the engineering students to cope up with the continuous flow of new technology.
- The student will able to understand the new developments and breakthroughs efficiently in engineering and technology.

Expected Prospective:

This course will equip students with the necessary chemical knowledge concerning the fundamentals as well as new technology in the field of chemistry.

Unit- A

Spectroscopy and its Applications

General Introduction: Introduction, electromagnetic spectrum, absorption and emission spectrum, atomic and molecular spectroscopy, types of molecular spectra, experimental techniques, selection rules, width and intensities of spectral lines.

UV/Visible Spectroscopy: types of electronic Transitions,Chromophores, Auxochromes, Effect of conjugation on Chromophores, Factors affecting λmax and intensity of spectral lines, effect of solvent onλmax, isobestic point, applications.

IR Spectroscopy: Infrared region, fundamental modes of vibrations and types, theory of infrared spectra, vibrational frequency and energy levels, anharmonic oscillator, modes of vibrations of polyatomic molecules, characteristic signals of IR spectrum, finger print region, factors affecting vibrational frequency; applications.

NMR Spectroscopy: Principle and instrumentation, relaxation processes, proton magnetic resonance spectroscopy, number of signals, Chemical shift, Spin-Spin Splitting, coupling constant, applications.

Unit- B

Water and its treatment

Introduction, hardness of water, degree of hardness, units of hardness, boiler feed water: specification, scales and sludge formation; priming& foaming, boiler corrosion, caustic embrittlement, treatment of boiler feed water, internal treatment of water; softening of water by

lime-soda, zeolite and ion exchange methods, desalination of water; Water for domestic use: purification of water for domestic use.

Corrosion and its Prevention

Introduction; different types of corrosion - wet and dry corrosion; mechanism of wet corrosion; comparison of dry and wet corrosion, Types of electrochemical corrosion: galvanic corrosion, concentration cell corrosion or differential aeration corrosion, waterline corrosion, pitting corrosion, crevice corrosion, stress corrosion, intergranular corrosion; other forms of corrosion: atmospheric corrosion, soil corrosion, microbiological corrosion, erosion corrosion, Filliform corrosion, stray current corrosion, passivity, galvanic series, factors influencing corrosion, various methods of corrosion control.

Unit-C

Chemistry in Nanoscience and Technology

Introduction,Materials self-assembly, molecular vs. material self-assembly, hierarchical assembly, self-assembling materials, two dimensional assemblies, mesoscale self-assembly, coercing colloids, nanocrystals, supramolecular structures, nanoscale materials, future perspectives applications,nanocomposities and its applications.

Unit-D

Polymers and polymerization

Introduction, monomer and repeating unit, degree of polymerization, functionality, classification of polymers: based on origin, monomers, structure, method of synthesis, tacticity or configuration, action of heat, chemical composition, ultimate form; types of polymerization, specific features of polymers, regularity and irregularity, tacticity of polymers, average molecular weights and size, determination of molecular weight by number average methods, effect of molecular weight on the properties of polymers, introduction to polymer reinforced composites.

References:

1. Kemp,William.*Organic Spectroscopy*. Palgrave Foundations, 1991.Print.
2. Skoog, D. A., Holler, F. J. and Timothy, A. N. *Principle of Instrumental Analysis*. 5th Edition.Saunders College Publishing, Philadelphia, 1998. Print.
3. Poole, C. P. and Owens Jr. F. J. *Introduction to Nanotechnology*.WileyInterscience, 2003. Print.
4. Foster, L.E. *Nanotechnology Science Innovation & Opportunity*. Pearson Education, 2007.Print.
5. Ghosh, P. *Polymer Science and technology.* 2nd Edition, Tata McGraw Hill, 2008.Print.
6. *Engineering Chemistry*, Second Edition. Wiley, 2013.Print.

Syllabus: Batch 2020 Onwards

Course Title: Computer Fundamentals and Programming

Course Code: CSE101A

L	T	P	Credits
4	0	0	4

Course Objective: To get basic knowledge of computers (hardware and software), its components and Operating systems. To acquire programming skills in C, basic knowledge of Internet

Unit-A

Introduction to Computers (8 Hrs.)

Define a Computer System, Block diagram of a Computer System and its working, memories, Volatile and non-volatile memory, cache, virtual, secondary storage devices-Magnetic Tape, Hard Disk, CD-DVD, Magnetic Disk, Various input devices including keyboard, Mouse, Joystick, Scanners and Various output devices including Monitors, Printers, Plotters

Operating Systems (7 Hrs.)

Computer Software and its types and Hardware, Operating Systems, their types and functions

Unit-B

Working Knowledge of Computer System (6 Hrs.)

Introduction to word processors and its features, creating, editing, printing and saving documents, spell check, mail merge, creating power point presentations, creating spreadsheets and simple graphs.

Fundamentals of Internet Technology (8 Hrs.)

Local area networks, MAN and wide area network, Internet, WWW, E-mail, Browsing and Search engines, Internet Connectivity, Network Topology, Hub, Switches, Router, Gateway.

Unit-C

Basic Constructs of C (8 Hrs.)

Keywords, Identifiers, Variables, Data Types and their storage, Arithmetic Operators, Relational Operators, Logical Operators, Bitwise Operators, Increment & Decrement Operators, Expressions, Conditional Expressions, Assignment Operators and Expressions, External Variables and Scope of Variables, Structure of C Program.

Control Structures (8 Hrs.)

Decision making statements: if, nested if, if – else ladder, switch, Loops and iteration: while loop, for loop, do – while loop, break statement, continue statement, goto statement.

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Unit-D

Functions (6 Hrs.)

Advantages of functions, function prototype, declaring and defining functions, return statement, call by value and call by reference, recursion, and storage classes.

Arrays and Strings (7 Hrs.)

Declaration of arrays, initialization of array, accessing elements of array, I/O of arrays, passing arrays as arguments to a function, strings, I / O of strings, string manipulation functions (strlen, strcat, strcpy, strcmp)

References:

1. Jain, V.K. *Fundamentals of Information Technology and Computer Programming.* PHI, Latest Edition. Print.
2. Goel, Anita. *Computers Fundamentals.* Pearson Publications, Print.
3. Kernighan, Brian, and Ritchie, Dennis M.*The C Programming Language.* Prentice Hall, 2007.Print.
4. King, K.N.*C Programming: A Modern Approach.* W.W. Norton Company, 2008.Print.
5. Schildt, Herbert. *C: The Complete Reference.* Tata Mcgraw Hill Publications, 4th edition.Print.
6. Gottfried, Byron. P*rogramming with C, Schaum Series.* TMH publications, 2nd Edition, 1996. Print.
7. Balaguruswamy, E.*PROGRAMMING IN ANSI C*. Mc-Graw Hill Publications, 7th edition. 2016. Print.

Syllabus: Batch 2020 Onwards

Course Title: Environmental Studies

Paper Code: EVS100A

L	T	P	Credits
4	0	0	0

Course Objective: This course aims at understanding the students in aspects of environmental problems, its potential impacts on global ecosystem and its inhabitants, solutions for these problems as well as environmental ethics which they should adopt to attain sustainable development.

Unit- A

The multidisciplinary nature of environmental studies (2 Hrs.)

Definition, scope and importance, Need for public awareness

Natural Resources: Renewable and non-renewable resources: (8 Hrs.)

Natural resources and associated problems

(a) **Forest resources:** Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

(b) **Water resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c) **Mineral resources:** 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.

Ecosystem: (4Hrs.)

- 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

Syllabus: Batch 2020 Onwards

- 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, ocean estuaries)

Unit -B

Biodiversity and its conservation (4 Hrs.)

- Introduction – Definition: Genetic, Species and Ecosystem Diversity
- Bio-geographical 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-spots of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity, global and national efforts.

Environmental Pollution (8Hrs.)

- Definition, causes, effects and control measures of:
  a. Air pollution
  b. Water pollution
  c. Soil pollution
  d. Marine pollution
  e. Noise pollution
  f. Thermal pollution
  g. Nuclear pollution
- 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

Syllabus: Batch 2020 Onwards

Unit-C

Social Issues and the Environment (7Hrs.)

- Population growth, variation among nations, Population explosion – Family Welfare Programmes.
- Environment and human health,
- From unsustainable to sustainable development
- Urban problems and 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
- Environmental Laws: The Environment Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and control of Pollution) Act 1974; The Wildlife Protection Act, 1972; Forest Conservation Act, 1980.
- Issues involved in enforcement of environmental legislation
- Public Awareness

Unit-D

Human Population and Environment (5 Hrs.)

- Population Growth and Variations among Nations
- Population Explosion
- Human Rights
- Value Education
- HIV / AIDS
- Women and Child Welfare
- Role of Information Technology in Environment and Human Health
- Case Studies

Field Work (5 Hrs.)

- 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 5 lecture hours)

Suggested Readings:

1. Odum, EP. *Basic Ecology*. Japan: Halt Saundurs, 1983.Print.
2. Botkin, DB, and Kodler EA. *Environmental Studies: The Earth as a living planet.* New York: John Wiley and Sons Inc., 2000.Print.
3. Singh, JS, Singh, SP, and Gupta SR. *Ecology,Environment and Resource Conservation.* New Delhi: Anamaya Publishers, 2006.Print.
4. De, AK. *Environmental Chemistry*. New Delhi: Wiley Eastern Ltd., 1990.Print.
5. Sharma, PD. *Ecology and Environment*. Meerut Rastogi Publications, 2004.Print.

Syllabus: Batch 2020 Onwards

Course Title: Engineering Drawing

Course Code: MEC101A

L	T	P	Credits
2	0	4	4

Course Objectives:

- Use techniques to interpret the drawings and to draw orthographic projections of objects
- To learn projections of various lines, planes, solids and their sectioning.
- To develop lateral surfaces of the 3D objects.

Unit-A

Drawing Techniques (8Hrs.)

Introduction to drawing instruments, various types of lines and their convention, principles of dimensioning, Engineering symbols, Gothic lettering in single stroke as per SP-46 code (Vertical and inclined)

Scales (6Hrs.)

Concept of scaling, construction of plane and diagonal scales

Projection of Points (6 Hrs.)

Concept of plane of projections (Principle planes), First and third angle projections; projection of points in all four quadrants, shortest distance problems

Unit-B

Projection of Lines and Planes (12 Hrs.)

Projection of line parallel to both planes, perpendicular to one plane, inclined to one and both the reference planes and their traces. Plane perpendicular to one plane inclined to one and both the reference planes and their traces. Concept of profile plane and auxiliary planes,tofind the true length, α, β, θ and Φ.

Projection of Solids (10 Hrs.)

Right and oblique solids; solids of revolution and polyhedrons, projection of solid with axis perpendicular to one plane and parallel to one or both reference planes. Projection of solid with axis inclined to one or both reference planes.

Unit-C

Sectioning of Solids (8Hrs.)

Theory of sectioning, types of section planes, their practice on projection of solids, Sectioning by auxiliary planes, to find true section of truncated solids.

Development of Surfaces (8 Hrs.)

Method of Development, Development of surfaces: Parallel line and Radial line method. Development of oblique solids, Development of curved surfaces.

Unit-D

Orthographic and Isometric Views (9 Hrs.)

Draw orthographic views from isometric view or vice-a-versa, Missing line and missing view

Overview of Computer Graphic (9 Hrs.)

Demonstrating knowledge of the theory of CAD software such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, 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, Isometric Views of lines, Planes, Simple and compound, set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; Use of layers. Drawing exercises using software.

Course Outcome:

- Students will learn a universal language for engineers.
- They will learn the concept of first angle and third angle projection.
- Will learn to develop lateral surface for engineering objects.
- Will learn to read drawing, use and application of various line types.

References:

1. Jolhe, D A. *Engineering Drawing*. New Delhi: Tata McGraw-Hill,Print.
2. Gill, PS. *Engineering Drawing.* Ludhiana: S.K. Kataria and Sons, Print.
3. French, TE, and Vierck, CJ. *Graphic Science*. New York: McGraw-Hill, Print.
4. Zozzora, F. *Engineering Drawing.* New York: McGraw Hill, Print.

Syllabus: Batch 2020 Onwards

Course Title: Basic Communication Skills

Course Code: ENG151B

L	T	P	Credits
3	0	0	3

Course Objective:

- To enhance students' vocabulary and comprehensive skills through prescribed texts.
- To hone students' writing skills.

Unit – A

Applied Grammar (Socio-Cultural Context)

1. Parts of Speech: Noun, Pronoun, Adjective, Verb, Adverb, Preposition, Conjunction, Interjection
2. Tenses (Rules and Usages in Socio-cultural contexts)
3. Modals: Can, Could, May, Might, Will, Would, Shall, Should, Must, Ought to
4. Passive/Active
5. Reported/Reporting Speech

Unit – B

Reading (Communicative Approach to be followed)

1. J M Synge: Riders to the Sea (One Act Play)
2. Anton Chekhov : Joy (Short Story)
3. Swami Vivekanand : The Secret of Work (Prose)

Unit – C

Writing

1. Essay Writing and Letter Writing
2. Report Writing
3. Group Discussion & Facing an Interview

Learning Outcomes: Students will be able to improve their writing skills as well as will enrich their word power.

Syllabus: Batch 2020 Onwards

References:

a. Books

1. Kumar, Sanjay and Pushp, Lata. *Communication Skills*. India: OUP, 2012. Print.
2. Vandana, R. Singh. *The Written Word* by. New Delhi: Oxford University Press, 2008. Print.

b. Websites

1. www.youtube.com (to download videos for panel discussions). Web.
2. www.letterwritingguide.com. Web.
3. www.teach-nology.com.Web.
4. www.englishforeveryone.org.Web.
5. www.dailywritingtips.com.Web.
6. www.englishwsheets.com.Web.
7. www.mindtools.com.Web.

Syllabus: Batch 2020 Onwards

Course Title: Chemistry Lab

Course Code: CHE152

L	T	P	Credits
0	0	2	1

Course Objectives:

This course is intended to learn the basic concepts of Engineering Chemistry Laboratory. The present syllabus has been framed as per the recent research trends in the subject. The various experiments have been designed to enhance laboratory skills of the undergraduate students.

Expected Prospective:

The students will be able to understand the basic objective of experiments in Engineering chemistry, properly carry out the experiments, and appropriately record and analyze the results through effective writing and oral communication skills. They will know and follow the proper procedures and regulations for safe handling and use of chemicals.

List of Practical's:

1. Verify Lambert Beer's law using spectrophotometer and $CoCl_2$ or $K_2Cr_2O_7$ solution.
2. Determine the strength of HCl solution by titrating against NaOHsolutionconductometerically.
3. Determination of the strength of HCl solution by titrating against NaOH using pH meter.
4. Determination of total hardness of water (tap) using standard EDTA solution and Eriochrome black T indicator.
5. Determination of alkalinity of water.
6. Determination of surface tension of given liquid by using Stalagmometer.
7. Determination of residual chlorine in a water sample.
8. Determination of Flash & Fire point of given a given lubricating oil by Pensky-Marten's apparatus.
9. Determination of the viscosity of given lubricating oil by using Redwood Viscometer.
10. Preparation of a polymer phenol/urea formaldehyde resin.
11. Determination of moisture, volatile matter and ash content in a given sample of coal by proximate analysis.
12. Determination of dissolved oxygen present in given sample of water.

References:

1. Levitt, B.P. *Findlay's Practical Physical Chemistry*, 9th edition, Longman Group Ltd., 1973.Print.

2. Yadav, J.B. *Advanced Practical Physical Chemistry*,Print.

3. Vogel, A. I. *A textbook of Quantitative Inorganic Analysis*, Longman Gp. Ltd., 4th edition, 2000.Print.

Syllabus: Batch 2020 Onwards

Course Title: Computer Fundamentals and ProgrammingLab

Course Code: CSE103

L	T	P	Credits
0	0	2	1

Instruction for Students: The students will be attending a laboratory session of 2 hours weekly and they have to perform the practical related to the following list.

1. Practical know-how of various internal and external Hardware components of a computer (including basic working of peripheral devices).
2. Introduction to Operating Systems; installing Windows; basics of windows.
3. Working knowledge of Internet.
4. Introduction to word processor and mail merge.
5. Introduction to MS-Excel.
6. Working on MS-PowerPoint.
7. Introduction to basic structure of C program, utility of header and library files.
8. Implementation of program related to the basic constructs in C
9. Programs using different data types in C
10. Programs using Loops and Conditional Statements in C
11. Programs using functions by passing values using call by value method.
12. Programs using functions by passing values using call by reference method.
13. Programs using arrays single dimension in C.
14. Program to implement array using pointers
15. Programs related to string handling in C

Syllabus: Batch 2020 Onwards

Course Title: Basic Communication Skills Lab oratory

Course Code: ENG152A

L	T	P	Credits
0	0	2	1

Course Objective:

- To improve fluency in speaking English.
- To promote interactive skills through Group Discussions and role plays.

Learning Outcome: Students will get exposure to speaking through the above mentioned interactive exercises. In addition, they will develop a technical understanding of language learning software, which will further improve their communicative skills.

Unit – A Speaking/Listening

1. Movie-Clippings (10 Hrs.)
2. Role Plays (10 Hrs.)
3. Group Discussions (10 Hrs.)

References:

1. Gangal, J. K. *A Practical Course in Spoken English.* India: Phi Private Limited, 2012. Print.
2. Kumar and PushpLata. *Communication Skills*. India: OUP, 2012. Print.

Websites

1. www.youtube.com (to download videos for panel discussions).Web.
2. www.englishforeveryone.org.Web.
3. www.talkenglish.com.Web.
4. www.mindtools.com.Web.

Syllabus: Batch 2020 Onwards

Course Title: Engineering Mathematics-II

Course Code: MTH152A

L	T	P	Credits
4	0	0	4

Objective:

The objective of the course is to equip the students with the knowledge of concepts of vectors and geometry and their applications. A flavour of pure mathematics is also given to the readers.

Unit-A(13 Hrs.)

Functions of Complex Variables: Complex Numbers and elementary functions of complex variable De-Moivre's theorem and its applications. Real and imaginary parts of exponential, logarithmic, circular, inverse circular, hyperbolic, inverse hyperbolic functions of complex variables.Summation of trigonometric series (C+iS method)

Unit-B (15 Hrs.)

Integral Calculus: Rectification of standard curves; Areas bounded by standard curves; Volumes and surfaces of revolution of curves;

Multiple Integrals: Double and triple integral and their evaluation, change of order of integration, change of variable, Application of double and triple integration to find areas and volumes. Centre of gravity and Moment of inertia

Unit-C (15 Hrs.)

Vector Calculus: Scalar and vector fields, differentiation of vectors, velocity and acceleration

Vector differential operators: Del, Gradient, Divergence and Curl, their physical interpretations. Line, surface and volume integrals

Application of Vector Calculus: Flux, Solenoidal and Irrotational vectors. Gauss Divergence theorem,Green’s theorem in plane, Stoke’s theorem (without proofs) and their applications

Unit-D (14 Hrs.)

Infinite Series: Convergence and divergence of series, Tests of convergence (without proofs): Comparison test, Integral test, Ratio test, Raabe's test, Logarithmic test, Cauchy's root test and Gauss test. Convergence and absolute convergence of alternating series, Uniform Convergence and Power Series

References:

1. Grewal, B.S. *Higher Engineering Mathematics*. New Delhi: Khanna Publication, 2009. Print.
2. Kreyszig, Erwin.*Advanced Engineering Mathematics*. New Delhi: Wiley Eastern Ltd., 2003.Print.
3. Jain, R. K. and K Iyengar S R. *Advanced Engineering Mathematics*. New Delhi: Narosa Publishing House, 2003.Print.
4. Thomas, George, and Finney, Ross L. *Calculus and Analytic Geometry*. New Delhi: Addison Wesley, 1995. Print.

Syllabus: Batch 2020 Onwards

Course Title: Engineering Physics

Course Code: PHY151B

Total Lecture: 60

L	T	P	Credits
4	0	0	4

Course Objective: The aim of this course on physics is to make the student of engineering understand the basic concepts of physics which will form the basis of certain concept in their respective fields.

Unit-A (15 Hrs.)

PHYSICAL OPTICS:

Interference: Division of wave front, Fresnel's biprism, division of amplitude, Newton's rings and applications.

Diffraction: Difference between Fraunhofer and Fresnel diffraction, Fraunhofer diffraction through a slit, plane transmission diffraction grating, its dispersive and resolving power.

Polarization: Polarized and unpolarized light, double refraction, Nicol prism, quarter and half wave plates.

Unit-B (15 Hrs.)

LASER: Spontaneous and stimulated emission, Laser action, Characteristics of laser beam, concept of coherence, He-Ne laser, Semiconductor laser, Ruby laser and applications, Holography.

FIBRE OPTICS: Propagation of light in fibres, numerical aperture, single mode and multimode fibres, applications

Unit-C (13Hrs.)

DIELECTRICS:

Molecular Theory, polarization, displacement, susceptibility, dielectric coefficient, permittivity, relations between electric vectors, Gauss's law in the presence of a dielectric, energy stored in an electric field, Behavior of dielectric in alternating field and clausius-Mossotti equation.

Unit-D (18Hrs.)

QUANTUM MECHANICS: Difficulties with Classical physics, Introduction to quantum mechanics simple concepts, Black Body radiation, Planck's Law of radiation and its limitations, Group velocity and phase velocity, Schrodinger's wave equations and their applications.

NANOPHYSICS: Introduction to Nanoscience and Nanotechnology, Electron confinement, Nanomaterials, Nanoparticles, Quantum structure, CNT, Synthesis of Nanomaterials and Application of Nanomaterials.

SUPER CONDUCTIVITY: Introduction (experimental survey), Meissner effect, Type I and type II superconductors, London equation, Elements of BCS theory, Applications of superconductors.

Reference Books:

1. Sear, F.W. *Electricity and Magnetism.* London: Addison-Wesley, 1962. Print.
2. Resnick and Halliday. *Physics.*New York: Wiley, 2002. Print.
3. Lal,B. and Subramanyam, N.*A. Text Book of Optics.* New Delhi: S. Chand and Company Limited, 1982.Print.
4. Jenkins, and White. *Fundamental of Physical Optics*. New York: Tata McGraw-Hill, 1937.Print.
5. Griffiths,D*. Introduction to Electrodynamics.*New Delhi: Prentice Hall, 1998.Print.
6. Beiser, A. *Perspective of Modern Physics.* New Delhi: McGraw Hill Ltd., 2002.Print.

Syllabus: Batch 2020 Onwards

Course Title: **Mechanical Engineering Fundamentals**

L	T	P	Credits
4	0	0	4

Course Code: MEC103

Course Objectives:

- To impart the knowledge of various thermodynamics and design principles.
- To provide the knowledge of different pressure measuring devices.
- To provide the information of different power transmission, power producing and power absorbing devices.

Unit-A

Fundamental Concepts of Thermodynamics (8 Hrs.)

Introduction, Thermodynamic System and its types, Boundary and its types, Surroundings, Thermodynamic properties, State, Path, process and cycles, Thermodynamic Equilibrium, Working Substance, Microscopic and Macroscopic Analysis, Units and Dimensions, Quasi Static Process, Reversible and Irreversible processes, Point Function and Path Function, Mechanical and Thermodynamic work, P-dv Work (Displacement Work), Work is a Path Function, Equations for work done in various processes

Laws of Thermodynamics (7 Hrs.)

Zeroth law of Thermodynamics, Temperature, Thermometry (Measurement of temperature), Temperature Scales, Energy, Potential and Kinetic Energies at Micro and Macro Level, Internal Energy, Law of conservation of energy, Joule's Experiment, First law of thermodynamics (Open and Closed System), Energy – A property of system, Enthalpy, Entropy, Heat, Heat vs Temperature, specific heat, Heat Capacity, Specific heat at constant volume, Specific heat at constant pressure, Adiabatic Index, Limitations of first law of thermodynamics

Unit-B

Pressure and its Measurement (7 Hrs.)

Pressure Concept and Definition, Pressure conversion Table, Atmospheric pressure, Standard Atmospheric Pressure, Gauge Pressure, Vacuum Pressure, Absolute pressure, Properties of fluid, Pressure head of a Liquid, Pascal's Law, Pressure measurement: Mechanical Gauges and Manometers, Mechanical Gauges: (Bourdon tube pressure gauge, Diaphragm pressure gauge, Dead weight), Manometers: (Principle/Advantage/Limitation/ Classification), Piezometer, Single U tube manometer (Numerical for Vacuum and Gauge pressure), [Simple problems on above topics]

Heat Transfer (5 Hrs.)

Introduction, Heat Transfer and Thermodynamics, Applications, Thermal Conductivity, Thermal Resistance, Modes of heat transfer, Spectrum of electromagnetic radiation, Absorptivity, Reflectivity

and Transmissivity, Fourier law, Newton's law of cooling, Stefan Boltzmann's Law, Heat Exchangers (Applications, Selection, Classification)

Unit-C

Power Absorbing Devices (4 Hrs.)

Power Absorbing Devices, Difference between Hydraulic pump, Air compressor, Fan, Blower, Pump (Function, Selection, Applications), Classification of Pump, Positive displacement and Dynamic Pumps, Reciprocating Pumps and its types, Rotary Pumps and its types, Centrifugal Pump

Power Producing Devices

Boiler (4 Hrs.)

Steam boiler, Application, Classification of boilers, Types of boilers (Brief Description), Essentials of a good boiler, Advantages of superheating the steam, Comparison between Water tube and Fire tube boilers, Function of boiler Mountings and Accessories

Internal Combustion Engines (4 Hrs.)

Heat Engine, Types of Heat Engine, Advantages, Disadvantages and Applications, Classification of IC Engine, Engine Components (Location, Function and Material), and Basic Terminology used in IC engine, Four stroke Cycle Engines (SI and CI), Two stroke Cycle Engines (SI and CI)

Unit-D

Power Transmission Devices and Machine Elements (5 Hrs.)

Individual and group drive system (advantages and Disadvantages), Belt drive (Types: V and Flat Belts and their Applications, Advantages and Disadvantages), Ropes drive (Types: Fibre and Wire Ropes and their Applications, Advantages and Disadvantages), Gear drive (Types of Gears), Keys (Function, Classification).

Principles of Design (8 Hrs.)

Need of design, Product Life Cycle, Material properties and selection, Factors affecting material selection, Stress and Strain and its types, Hooke's law, Modulus of Elasticity, Longitudinal and Lateral Strain, Poisson's ratio, Stress- Strain Curve for ductile material, Factor of Safety

Centre of Gravity & Centroid, Centroid of areas of plain, Figures (Without Derivation), Centroid of areas of composite sections (Without Derivation), Moment of Inertia, Radius of gyration, Theorem of perpendicular axis, Theorem of parallel axis, MI of L, I and T sections, [Simple problems on above topics]

Learning Outcomes:

- Students will be able to know about the different thermodynamic processes and design principles.
- Student will able to know the about different pressure measuring units and devices.

Syllabus: Batch 2020 Onwards

- Students will able to recognize the different power transmission devices and machine elements and their applications.
- Students will able to know about various power producing and power absorbing devices and their working.

References:

1) Rajan, T.S. *Basic Mechanical Engineering*, New Delhi: New Age Publishers,2012.Print
2) Singh, Sadhu. *Principles of Mechanical Engineering*, New Delhi: S Chand Publishers,2010. Print.
3) Manglic, V.K. *Elements of Mechanical Engineering*, New Delhi: PHI, 2013. Print.
4) Pathak, G. K. *Basic Mechanical Engineering*, New Delhi: Rajsons Publications,2014.Print.
5) Kumar, Parveen. *Basic Mechanical Engineering*, New Delhi: Pearson Education. 2014. Print.

Syllabus: Batch 2020 Onwards

Course Title: Basic Electrical Engineering

Course Code: ELE105

L	T	P	Credits
4	0	0	4

Course Objective:

- To impart basic knowledge of DC and AC Circuit Analysis and Network Theorems,
- To impart knowledge of Magnetic Circuits and various electrical devices & amp;
- To impart knowledge of Installation of MCB, ELCB, MCCB, DC Machines, AC Machines etc.

Unit-A

D.C Circuit Analysis:

Voltage source, current source, dependent and independent sources, analysis of D.C circuit by KCL and KVL , Nodal and Mesh analysis, Superposition theorem, Maximum Power Transfer Theorem, Thevenin and Norton Theorems.

Unit-B

A.C Circuit Analysis:

Review of single phase A.C. circuit under sinusoidal steady state, RMS Value , Average Value, Form factor, Peak factor solution of RL, RC, R.L.C. Series circuit, the j operator, complex representation of impedance, solution of series circuit, series resonance, 3 phase A.C. Circuit, star and delta connections, line and phase quantities solution of 3 phase circuits, balance supply voltage and balanced supply voltage and balance load, Phasor diagram, measurement of power and power factor.

Unit-C

Magnetic Circuit & Transformers:

B-H Curve, saturation leakage and fringing. Hysteresis and eddy currents.Single phase transformer, basic concepts constructional, voltage, current Transformation, Ideal transformer and its phasor diagram, voltage regulation, OC/SC test, losses and efficiency, Autotransformer.

Unit-D

Rotating Electrical Machines:

Basic concepts, working principle and general construction of DC machines (motor/generators), torque and EMF expression. Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor.

Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and

Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Various faults in Battries, Elementary calculations for energy consumption, power factor improvement and battery backup.

Learning Outcomes:

- Apply the knowledge of Electrical Engineering principles to solve DC and AC circuits.
- Formulate and analyze electrical circuits. Understand basic principles of electromagnetism to implement in electrical machines and transformers.
- Identify and select various electrical machines according to the applications.
- Apply the ethical principles for troubleshooting & installation of safety devices as per norms of engineering practice

References:

1. Sukhija,and Nagsarkar, T.K.*Basic Electrical and Electronics Engineering.* Oxford University Press, 2012.Print.
2. Husain, and Harsoon,Ashfaq.*Fundamentals of Electrical Engineering*. 4th Edition, DhanpatRai and Co., 2013.Print.
3. Mittle,V.N.*BasicElectrical Engineering*. Tata McGraw Hill Publication. 2nd Edition, Print.
4. TherajaB.L., and TherajaA.K.*AText Book of Electrical Technology*, Volume-I, S. Chand Publication.Print.
5. Jena,Debashisha.*Basic Electrical Engineering.* 1st edition, Wiley India Publication, 2012.Print.
6. Theraja, and Sedha,R.S.*Principles of Electric Devices and Circuits.* S. Chand Publication, 1st edition, 2006.Print.

Syllabus: Batch 2020 Onwards

Course Title: Human Values and General Studies

Course Code: SGS107B

L	T	P	Credits
4	0	0	0

Course Objectives

a) To sensitize students about the role and importance of human values and ethics in personal, social and professional life.
b) To enable students to understand and appreciate ethical concerns relevant to modern lives.
c) To prepare a foundation for appearing in various competitive examinations
d) To sensitize the students about the current issues and events of national and international importance
e) To provide opportunity to the students to study inter disciplinary subjects like Geography, Science, Economy, Polity, History, International Relations etc.

Unit-A

Human Values

1. **Concept of Human Values:** Meaning, Types and Importance of Values. **(2Hrs)**
2. **Value Education :** Basic guidelines forvalueeducation **(2Hrs)**
3. **Value crisis and its redressal** **(1Hrs)**

Being Good and Responsible

1. Self-Exploration and Self Evaluation **(2Hrs)**
2. Acquiring Core Values for Self Development **(2Hrs)**
3. Living in Harmony with Self, Family and Society **(3Hrs)**
4. Values enshrined in the Constitution: Liberty, Equality, Fraternity and Fundamental Duties. **(3Hrs)**

Unit-B

Value – based living

1. Vedic values of life **(2Hrs)**
2. *Karma Yoga* and *Jnana Yoga* **(2Hrs)**
3. *AshtaMarga* and *Tri-Ratna* **(2Hrs)**

Ethical Living:

1. Personal Ethics **(2Hrs)**
2. Professional Ethics **(3Hrs)**
3. Ethics in Education **(2Hrs)**

Syllabus: Batch 2020 Onwards

Unit-C

General Geography

World Geography (3Hrs)

The Universe, The Solar System, The Earth, Atmosphere, The World we live in, Countries rich in Minerals, Wonders of the World, Biggest and Smallest.

Indian Geography (3Hrs)

Location, Area and Dimensions, Physical Presence, Indian States and Union Territories, Important sites and Monuments, Largest-Longest and Highest in India.

General History (3Hrs)

Glimpses of India History, Ancient Indian, Medieval India, Modern India, Various Phases of Indian National Movement, Prominent Personalities, Glimpses of Punjab history with special reference to period of Sikh Gurus

Glimpses of World History (3Hrs)

Important Events of World History, Revolutions and Wars of Independence, Political Philosophies like Nazism, Fascism, Communism, Capitalism, Liberalism etc.

Indian Polity: Constitution of India (3Hrs)

Important Provisions, Basic Structure, Union Government, Union Legislature and Executive, State Government: State Legislature and Executive, Indian Judiciary, The Election Commission, Panachayati Raj System, RTI etc.

General Economy (3Hrs)

The process of liberalization, privatization, globalization and Major World Issues, Indian Economy, Indian Financial System, Major Economic Issues, Economic Terminology.

Unit-D

General Science (3Hrs)

General appreciation and understandings of science including the matters of everyday observation and experience, Inventions and Discoveries

Sports and Recreation (3Hrs)

The World of Sports and recreation, Who's Who is sports, Major Events, Awards and Honours. Famous personalities, Festivals, Arts and Artists

Current Affairs (3Hrs)

National and International Issues and Events in News, Governments Schemes and Policy Decisions

Miscellaneous Information

Who is who (2Hrs)

Syllabus: Batch 2020 Onwards

Books and Authors, Persons in News, Awards and Honours, Abbreviations and Sports

References:

1. Tripathi A. N. *Human Values*.New Delhi: New Age International Publishers, Third Edition, 2009. Print.
2. Surbiramanian, R. *Professional Ethics.*New Delhi: Oxford University Press, 2013. Print.
3. Anand, Rishabh. *Human Values and Professional Ethics.*New Delhi: SatyaPrakashan, 2012. Print.
4. Bhalla, Sanjeev. *Human Values and Professional Ethics.*New Delhi: SatyaPrakashan, 2012. Print.
5. Soryan, Ritu. *Human Values and Professional Ethics.* New Delhi:DhanpatRai& Co. Pvt. Ltd., First Edition, 2010. Print.
6. Jayshree, and Raghavan, B. S.*Human Values and Professional Ethics.*, S. Chand & Co. Ltd. , 2007. Print.
7. Singh, Yogendra and Garg, Ankur. *Human Values and Professional Ethics.* Aitbs publishers, 2011. Print.
8. Kumar, Vrinder*. Human Values and Professional Ethics*.Ludhiana: Kalyani Publishers, , 2013. Print.
9. Gaur, Sangal, and Bagaria, G.P. *Human Values and Professional Ethics.*New Delhi: Excel Books, 2010. Print.
10. Osula, and Upadhyay, Saroj. *Values and Ethics*, Asian Books Pvt. Ltd., 2011. Print.
11. Radhakrishnan, and George, Allen.*Indian Philosophy*. New York: S &Unwin Ltd., Humanities Press INC, 1929. Print.
12. Dwivedi, A. N. *Essentials of Hinduism, Jainism and Buddhism.*NewDelhi:Books Today, 1979. Print.
13. Bhan, Suraj.*Dayanand : His life and work. New Delhi:* DAVCMC, 2001. Print.
14. Dwivedi, Kapil Dev. *Esence of Vedas.*Hoshiarpur: Katyayan Vedic SahityaPrakashan, 1990. Print.
15. Chaubey,B.B. *Vedic Concepts.*Hoshiarpur:Katyayan Vedic SahityaPrakashan, , 1990. Print.
16. Aggarwal, R. S. *Advance Objective General Knowledge*.S. Chand Publisher, 2013. Print.
17. Sen, S. *Concise General Knowledge Manual* 2013. Unique Publishers,2013. Print.
18. Verma, R. P. *Encyclopedia of General Knowledge and General Awareness*, Penguin Books Ltd., 2010.Print.

19. Thorpe, Edgar and Thorpe, Showick. *General Knowledge Manual 2013-14.*Delhi: The Pearson, Print.
20. Mohanty, Muktikanta*. General Knowledge Manual 2013-14*, Delhi: Macmillan Publishers India Ltd., Print.
21. India 2013, Government of India (Ministry of Information Broadcasting), Publication Division, 2013. Print.
22. Methew, Mammen.*Manorama Year Book 2013-14.* Malayalam Manorama Publishers, Kottayam, 2013. Print.
23. *Spectrum's Handbook of General Studies* – 2013-14, New Delhi: Spectrum Books (P) Ltd., Print.

CURRENT AFFAIRS

Magazines

Yojna*. Economic and Political Weekly.* The Week, India Today, Frontline, Spectrum.

Competition Success Review, Competition Master, Civil Services Chronicle, Current Affairs, World Atlas Book

Newspapers

The Hindu, Times of India, The Hindustan Times, The Tribune

Syllabus: Batch 2020 Onwards

Course Title: **Manufacturing Practice**

Course Code: MEC104

L	T	P	Credits
0	0	4	2

Course Objective:

1. Know basic workshop processes, Read and interpret job drawing.
2. Identify, select and use various marking, measuring, holding, striking and cutting tools & equipment's
3. Operate and control different machines and equipment's.

CARPENTRY SHOP

a) Preparation of half lap joint
b) Preparation of Mortise and Tenon Joint
c) Preparation of a Dove & Tail joint
d) To prepare a White board duster

Welding Shop:

a) Preparation of Joint by Arc Welding
b) Preparation of Joint by using Gas Welding
c) Preparation of Joint by MIG/ TIG Welding
d) Preparation of Joint by Spot/ Seam Welding

Smithy Shop

a) To Forge the L – Hook
b) To Forge a Chisel
c) To Forge a Cube from a M.S Round
d) To forge a screw driver

Fitting Shop

a) Filing a dimensioned rectangular or square piece and prepare a sq. fitting
b) Preparation of T fitting male part
c) Preparation of U fitting Female part
d) Internal thread Cutting in Square piece and external thread cutting on a rod and assembling as a paper weight

Foundry Shop:

a) To make a Mould of solid pattern
b) To prepare a mould of sleeve fitting using gating system
c) To make a Mould of Split Pattern using Cope & Drag
d) To check the Hardness of the Mould

To check the Moisture Content in the Moulding Sand

To check the Compressive Strength of Moulding Sand

Sheet-Metal Shop

a) Preparation of a funnel from G.I. sheet
b) Preparation of a book rack stand from G.I. Sheet
c) Preparation of a leak proof tray with inclined edges from G.I. Sheet
d) Preparation of a square pen stand from G.I. Sheet with riveting at corners

Machine Shop

a) To make a job using step turning and grooving
b) To make a job using knurling and threading
c) To make a multi operation job on a Lathe machine
d) To make V – slot by using shaper machine

Electrical Shop

a) Layout of electrical tube light wiring
b) Layout of stair case wiring using two way switch
c) Testing and rectification of simulated faults in electrical appliances such as 'Electric Iron' Ceiling Fan. Electric kettle
d) To fabricate a circuit for the electrical wiring of, Fan with regulator and Bulb through a main switch and its testing using a series lamp

Learning Outcomes:

After passing the course, students will be able to:

- Explain and strictly adhere to the rules and safety regulations for work in the mechanical workshop
- Properly operate the manufacturing equipment in the mechanical workshop
- Create and document a typical process plan for manufacturing of a product in the mechanical workshop
- Read and use a manufacturing drawing as a definition for the manufacturing of a part
- Use gauging equipment to verify that a manufactured part fulfills the requirements specified on a manufacturing drawing

References:

1. Johl, K. C. *Mechanical Workshop Practice.* Prentice Hall India, 1st Edition,2010. Print.
2. Bawa, H.S. Workshop Technology. New Delhi: Tata McGraw Hill, 7th Edition,2004. Print.

Syllabus: Batch 2020 Onwards

Course Title: Engineering Physics Lab

Course Code: PHY152A

L	T	P	Credits
0	0	2	1

Objective: The laboratory exercises have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipment's.

Note:

- Students are expected to perform at least eight-ten experiments out of following list. The experiments performed in first semester cannot be repeated in second Semester.
- The examination for both the courses will be of 3 hours duration

List of Experiments:

Experimental skills: General Precautions for measurements and handling of equipment, representation of measurements, Fitting of given data to a straight line, and Error analysis, Significant figures and interpretation of results.

1. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
2. To determine the Dispersive Power and resolving power of the Material of a given Prism using Mercury Light.
2. To determine wavelength of sodium light using Fresnel Biprism.
3. To determine wavelength of sodium light using Newton's Rings.
4. To determination Wavelength of Sodium Light using Michelson's Interferometer.
5. To determine the wavelength of Laser light using Diffraction of Single Slit.
6. To determine the wavelength of (1) Sodium and (2) Mercury Light using Plane Diffraction Grating.
7. To determine the (1) Wavelength and (2) Angular Spread of HeNe Laser using Plane Diffraction Grating.
8. To study the wavelength of spectral lines of sodium light using plane transmission grating.
9. To study the specific rotation of sugar solution Laurent's half shade polarimeter method
10. To study the numerical aperture and propagation losses using HeNe laser Optical fibre set up.
11. To compare the focal length of two lenses by Nodal slide method.
12. To find the unknown low resistance by Carey Foster bridge.
13. To determine the beam divergence of the HeNe laser.
14. To study the Meissner's effect in superconducting sample.
15. To study the Faraday law of electromagnetic induction.

16. To study the capacitance by flashing/quenching of Neon bulb kit
17. To compare the two unknown capacitances of two capacitors by using DeSauty's bridge.
18. To find our out the unknown inductance by using the Anderson's bridge method.
19. To study the numerical aperture and propagation losses for He-Ne laser by using the optical fibre set up for
20. To study the Planck's constant by using photoelectric cell method.

Syllabus: Batch 2020 Onwards

Course Title: Basic Electrical Engineering Laboratory

Course Code: ELE106

L	T	P	Credits
0	0	2	1

Course Objective: This course provides a practical aspect of Circuit Analysis using Ohm's law, Kirchhoff's laws and network theorems, to understand the constructional detail of Electrical machines.

List of Experiments

1. To verify Ohm's Law, Kirchhoff's Current Law and Kirchhoff's Voltage Law.
2. To verify Thevenin's and Norton's theorems.
3. To verify Superposition theorem.
4. To verify Maximum Power Transfer theorem.
5. To study frequency response of a series R-L-C circuit and determine resonant frequency and Q-factor for various values of R, L and C
6. To study frequency response of a parallel R-L-C circuit and determine resonant frequency and Q-factor for various values of R, L and C.
7. To perform direct load test of a transformer and plot efficiency versus load characteristics.
8. To perform open circuit and short circuit test on transformer.
9. To perform speed control of DC motor.
10. Measurement of power in a three phase system by two wattmeter method.
11. Basic safety precautions. Introduction and use of measuring instruments – voltmeter,ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
12. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor)
13. To study various starting methods of three phase induction motor.
    (i) DOL Starter
    (ii) Auto- transformer starter
    (iii) Star-delta starter
14. To study speed control of three phase induction motor. (V/F control)

Syllabus: Batch 2020 Onwards

Course Title: Kinematics of Machines

Course Code: MEC201

L	T	P	Credits
3	1	0	4

Course Objectives:

- To learn basic concepts of machines and their mechanisms.
- To draw velocity and acceleration diagrams of all basic mechanisms.
- To learn about the various types of cam & follower.
- To learn various types of drives such as: belts, ropes, chains and gears.

Unit-A

Basic of Mechanics (6 Hrs.)

Link or Element, Kinematic Pair, Degrees of Freedom, Kinematic chain, Mechanism, Mobility of Mechanism, Inversions, Machine, Four bar chain, Single slider crank chain and Double slider crank chain and their inversions, Universal Joint- Rockermechanisms.

Velocity and Acceleration analysis (8 Hrs.)

Velocity diagram, velocity determination, instantaneous centre of velocity, acceleration diagram, acceleration determination, Coriolis component of acceleration.

Unit-B

Cams (8 Hrs.)

Classification of cams and followers, disc cam nomenclature, construction of displacement, velocity and acceleration diagrams for different types of follower motions, determination of basic dimension, synthesis of cam profile by graphical methods with various motions, cams with specified contours, problems.

Friction (6 Hrs.)

Concepts of friction, types of friction, laws of dry friction, friction in journal bearing, friction circle and friction axis, pivots and collar friction, uniform pressure and uniform wear.

Unit-C

Brakes and Dynamometers (7 Hrs.)

Types of brakes, function of brakes, braking of front and rear types of a vehicle. Determination of braking capacity, Types of dynamometers, (absorption, and transmission), torsion dynamometer.

Belts, Chain and Rope Drive (8 Hrs.)

Open and cross belt drive, velocity ratio, slip, material for belts, crowning of pulleys, length of belts, ratio of tension, centrifugal tension, power transmitted by belts and ropes, initial tension, creep, chain drives, classification of chains, rope drive.

Syllabus: Batch 2020 Onwards

Unit-D

Gears **(7 Hrs.)**

Terminology, Fundamental law of gearing, involute spur gears, characteristics of involute and cycloidal action, Interference and undercutting, centre distance variation, path of contact, arc of contact, nonstandard gear teeth, helical, spiral bevel and worm gears, problems.

Gear Trains **(5 Hrs.)**

Synthesis of simple, compound and reverted gear trains, analysis of epicylic gear trains, problems.

Course Outcomes:

- Students will learn basics of machines and their mechanisms to power them.
- They will learn various modes to transfer power from driver to driven shaft.
- They will learn gears and gear trains to have variable speed at driven shaft.
- They will learn to use dynamometers to measure force in different brake mechanisms.

References:

1. Rattan, S.S. *Theory of Machines*. New Delhi: Tata McGraw-Hill Publishing Company Ltd. Print.
2. Shigley, and Uicker, J.J. *Theory of Machines and Mechanisms.* Oxford University Press. Print.
3. Ghosh, and Mallick, A.K. *Theory of Mechanisms and Machines.* New Delhi: Affiliated East-West Pvt. Ltd. Print.
4. Singh, V.P. *Theory of Machines.* New Delhi:DhanpatRai& Co. Print.
5. Rao, and Dukkipati, R.V. *Mechanism and Machine Theory.* New Delhi: Wiley-Eastern Ltd. Print.
6. http://nptel.ac.in/courses/112104121

Syllabus: Batch 2020 Onwards

Title: Mechanics of Solids-I

Course Code: MEC207

L	T	P	Credits
3	1	0	4

Course Objectives:

- To familiarize the students with simple stress, strain & deformation in components due to external loads.
- To study the distribution of various stresses in the mechanical elements such as beams, shafts etc.
- To analyse the beam of different cross section for shear, bending moment, slope and deflection.

Unit-A

Statics of Rigid Bodies (8 Hrs.)

Introduction, units and dimensions, Engineering materials, Properties of materials, Laws of Mechanics-Lami's theorem, Parallelogram and law of forces, Vectorial representation of forces-Vectors operation of forces, Coplanar forces-rectangular components, Equilibrium of a particle, forces in space, Equilibrium, equivalent system of forces of a particle in space, free body diagram, Moment of a force about a point and an axis, Varignon's theorem, single equivalent force, equilibrium of rigid bodies in two dimensions.

Stresses and strains (6 Hrs.)

Introduction, stress, types of stresses, Stress tensor, strain, strain tensor, Hook's law, elastic moduli, stress –strain curve for ductile and brittle materials, factor of safety, analysis of bar of varying sections, analysis of uniformly tapering circular rod and tapering rectangular bar, analysis of bars of composite sections, thermal stresses, thermal stresses in composite bars, elongation of a bar due to its own weight and analysis of bar of uniform strength

Unit-B

Elastic Constants (7 Hrs.)

Introduction, longitudinal strain, lateral strain, poisson's ratio, volumetric strain, volumetric strain of a rectangular bar subjected to axial load and three forces mutually perpendicular, volumetric strain of a cylindrical rod, Bulk modulus, expression for Young's modulus in terms of Bulk modulus, principle of complementary shear stresses, stresses on inclined sections when the element is subjected to simple shear stresses, diagonal stresses produced by simple shear on a square block, direct (tensile & compressive) strains of the diagonals, relationship between modulus of elasticity and modulus of rigidity.

Syllabus: Batch 2020 Onwards

Compound Stresses and Strains (7 Hrs.)

Two dimensional stress system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress ellipse of stress and their applications. Generalized Hook's law, principal stresses related to principal strains.

Unit-C

Bending Moment & Shear Force Diagram (8 Hrs.)

Introduction, Shear force and bending moment diagrams, types of beams, types of loads , sign conventions for shear force and bending moment, important points for shear force and bending moment diagrams, Shear force & bending moment diagrams for cantilevers, simply supported beams with or without overhangs and calculation of maximum bending moment and shear force and the point of contra flexure under concentrated loads, uniformly distributed loads over whole span or part of it, combination of uniformly distributed loads and uniformly distributed loads, uniformly varying loads; Relation between rate of loading, shear force & bending moments. Unsymmetrical bending.

Deflection of Beams (7 Hrs.)

Relationship between Moment, Slope and Deflection, Moment area method, Method of Integration, Macaulay's method – To calculate slope & deflection of cantilevers, simply supported beams with or without overhangs under various load conditions.

Unit-D

Bending Stresses in beams (7 Hrs.)

Introduction, Pure bending or simple bending, theory of simple bending with assumptions made, expression for bending stress, section modulus for various shapes or beam sections, bending stresses in circular, rectangular, I, T and channel sections, Strength of a section, Composite beams (flitched Beams).

Torsion (6 Hrs.)

Introduction, torsion of shafts, torsion equation, hollow circular shaft, torsional rigidity, power transmitted by the shaft, modulus of rupture, comparison of solid and hollow shafts, combined bending and torsion.

Learning Outcomes:

- Students will be able to clear the basic concepts of stress and strain and importance of compound stresses.
- Compute and analyse the stresses in basic mechanical components.
- Draw SFD and BMD for different types of loads and support conditions.

References:

1. Ramamrutham, S. *Strength of Materials.* New Delhi: DhanpatRai& Sons, 2014. Print.
2. Bansal, R. K. *Strength of Material.* New Delhi: Laxmi Publishers, 2012. Print.
3. Shames, D.H. *Introduction to Solid Mechanic.* Delhi: Prentice Hall Inc. 2003. Print.
4. Gere, and Goodno, B.J. *Mechanics of Materials.* Delhi: Cengage Learning, 2015. Print.
5. Hibbeler R. C. *Mechanics of Materials.* New Delhi: Pearson Education, 2015. Print.
6. Beer, and Johnston E. R. *Mechanics of Materials.* New Delhi: McGraw Hill Education, 2013. Print.
7. Ryder G.H. Strength of Materials. New Delhi: Macmillan India Ltd". 2002. Print.
8. http://nptel.ac.in/courses/112106141/

Syllabus: Batch 2020 Onwards

Course Title: Applied Thermodynamics

L	T	P	Credits
3	1	0	4

Course Code: MEC208

Course Objectives:

- To understand the applications of thermodynamic engineering
- To identify the properties of steam, steam power generation, steam condenser, steam nozzles and turbines.
- To gain the knowledge of draught and air compressor.

Unit-A

Second Law of Thermodynamics (8Hrs)

Limitations of First Law, Heat Source and Heat Sink, Heat Engine, Refrigerator and Heat Pump, Kelvin- Planck and Clausius Statements and their Equivalence, PMMSK. Carnot Cycle, Carnot Heat Engine and Carnot Heat Pump, Carnot Theorem and its Corollaries, Thermodynamic Temperature, Entropy, Clausius Inequality, Principle of Entropy Increase, Temperature Entropy Plot, Entropy Change in Different Processes.**Thermodynamics Relations, Equilibrium and Third Law**

Pure Substance (8Hrs)

Pure Substance and its Properties, Phase and Phase Transformation, effect of pressure on boiling point, generation of steam, conditions of steam, dryness fraction of saturated steam, uses of steam tables, internal energy of steam, entropy, Temperature- entropy diagram of steam, enthalpy-entropy chart for steam (Mollier diagram for steam) and vapour processes.

Unit-B

Steam Boilers, Boiler mountings, Accessories and its performance (10Hrs)

Functions of a Boiler, Classification of boilers, Terms commonly employed in connections with boilers, comparison between water tube and fire tube boilers, construction of Cochran, Locomotive, Lancashire, Babcock and Wilcox boilers in detail, merits and demerits of fire-tube and water-tube boilers; Modern high pressure boilers and Super critical boilers, Description of Heat recovery in boilers, mountings and its accessories, equivalent evaporation, boiler efficiency of thermal, economiser efficiency, boiler power and heat loss in a boiler plant, boiler trial and heat balance sheet.

Syllabus: Batch 2020 Onwards

Draught and Thermodynamic vapour cycles (5Hrs)

Definition of Draught, objects of producing draught in a boiler, classification of Draught. Introduction, Carnot cycle, Rankine cycle, Rankine cycle applied to steam engine plant, working fluid for Rankine cycle, Methods of increasing the thermal efficiency of Rankine cycle.

Unit-C

Steam nozzles (5Hrs)

Introduction, types of steam nozzles, flow of steam through nozzles, mass of steam discharged through nozzle, critical pressure ratio, areas of throat and exit for maximum discharge, supersaturated or Metastable flow through nozzle, effect of super saturation and effect of friction in a nozzle, under-expansion and over-expansion, steam injector.

Steam Turbine (10Hrs)

Introduction, classifications of turbine, difference b/w impulse and reaction turbine, advantages of steam turbine over reciprocating steam engine, simple impulse turbine, velocity diagram for moving blades for an impulse turbine, combined velocity diagram, maximum work and maximum diagram efficiency, methods of reducing rotor speed, working of reaction turbine, governing and improvement of turbine.

Unit-D

Steam condenser (5Hrs)

Introduction**,** advantage obtained by incorporating a condenser in a steam Engine or steam turbine plant, Principal requirement of condensing plant, types of condenser, vacuum in condenser and its measurement, vacuum and condenser efficiency, C.O.P of condenser, source and effects of air leakage in condenser, cooling tower and air pump**.**

Air compressors (5Hrs)

Introduction, uses of compressed Air, classifications of compressor, Air compressor terminology, reciprocating compressor, ideal single stage compressor, effect of clearance volume and expression for volumetric efficiency, expression for work done, power and efficiency of a compressor.

Learning Outcomes:

- Students will be able to know the applications of thermodynamics.
- Student will able to get the knowledge of steam generation and steam quality.
- Students will able to get awareness of turbines and nozzles.
- Students will wakefulness of condensers and air compressors.

Syllabus: Batch 2020 Onwards

References:

1.Sarkar,B.K., *Thermal Engineering*. New Delhi:Tata McGraw Hill, 2012. Print.

2.Cengel, Y. A.*AppliedThermodynamics*. New Delhi: Tata McGraw Hill, 2014 Print.

3.Kumar, D.S. Vasandani V.P. *Heat Engineering*.New Delhi:Metropolitan Book Co Pvt.Ltd, 2013. Print.

4.Ballaney,P.L. *Thermal Engineering*.Delhi: Khanna Publisher, 2011Print.

5.Domkundwar, and Kothand.*Thermal Engineering*.New Delhi: DhanpatRai&Co, 2013.Print.

6. http://nptel.ac.in/courses/112106133/ and http://nptel.ac.in/courses/112107077/

Syllabus: Batch 2020 Onwards

Course Title: Manufacturing Processes

Course Code: MEC209

L	T	P	Credits
3	0	0	3

Course Objectives:

- To provide an overviewof a wide variety of manufacturing processes for processing of engineering materials.
- To learn principles, operations and capabilities of various metal casting and weldingprocesses.
- To learn about the defects, their causes and remedies in these processes

Unit-A

Introduction (3 Hrs.)

General, Classification of manufacturing processes, Various kinds of Production System, Computers in manufacturing, Selection of manufacturing process.

Casting and Moulding Methods (7 Hrs.)

Introduction to metal casting, Types of patterns, their materials and allowances, Colour coding and storing of patterns,moulding methods and Processes, Moulding materials: Moulding sand compositions and moulding sand properties, Sand testing, Types of moulds, Core sands, Types of cores, Core banking, Gates and risers and their design, Cupola Furnace.

Unit-B

Castings Processes (8Hrs.)

Introduction, Advantages, Limitations and applications of sand casting, Shell mould casting, Vacuum casting, Pressure die casting, Permanent mould casting, Centrifugal casting, Investment casting and Continuous casting.

Unit-C

Introduction of welding (6 Hrs.)

Introduction of welding and its classification, Welding positions, Filler metals.

Gas welding: Principle of operation, Types of gas welding flames and their applications, Gas welding equipment and filler rods and fluxes.

Arc welding: Principle of operation, Arc welding machines and equipment, A.C. and D.C. arc welding, Effect of polarity and flux for arc welding.

Welding electrodes: Classification and selection of electrodes, Welding arc and its characteristics, Arc stability, Arc blow.

Syllabus: Batch 2020 Onwards

Welding Processes (8 Hrs.)

Introduction, Definition Principle of operation, Welding equipment, Process variable, Advantages, Limitations and industrial applications of:Gas tungsten arc welding (GTAW), Gas metal arc welding (GMAW), Submerged arc welding (SAW), Thermit welding, Friction welding and Ultrasonic welding, Electron beam welding and laser beam welding, Resistance welding: Spot welding, Seam welding, Projection welding, Flash welding.

Soldering, Brazing and Welding Defects (2 Hrs.)

Principle of soldering and brazing, Welding defects, Their cases and remedies

Unit-D

Metal Forming (10Hrs)

Forging: Open and closed die forging, Forging defects, Their causes and remedies.

Rolling process: Introduction, Classification, Rolling defects and remedies.

Extrusion: Classification, Equipment, Defects and remedies.

Drawing: Drawing of rods, Wires and tubes, Draw benches, Drawing defects and remedies.

Powder Metallurgy: Production of metal powders. Compaction and sintering processes.

Secondary and finishing operations, advantages, and applications of powder metallurgy.

Learning Outcomes:

- Students should have the ability to understand the importance of the manufacturing processes.
- Student can select a suitable metal casting and welding processes to fabricate an engineering product.

References:

1. Taylor,and Fleming, M.C.*Foundry Engineering*",Tronica city: Wiley Eastern Limited, 1993. Print.
2. Rao, P. N. *Manufacturing Technology, Foundry, Forming & Welding.* New Delhi:Tata McGraw Hill. Print.
3. Raghuwanshi, B.S.*A Course in Workshop Technology.*New Delhi: Vol. I, DhanpatRai, 2009. Print.
4. Lindberg, R.A. *Processes and Materials of Manufacture.* Prentice Hall of India (P) Ltd.,1996. Print.
5. Kalpakjian, and Schmid, S.R. *Manufacturing Engineering and Technology.* Addision Wesley Publishing Co., 1995. Print.
6. Cary, H. B. *Modern Welding Technology.* PrenticeHall, 1998. Print.
7. Kumar, and Gupta, M.D, "*Manufacturing Processes*" New Delhi: PHI Learning Pvt. Ltd., 2014. Print.
8. http://nptel.ac.in/courses/112107145/

Syllabus: Batch 2020 Onwards

Course Title: Engineering Materials and Metallurgy

Paper Code: MEC210

L	T	P	Credits
3	0	0	3

Objective:

1. Understanding of the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria.
2. To provide a detailed interpretation of equilibrium phase diagrams.
3. Learning about different phases and heat treatment methods to tailor the properties of Fe-C alloys.

UNIT-A

Crystal Structure: Atomic structure, Atomic bonding in solid, Unit cells, Crystallographic point, directions, and planes, Crystalline and non-crystalline materials. Metallic crystal structures (FCC, BCC, HCP) Density computations, Atomic arrangement, Polymorphism and allotropy. (4)

Imperfection in solid

Point, line, interfacial and volume defects; deformation by slip system or plane, twinning, mechanical and annealing twins, dislocation- edge and screw dislocation, critical resolved shear stress, strain hardening, recovery, recrystallization and grain growth. (6)

Mechanical Property measurement: Elastic and plastic deformation, relations between true and engineering stress-strain curves, generalized Hooke'slaw, yielding and yield strength, ductility, resilience, toughness and elastic recovery;Hardness: Rockwell, Brinell and Vickers and their relation to strength. (6)

UNIT –B

Failure of metals: Ductile and brittle failure mechanisms, Tresca, Von-mises, Maximum normal stress, Mohr-Coulomb and Modified Mohr-Coulomb; Fracture mechanics:Introduction to Stress-intensity factor approach and Griffith criterion. Fatigue failure: Highcycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits, effects of meanstress using the Modified Goodman diagram; Fracture with fatigue. (8)

UNIT –C

Phase Diagram: Component, Solubility limit, Phase, Microstructure Intermediate phase, Equilibrium Phase diagrams, Gibb's phase rule, lever rule, Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid andmonotecticsystem. Iron Iron-carbide phase diagram and microstructural aspects ofledeburite, austenite, ferrite and cementite, cast iron. (6)

Syllabus: Batch 2020 Onwards

UNIT –D

Heat treatment of Steel: TTT diagram, pearlite transformation and bainite transformation, continuous cooling and TTT diagram- transformation of austenite, factors affecting critical cooling rate, heat treatment processes- annealing, normalizing, spheroidizing, hardening and tempering, austempering, martempering, precipitation hardening, case hardening- carburising, nitriding, cyaniding, flame hardening, induction hardening. (6)

Alloying of steel: properties of stainless steel and tool steels, maraging steels- cast irons; grey, white, malleable and spheroidal cast irons- copper and copper alloys; brass, bronze and copper-nickel; Aluminium and Al-Cu – Mg alloys- Nickel based superalloys and Titanium alloys. (4)

Course Outcomes:

1. Student will be able to identify crystal structures for various materials and understand the defects in such structures.
2. Understand how to tailor material properties of ferrous and non-ferrous alloys.
3. How to quantify mechanical integrity and failure in materials

Text Book:

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

Syllabus: Batch 2020 Onwards

Course Title: Machine Drawing

Course Code: MEC211A

L	T	P	Credits
0	0	6	3

Course Objectives:

- To make the students understand the principles and requirements of production drawings.
- To provide the students a clear understanding of assembly and disassembly of important mechanical parts used in major engineering applications.
- To learn various welding, machining symbols and tolerance.

Unit-A

Requirements of Production Drawing **(6 Hrs)**

Types of Machine Drawing, Requirements of Production Drawing, Conventional representation of materials, Dimensioning, Limits, Fits & Tolerances, Symbols of standard tolerances, Machining & Welding Symbol.

Fasteners **(12 Hrs)**

Introduction, Temporary & Permanent Fasteners; Types of Rivet Head, Riveting Process, Types of Riveted joints, Various types of screw threads, Types of nuts and bolts, Assembly of Nut, Bolt and Washer,

Unit-B

Keys, Cotter & Knuckle Joint **(12 Hrs)**

Types of keys, Saddle Key, Sunk Key, Gib Head Key; Socket & Spigot cotter joint, Sleeve and cotter joint, Gib and Cotter Joint**,** Knuckle Joint, Pipe joints and Pipe fittings.

Couplings **(12 Hrs)**

Solid or Rigid Coupling, Protected and Unprotected Type Flange coupling, Pin type flexible coupling, muff coupling, Oldham's & Universal coupling

Unit-C

Boiler Mountings **(12 Hrs)**

Steam stop valve, feed check valve, safety valve, blow off cock valve.

IC Engine Parts **(8 Hrs)**

Piston, connecting rod, Crankshaft

Unit-D

Bearings **(10 Hrs)**

Bushed bearing, Plummer block, footstep bearing, Swivel bearing

Syllabus: Batch 2020 Onwards

Miscellaneous **(16Hrs)**

Screw Jack, Tool Post, Tail Stock, Drilling jig, Machine vice, Bench Vice, cross head, Eccentric

Solution of few problems using computer design software.

Course Outcome:

- Students will learn importance of tolerance, machining symbols and conventions in production drawing.
- They will learn various locking devices applicable in different working conditions.
- They will learn assembly of various parts of a machine component and to draw its ortho graphic views.

References:

1. Gill, P.S. M*achine Drawing.* New Delhi: S. K. Kataria& Sons, 2013. Print.
2. Dhawan, R.K. *Machine Drawing*. New Delhi: S. Chand & Sons, 2014. Print.
3. Sidheshwar, N., Kannaieh, P., Sastry V.V.S. *Machine Drawing*. New Delhi: Tata McGraw Hill, 2010. Print.
4. Narayana, K. L., Kannaiah, P. and Reddy, K. V. *Machine Drawing*. New Delhi: New Age International Publishers, 2009. Print.

Syllabus: Batch 2020 Onwards

Course Title: **Mechanics of Solids** Laboratory - I

Course Code: MEC212

L	T	P	Credits
0	0	2	1

List of Experiments

1 To conduct a tensile test on mild steel Specimen and determine the following:-
The yield stress, Ultimate stress, breaking stress, Young modulus of elasticity, Percentage elongation, Percentage reduction in Area

2 To perform bending tests on UTM.

3 To perform shear test on UTM.

4 To Perform the compressive test on Cast iron on UTM machine.

5 To determine the impact strength of a specimen of M.S/Cast Iron by Charpy test.

6 To determine the impact strength of a specimen of M.S/Cast Iron by Izod test.

7 To Conduct torsion test on Mild steel/Cast iron specimen to find out modulus of rigidity.

8 To determine the Stiffness of the spring and modulus of rigidity of the open spring wire.

9 To determine the Stiffness of the spring and modulus of rigidity of the closed spring wire.

10 Determination of buckling loads of long columns with different end conditions.

11 To prove Maxwell's theorem of beam deflection

Syllabus: Batch 2020 Onwards

Course Title: Thermodynamic Laboratory - I

Course Code: MEC213

L	T	P	Credits
0	0	2	1

List of Experiments:

1. To study of Babcock-Wilcox boiler (Model).
2. To study of locomotive boiler (Model).
3. To Study of Lancashire boiler (Model).
4. To study the Red wood viscometer and measure the viscosity of fluid.
5. To measure the flash point of the given fuel.
6. To study various parts of the vertical steam engine.
7. To study the diesel engine and make a trial on it.
8. To study the cooling tower and make calculations on it.
9. To study the two stage reciprocating air compressor and make calculations on it.
10. To study the surface condenser and performs various experiments on it.
11. To determination of dryness fraction of steam.
12. To study the effect of forward curved, backward, curved and radial vanes in a centrifugal compressor and to find out the overall efficiency of the compressor.
13. To study the performance of axial flow fan.

Syllabus: Batch 2020 Onwards

Course Title: Engineering Materials and Metallurgy Lab

Course Code: MEC215

L	T	P	Credits
0	0	2	1

List of experiments

1. Prepare the different specimen for examination of microstructure of mild steel, aluminium, stainless steel, copper using metallurgical microscope.
2. Annealing the steel specimen to study the effect on hardness and analysing the microstructure using metallurgical microscope.
3. Normalizing the steel specimen and study the effect on hardness and analysing the microstructure using metallurgical microscope.
4. Hardening the steel specimen for studying the effect of quenching medium on hardness and analysing the microstructure using metallurgical microscope.
5. Identification of ferrite, pearlite, bainite and martensite constituents in given specimen of steel.
6. To performed surface hardening of steel by using flame hardening method.
7. To performed surface hardening of steel by using carburising, nitriding and cyaniding method.

Syllabus: Batch 2020 Onwards

Course Title: Production and Operation Management

Paper Code: MEC250A

L	T	P	Credits
3	0	0	3

Course Objective:

- To understand the role of Production and operations management in the overall business strategy of the organization.
- To identify and evaluate the key factors and the interdependence of these factors in the design of effective Production systems.
- To identify and evaluate a range of tools appropriate for analysis of operating systems of the organization.

Unit-A

Introduction (3 Hrs.)

Production Management, Service verses Goods, Objectives,Scope &Functions/Activities of Production and Operation Management,Decisions in Production and Operation Management, Production Management verses Industrial Engineering.

Production and Productivity (7 Hrs.)

Introduction, Fabrication, Manufacturing and Production, **Production Systems**: Intermittent System, Project System, Job Order Production, Batch Production, Continuous Production and their characteristics, Process Life Cycle or Production Life Cycle, Productivity, Measurement of Productivity, Ways to improve Productivity, Productivity and Fatigue, Relationship between Productivity and Standard of living.

Factory Organization

Concept and structure of an organization, Significance and Requirement of an organizationstructure, Types of Organization-Military or Line Organization, Functional Organization, Line and Staff Organization, Committees Organization.

Unit-B

Production Planning and Control (12 Hrs.)

Production, Planning, Control, Definition and Objectives of PPC, Functions of PPC, (Pre-Planning, Active Planning and Post Planning), Definition and Concept of forecasting, Importance and application for purpose of sales forecasts, Methods of Sales forecast, Routing (Routing Procedures, Route Sheet and Route Cards, Advantages of good Routing), Scheduling Loading (Objectives of Loading, Adjustment to Machine Overloading and under loading), Dispatching (Duties/Activities of a dispatcher, Centralized and Decentralized dispatching), Control(Need and Significance, Objectives), Follow up Phase(Progress Reporting, Corrective Action, Common reasons for

Production delay, Method of taking corrective action), Advantage of better PPC, Principles of Sound PPC, Assembly line balancing; Aggregate production planning; Master production scheduling; MRP and MRP-II

Unit-C

Facility Location and Layout (8 Hrs.)

Need for a suitable location, Factor Affecting Plant Location, Selection of actual site, Selection of Urban, Suburban or Rural area, Comparison between Urban and Rural area in connection with selection of site, Recent Trends in Location of Industries.

Ideal Plant Layout, Objectives of plant layout, Factors affecting the plant layout decision, Principles of plant layout, Material Flow System, Different types of layouts viz. Product, Process, Combination, Static or Project and Group layouts and their suitability. Computer aided layout design techniques.

Management Information System

MIS, Nature, Scope, Objectives and Need of MIS, Structure of MIS, Types of MIS system.

Unit-D

Material Handling (8Hrs.) Introduction, Definition and Concept, Material Handling and Plant Layout, Benefits, Negative aspects of Material Handling, Objectives of Material Handling, Functions of Material Handling, Principles of economic Material Handling, Selection of Material Handling Equipment, Types of Material Handling Equipment's.

Repair and Maintenance (6 Hrs.)

Objective and importance of Maintenance, Different type of maintenance, Predictive and Preventive Maintenance, Procedure of Preventive Maintenance, Schedules of Preventive Maintenance, Nature of maintenance problem

Learning Outcomes:

- Students will be able to know about the different elements of PPC.
- Student will able to know about the site selection for a plant.
- Students will able to recognize the different material handing equipment's and the utility of these material handing equipment's.
- Students will able to know about different type of maintenance schedules and maintenance problems.

References:

1. Bansal, V.B. *Industrial Engineering and Production Management.* New Delhi: Kapson Publishers. 2015. Print
2. Raju, N.V.S. *Industrial Engineering and Management*. New Delhi: Cengage Learning. 2013. Print.
3. Chunawala. *Production and Operation Management.* New Delhi: Himalaya Publication. 2013. Print.
4. Dalela, and Ali, Mansoor. *Industrial Engineering and Management Systems*. New Delhi: Standard Publishing Distributors. 2010. Print.
5. Hicks. *Industrial Engineering & Management-A new perspective*. New Delhi: Tata McGraw Hill. 2014. Print.
6. Shankar, Ravi. *Industrial Engineering and Management*. New Delhi: Galgotia Publishers. 2010. Print.
7. Jain and Agarwal. *Production Planning & Control.* New Delhi: Khanna Publishers. 2013. Print.
8. Verma, A.P. *Industrial Engineering and Management*. New Delhi: Katson Books. 2010. Print.

Syllabus: Batch 2020 Onwards

L	T	P	Credits
3	1	0	4

Course Title: Dynamics of Machines

Course Code: MEC251A

Course Objectives:

- To provide the basic concepts of forces in mechanisms.
- To provide the information of balancing of machines.
- To provide the information of gyroscopic couple and fuel regulation to engine.

Unit-A

Static Force Analysis (8 Hrs.)

Concept of force and couple, free body diagram, condition of equilibrium, static equilibrium of mechanism, methods of static force analysis of simple mechanisms. Power transmission elements, considerations of frictional forces

Dynamic Force Analysis (8 Hrs.)

Determination of forces and couples for a crank, inertia of reciprocating parts, dynamically equivalent system, analytical and graphical method, inertia force analysis of basic engine mechanism, torque required to overcome inertia and gravitational force of a four bar linkage.

Unit-B

Balancing of Rotating Components (7 Hrs.)

Static balance, dynamic balance, balancing of rotating masses, two plane balancing, graphical and analytical methods, balancing of rotors, balancing machines, field balancing

Balancing of Reciprocating Parts (7Hrs.)

Balancing of single cylinder engine, balancing of multi cylinder; inline, radial and V type engines, firing order

Unit-C

Flywheels (6Hrs.)

Turning moment and crank effort diagrams for reciprocating machines' Fluctuations of speed, coefficient of fluctuation of speed and energy, Determination of mass and dimensions of flywheel used for engines and punching machines

Governors (7 Hrs.)

Introduction, types of governors, characteristics of centrifugal governors, gravity controlled and spring controlled centrifugal governors, hunting of centrifugal governors, inertia governors

Syllabus: Batch 2020 Onwards

Unit-D

Gyroscope (6 Hrs.)

Concept of gyroscopes, gyroscopic forces and couples, gyroscopic stabilization, ship stabilization, stability of four wheel and two wheel vehicles moving on curved paths

Kinematics synthesis of Mechanisms (7 Hrs.)

function generation, path generation, Freudenstein's equation, two and three position synthesis of four bar and slider crank mechanisms by graphical and analytical methods, , precision positions, structural error; Chebychev spacing, transmission angle.

Learning Outcomes:

- Students will be able to know about the static and dynamic forces in the mechanisms.
- Student will able to know the about different methods of balancing of rotating and reciprocating parts in the engines.
- Students will able to know about the concept and effects of gyroscopic couple.
- Students will able to know about various types and working of governors.

References:

1) Rattan,S.S.*Theory of Machines*, New Delhi: Tata McGraw-Hill Publishing Company Ltd., 2013.Print.

2) Shigley, J.E. and Uicker,J.J.*Theory of Machines and Mechanisms*. New Delhi:Oxford University Press, 2015. Print.

3) Bansal, R.K. and Brar, J.S. *Theory of Machines*, New Delhi:Laxmi Publications (P) Ltd., 2013.Print.

4) Singh, V.P. *Theory of Machines*, New Delhi:DhanpatRai& CO., 2014.Print.

5) Singh, Sadhu *Theory of Machines*, New Delhi:Pearson Education, 2014.Print.

6) Ballaney, P.L.*Theory of Machines and Mechanism*, New Delhi:Khanna Publishers, 2015.Print.

7) Ghosh, A. and Mallick, A.K.*Theory of Mechanisms and Machines*. New Delhi: Affiliated East-West Pvt. Ltd., 2009. Print.

8) Rao, J.S. and Dukkipati, R.V. *Mechanism and Machine Theory*. New Delhi: New Age International Publishers, 2010. Print.

9) http://nptel.ac.in/courses/112101096/

Syllabus: Batch 2020 Onwards

Course Title: Mechanics of solids-II

Course Code: MEC257A

L	T	P	Credits
3	1	0	4

Course Objectives:

- To familiarise the students with common theories of failure and their application to different machine elements.
- To aware the students about the various stresses in spring, thin cylinder, thick cylinder, sphere and application of theories of failure to these elements.
- To familiarise the students with shear stress distribution in beam and thin section.

Unit-A

Strain Energy (8 Hrs.)

Strain energy (resilience), strain energy under direct stresses, simple shear, torsion and bending. Strain energy due to principal stresses, Energy of distortion and dilation. Castigliano's theorem, Maxwell's theorem of reciprocal deflections

Theories of Failure (6 Hrs.)

Importance of theories of elastic failure, Maximum Principal Stress theory, Maximum Principal Strain theory, Max. Shear stress theory, Total strain energy theory, Distortion energy theory, two and three dimensional equations for theories of failure and their graphical representation.

Unit-B

Columns and struts (6 Hrs.)

Columns under axial load, Concept of Instability & Buckling, Slenderness ratio, Effective Length; Euler's theory of buckling of columns, limitation of Euler's formula; Rankine formula, Johnson's parabolic formula.

Thin & Thick cylinders and spheres (9 Hrs.)

Stresses in cylinders due to internal pressure, modification due to joints in plates, Applications of theories of failure to thin cylinders, Principal strain and increase in enclosed volume for a thin cylinder closed at ends, , Principal stresses in spherical vessels, Cylindrical pressure vessels with hemi spherical heads, wire wound thin cylinders. Derivation of Lame's Equation, hoop, radial and longitudinal stresses in cylinders, thick spherical vessels, compound cylinders.

Unit-C

Shear stress distribution in beams (6 Hrs.)

Introduction, Shear stress at a section, Shear stress distribution for different sections-rectangular, circular, I, T and miscellaneous sections

Bending of curved beams:

Calculation of stresses in crane or chain hook, rings of circular section and trapezoidal section.

Unit-D

Springs **(8 Hrs.)**

Introduction springs classification, force components in the circular wire section of a helical spring, close and open coiled helical springs subjected to combined axial load and couple, axial load only and axial couple only, spiral spring, leaf springs, laminated leaf springs, applications.

Rotational Stresses:

Discs, and rims, discs of uniform strength.

Learning Outcomes:

- They will also be able to design cylinders and springs for various mechanical applications.
- Students able to know about how the shear stress is distributed in different sections.
- Students will be enabled to solve the compound loaded applications

References:

1. Hibbeler R. C. *Mechanics of Materials.* New Delhi: Pearson Education, 2015. Print.
2. Nag, D. and Chanda, A. *Strength of materials.* New Delhi: Wiley publications, 2012. Print.
3. Ramamrutham, S. *Strength of Materials.* New Delhi: DhanpatRai& Sons, 2014. Print.
4. Lehri, R.S. and Lehri, A.S. *Strength of Materials*. New Delhi: S. K. Kataria& Sons, 2011. Print.
5. Dr. Bansal, R. K. *Strength of Material.* New Delhi: Laxmi Publishers, 2012. Print.
6. Shames, D.H. *Introduction to Solid Mechanic.* Delhi: Prentice Hall Inc. 2003. Print.
7. Ryder, G.H. *Strength of Materials*. Noida: MacMillan, 2014. Print.
8. Crandall, S.H. and Dahl, N.C. *An introduction to Mechanics of Solids*. Tata McGraw Hill, 2012. Print.
9. Gere J.M., and Goodno, B.J. *Mechanics of Materials.* Delhi: Cengage Learning, 2015. Print.
10. http://nptel.ac.in/courses/112106141/ and http://nptel.ac.in/courses/1F12107146

Syllabus: Batch 2020 Onwards

Course Title: I.C. Engines

Course Code: MEC258A

L	T	P	Credits
3	1	0	4

Course Objective

- To make understanding of internal combustion engines and gas turbines
- To make students familiar with the impact of I.C. engines on environment

UNIT-A

Air Standard Cycles (9 Hrs.)

Internal and external combustion engines; classification of I.C. Engines, Cycles of operation in four stroke and two stroke I.C. Engines, Assumptions made in air standard cycle; Otto cycle; diesel cycle, dual combustion cycle, comparison of Otto, diesel and dual combustion cycles; Lenoir cycle, Sterling and Ericsson cycles; various engine cycle performance parameters; deviation of actual cycle from real cycle. Problems

Carburetion, fuel Injection and Ignition systems (7 Hrs.)

Mixture requirements for various operating conditions in S.I. Engines; elementary carburettor, Gasoline injection systems, Multi point fuel injection system (MPFI), diesel injection systems, Ignition system requirements and structure, Problems

UNIT-B

Combustion in I.C. Engines (7 Hrs.)

S.I engines; Ignition limits; stages of combustion in S.I. Engines; Ignition lag; velocity of flame propagation; detonation; effects of engine variables on detonation; theories of detonation; octane rating; pre -ignition; combustion chambers, Stages of combustion in C.I. Engines; delay period; variables affecting delay period; knock in C.I. engines, Cetane rating;

Lubrication and Cooling Systems (8 Hrs.)

Functions of a lubricating system, Types of lubrication system; mist, wet sump and dry sump systems; properties of lubricating oil; SAE rating of lubricants, engine performance and lubrication, Necessity of engine cooling; disadvantages of overcooling; types of engine cooling systems; radiators.

UNIT-C

Engine Testing and Performance (7 Hrs.)

Performance parameters: BHP, IHP; specific fuel consumption (BSFC, ISFC), thermal efficiency, volumetric efficiency, heat balance; fuel and air consumption, brake power, indicated power and friction power, heat lost to coolant and exhaust gases; performance curves. Problems

Air pollution from I.C. Engine and Its remedies (6 Hrs.)

Pollutants from S.I. and C.I. Engines, Methods of emission control; alternative fuels for I.C. Engines; the current scenario on the pollution front

Syllabus: Batch 2020 Onwards

UNIT-D

Gas Dynamics **(12 Hrs.)**

Brayton cycle; Components of a gas turbine plant; open and closed types of gas turbine plants; Introduction to axial flow gas turbine; Introduction to centrifugal and axial flow compressors; Jet propulsion ; Turbo jet; Turboprop; Turbofan; Ramjet; Thrust and propulsive efficiency; Rocket propulsion.

Learning Outcomes:

After learning of this course

- Students will be able to think about innovation in the ignition system
- Students will be enabled about the appropriate selection of lubrication and cooling system
- Students can do number of test to find the performance of the engine and thereby improvement in efficiency of the engine can be made.

References:

1. Ganesan, V. Internal combustion engines . New Delhi: Tata McGraw-Hill. Print.
2. Willard, W. Pulkrabek. Engineering fundamental of the I.C. Engine. New Delhi: PHI. Print.
3. Obert, E.F. Internal Combustion Engines & Air pollution . New York: Hopper & Row Publication. Print.
4. Heywood, B. John. Internal Combustion Engines Fundamentals. New York: McGraw Hill . Print.
5. Gupta, N. H. Fundamentals of Internal Combustion Engines . New Delhi: PHI. Print.
6. Cohen, H. and Rogers, G.F.C. Gas turbine theory . England: Longman house publication. Print.
7. http:/ / nptel.ac.in/courses/ 11210403

Syllabus: Batch 2020 Onwards

Course Title: Metal Cutting & Machine Tools

Course Code: MEC259

L	T	P	Credits
3	0	0	3

Course Objectives:

- To learn principles, operations and capabilities of various metal machining and metal forming processes.
- To learn the importance of process variables controlling these processes.
- To recognize the inter-relationships between material properties and manufacturing processes.
- To learn various sheet metal operation and designing of work holding devices.

Unit-A

Metal Cutting: (7 Hrs.)

Introduction, system of tool nomenclature, Tool geometry, Mechanics of metal cutting, Tool wear in metal cutting, Tool life, Cutting forces and power, Machinability, Cutting tool materials, Cutting fluids

Lathe: (8 Hrs.)

Classification, Description and operations, kinematic scheme of lathe, Operation performed on lath and lathe attachments, machining time estimation.

Unit-B

Hole Making Process: **(4 Hrs.)**

Introduction, Drilling, Types of drilling machines, Gun Drill, deep hole drilling, Reaming, Boring, Tapping, Machining time estimation

Milling Machine: (3 Hrs.)

Classification, Description and operations, milling cutters

Shaper and Planer: **(3 Hrs.)**

Shaping and planning machine: Classification, Description and operations, Drive mechanisms.

Manufacturing of Gears (3 Hrs.)

Gear generation processes, gear shaping, shaving, hobbing, gear finishing

Unit-C

Abrasive Processes: (3 Hrs.)

Introduction, Grinding wheel designation and selection, Grinding process, Grinding process parameters, Honing, Lapping

Broaching Machine: (3Hrs.)

Classification, Description and Operations

Syllabus: Batch 2020 Onwards

Unit-D

Press Working of Sheet Metal: (6 Hrs.)

Types of presses, drives and feed mechanisms, Operations: Shearing, Bending, Spinning, Embossing, Blanking, Coining and Deep drawing; Die materials, Stock layout, Compound and progressive dies and Punches, Construction details of die set, Auxiliary equipment, Safety devices.

Jig and Fixtures: (8 Hrs.)

Introduction, Functional surfaces, Location principles, clamping devices, locating devices.

Learning Outcomes:

- Students should have the ability to understand the importance of the machining processes.
- Student can select suitable machining processes to fabricate an engineering product.

References:

1. Raghuwanshi, B.S.*ACourse in Workshop Technology.*New Delhi: Vol. I, DhanpatRai, 2009.Print.
2. Lindberg, R.A. *Processes and Materials of Manufacture*. Prentice Hall of India (P) Ltd.,1996.Print.
3. Serope, K. J. *Manufacturing engineering and Technology*. 3rd Edition,Addision Wesley Publishing Co., 1995.Print.
4. GrooverM. P. *Fundamentals of Modern manufacturing*, Wiley. Print.
5. Kumar, R. and Gupta, M.D. *Manufacturing Processes.* New Delhi: PHI Learning Pvt. Ltd. 2014. Print.
6. Ostwald, P.F., Munoz, J. *Manufacturing processes and systems.* Wiley, 2012. Print.
7. http://nptel.ac.in/courses/112105127

Syllabus: Batch 2020 Onwards

Course Name: Mechanical Measurement

Course Code: MEC260

L	T	P	Credits
3	0	0	3

Objective:

1. To provide a basic knowledge about measurement systems and their components.
2. To learn about various sensors used for measurement of mechanical quantities
3. To learn about system stability and control
4. To integrate the measurement systems with the process for process monitoring and control

UNIT-A

Introduction: Measurement, Significance, method of measurement definitions and concept of accuracy, precision, range, resolution, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay, Factor in selection of measuring instruments.

Errors in measuring instruments: Classifications of error, sources of error, temperature problem, static & dynamic characteristics of measuring instruments, calibration, error.

UNIT –B

Metrology: Standards of measurements- Line, end and wavelength; linear measurements - Vernier callipers, Vernier height gauge and depth gaugeand micrometre; Angular measurements - sine bar, clinometer, angle gauge;Measurement of major diameter, minor diameter, effective diameter, pitch, angle and form of threads for internal and external threads; comparators - their types, relative merits and limitations; surface roughness - specifications and measurement,concept and measurement of straightness and flatness by interferometry.

UNIT –C

Sensors and transducers: Introduction to sensors and transducers, types of sensors, review of electro-mechanical sensors and transducers - variable resistance, inductance and capacitive pickups, photo cells and piezoelectric transducers and application of these elements for measurement of position / displacement, speed / velocity / acceleration, force and liquid level. Resistance strain gauges, gauge factor, bonded and unbounded gauges, surface preparation and bonding technique signal conditioning and bridge circuits, temperature compensation, application of strain gauges for direct, bending and torsional loads. Introduction to amplifying, transmitting and recording devices.

Syllabus: Batch 2020 Onwards

UNIT –D

Pressure and Flow Measurement: Bourdon tube, diaphragm and bellows, vacuum measurement - Mcleod gauge, thermal conductivity gauge and ionization gauge; Dead weight gauge tester. Electromagnetic flux meters, ultra-sonic flow meters and hot wire anemometer: flow visualization techniques.

Temperature Measurement: Thermal expansion methods - bimetallic thermometers, liquid-in-glass thermeter and filled-insystem thermometers; thermo-electric sensors - common thermo couples, reference junction considerations, special materials and configurations; metal resistance thermometers and thermistors; optical and total radiation pyrometers; calibration standards.

Speed:, Force, Torque and Shaft Power Measurement Mechanical tachometers, vibration reed tachometer and stroboscope; proving ring, hydraulic and pneumatic load cells, torque on rotating shafts; Absorption, transmission and driving dynamo meters.

Course Outcomes:

Upon completion of this course, the students will be able to understand the measurement ofvarious quantities using instruments, their accuracy & range, and the techniques for controlling devices automatically.

Text Books:

1. Instrumentation and control systems by W. Bolton, 2nd edition, Newnes, 200
2. Thomas G. Beckwith, Roy D. Marangoni, John H. LienhardV, Mechanical Measurements (6th Edition) 6th Edition, Pearson Education India, 2007.
3. Gregory K. McMillan, Process/Industrial Instruments and Controls Handbook, Fifth Edition, McGraw-Hill: New York,1999.

Syllabus: Batch 2020 Onwards

Course Title: Dynamics of Machines Lab

Course Code: MEC261A

L	T	P	Credits
0	0	2	1

List of Experiments:

1. To study inversions of 4 Bar Mechanisms, Single and double slider crank mechanisms.
2. To study various type of cam and follower arrangements.
3. To plot follower displacement vs cam rotation for various Cam Follower systems.
4. Determination of gear- train value of compound gear trains and Epicyclic gear trains.
5. To perform experiment on Watt Governors to prepare performance characteristic Curves, and to find stability & sensitivity
6. To perform experiment on Proell Governor to prepare performance characteristic curves, and to find stability & sensitivity.
7. To perform experiment on Hartnell Governor to prepare performance characteristic Curves, and to find stability & sensitivity.
8. To determine gyroscopic couple on Motorized Gyroscope.
9. To perform the experiment for static balancing on static balancing machine.
10. To perform the experiment for dynamic balancing on dynamic balancing machine.
11. To determine experimentally the ratio of cutting to idle time to the crank & slotted lever (QRM) & Compare the result with theoretical values. Plot the following:
    θ v/s displacement of slider
    θ v/s velocity
    θ v/s acceleration
12. To determine velocity & acceleration of slider in Slider Crank mechanism and plot the following:
    θ v/s displacement of slider
    θ v/s velocity
    θ v/s acceleration Compare the values of velocities and acceleration with those obtained theoretically. Assume W= 1 rad/sec
13. To determine the values of coefficient of friction between the screw & nut of jack while:
    Raising the load
    Lowering the load
14. To draw experimentally a curve of the follower displacement v/s cam angle. Differentiate the above curve to get velocity & acceleration plot & compare the values with those obtained analytically.
15. To determine the value of coefficient of friction between belt & pulley and plot a graph between log T1/T2, &θ and measure the slip and creep in belt drive.

L	T	P	Credits

Syllabus: Batch 2020 Onwards

Course Title: I.C. Engines lab

0	0	2	1

Course Code: MEC263

List of Experiments:

1. To study the constructional details & working principles of two -stroke/ four stroke petrol engine.
2. To study the constructional detail & working of two -stroke/ four stroke diesel engine.
3. Analysis of exhaust gases from single cylinder/ multi cylinder diesel/ petrol engine by orsat Apparatus.
4. To prepare heat balance sheet on multi -cylinder diesel engine/petrol engine.
5. To find the indicated horse power (IHP) on multi -cylinder petrol engine/ diesel engine by Morse Test.
6. To prepare variable speed performance test of a multi -cylinder/single cylinder petrol engine/diesel engine and prepare the curves (i) bhp, ihp, fhp, vs speed (ii) volumetric efficiency & indicated specific fuel consumption vs speed.
7. To find fhp of a multi -cylinder diesel engine/petrol engine by Willian's line method & by motoring method.
8. To perform constant speed performance test on a single cylinder/ multi -cylinder diesel engine & draw curves of (i) bhp vs fuel rate, air rate and A/ F and (ii) bhp vs mep, mech efficiency &sfc.
9. To measure CO & Hydrocarbons in the exhaust of 2 - stroke / 4 -stroke petrol engine.
10. To find intensity of smoke from a single cylinder / multi -cylinder diesel engine.
11. To draw the scavenging characteristic curve s of single cylinder petrol engine.
12. To study the effects of secondary air flow on bhp, sfc, Mech. Efficiency & emission of a two-stroke petrol engine.

Syllabus: Batch 2020 Onwards

Course Title: Manufacturing Technology Lab

Paper Code: MEC264

L	T	P	Credits
0	0	2	1

MACHINE SHOP

1. To study the characteristic features of lathe and prepare a job practicing different operations on mild steel rod.
2. To study the characteristic features of milling machine and machine the hexagonal head and the slot on the specimen.
3. To study the characteristic features of shaper and machine a V-block.
4. To study the characteristic features of drilling machine.

WELDING SHOP

5. To join two given metal plates by a square butt joint, Lap joint, Tee joint using arc welding.
6. To study the characteristic features of TIG/MIG welding and join two given metal plates making different welded joints.
7. To study the characteristic features of different resistance welding processes and join two given metal sheet by resistance welding processes
8. To study the characteristic features of SAW welding and join two given metal plates.

FOUNDARY SHOP

9. To make the mould of different types of pattern.
10. To make cores of different shapes and test the core.
11. To make pattern for given casting with all necessary allowances, parting line running system details.
12. Investigate the casting defects and suggest remedial measures.

References:

1. Sen and Bhattacharya. *Principles of Machine tools*. New Central Book Agency.
2. Brown. *Machining of Metals*. Prentice hall. Print.
3. Shaw. *Principles of Metal cutting.* Oxford I.B.H. Print.
4. Arshimovand Alekree. *Metal cutting theory & Cutting tool design*. MIR Publications. Print.

Syllabus: Batch 2020 Onwards

Course Title: Mechanical Measurement Lab.

Paper Code: MEC265

L	T	P	Credits
0	0	2	1

List of experiments

1. Measurement of internal and external diameter or length of specimen with the help of vernier caliper.
2. Measurement of internal and external diameter or length of specimen with the help of outside and inside micrometer.
3. Measurement the height of specimen and marking the specimen to be worked with the help of height gauge.
4. Measurement of an angle of specimen with the help of sine bar.
5. Measurement of an angle of specimen with the help of angle protector.
6. Measurement of surface roughness using surface roughness tester.
7. Measurement of gear elements using profile projector.
8. Measurement of thread element by Tool maker's microscope.
9. Preparation of a thermocouple, its calibration and application for temperature measurement.
10. Measurement of strain with the help of hole-drilling strain-gage method.

Syllabus: Batch 2020 Onwards

Course Title: Heat Transfer

Course Code: MEC303B

L	T	P	Credits
3	1	0	4

Course Objectives:

- The aim of the course is to build a solid foundation in heat transfer exposing students to the three basic modes namely conduction, convection and radiation.
- Rigorous treatment of governing equations and solution procedures for the three modes will be provided, along with solution of practical problems using empirical correlations.
- The course will also briefly cover boiling and condensation heat transfer, and the analysis and design of heat exchangers.

Unit-A (12 hours)

Basics and Laws

Definition of Heat Transfer, Reversible and irreversible processes, Modes of heat flow, Combined heat transfer system and law of energy conservation**.**

Heat Conduction

Introduction, I-D heat conduction through a plane wall, long hollow cylinder, hollow sphere, Conduction equation in Cartesian, polar and spherical co-ordinate systems, critical insulation thickness.

Unit-B (10 hours)

Steady State Conduction with Heat Generation and fins

Two dimensional conduction solutions for both steady and unsteady heat transfer, Numerical problems, lumped system approximation and Biot number, Heat transfer through extended surfaces (fins), Fin effectiveness and design criteria, Systems with negligible internal resistance, Transient heat conduction.

Unit-C (17 hours)

Convection

Forced convection-Thermal and hydro-dynamic boundary layers, Equation of continuity, Dimensionless parameters for forced and free convection heat transfer-Correlations for forced and free convection, Momentum and energy equations, Empirical relations for free convection from vertical and horizontal planes & cylinders, Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection.

Thermal Radiation

Introduction, Radiation spectrum, Planck's Law, The Stephen-Boltzmann law,Wein'sDsiplacement law, Kirchoff's Law,Radiative properties, Shape factors and their relationships, Heat exchange between non-black bodies, Derivation of formula for radiation

exchange between two bodies using the definition of radiosity and irradiation and its application to cases of radiation exchange between three or four bodies

Unit-D (11 hours)

Heat Exchangers

Classification, Performance variables, Analysis and design of heat exchangers using both LMTDandNTU methods, Heat exchanger effectiveness,Heat Transfer with Change of Phase, Laminar film condensation on a vertical plate, Drop-wise condensation, Boiling regimes, Free convective nucleate and film boiling, Similarity between heat and mass transfer.

Learning Outcomes:

- After completing the course, the students will be able to formulate and analyze a heat transfer problem involving any of the three modes of heat transfer
- The students will be able to obtain exact solutions for the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer.
- The students will be able to analyze devices such as heat exchangers and also estimate the insulation needed to reduce heat losses where necessary.

References:

1. Yunus A. Cengel, Afshin, Ghajar. *Heat and Mass Transfer.* Noida:McGraw Hill, 2015 Print.
2. Incropera, F.P. and Dewill, D.P. *Fundamentals of Heat & Mass Transfer.* New York: John Willey, 2013Print.
3. M. Thirumaleshwar. *Fundamentals of Heat & Mass Transfer.* Noida: Pearson, 2015Print.
4. Rajput R.K. *Heat and Mass Transfer.* New Delhi: S.Chand and Company, 2013 Print.
5. D. S. Kumar. *Heat and Mass Transfer. New Delhi: Katson, 2015 Print.*
6. J.P.Holman, *Heat Transfer*, Eighth Edition, McGraw Hill, 1997.
7. http://nptel.ac.in/courses/112108149/#

Syllabus: Batch 2020 Onwards

Course Title: Mechanics of Fluids

Course Code: MEC306B

L	T	P	Credits
3	1	0	4

Course Objective:

- The main objective of this course is to understand the fundamentals of the fluid mechanics such as fluid and flow properties, fluid behaviour at rest and in motion.
- To provide the knowledge of different pressure measuring devices.
- Understand the Fundamental equations like mass, energy and momentum conservation of the fluid flow.
- To provide the knowledge of different types of head losses in flow.

Unit-A

Properties of fluid: **(4 Hrs.)**

Fluid, ideal and real fluid, Properties of fluid: Mass density, Weight density, Specific volume, Specific gravity, Viscosity, Surface tension, Capillarity, Vapour pressure, Compressibility and bulk modulus, Newtonian and non-Newtonian fluids.

Fluid statics: **(4 Hrs.)**

Pressure, Pascal's law, Hydrostatic law, Pressure measurement, Hydrostatic force on submerged plane and curved surface, Buoyancy and Flotation, Metacentric height.

Unit-B

Fluid kinematics: **(6 Hrs.)**

Description of fluid motion, Langragian and Eulerian approach, Type of fluid flow, Type of flow lines-path line, Streak line, Stream line, Stream tube, Continuity equation, Acceleration of a fluid particle, Motion of fluid particle along curved path, Normal and tangential acceleration, Rotational flow, Rotation and Vorticity, Circulation, Stream and potential function, Flow net, Its characteristics and utilities, Vortex motion.

Dimensional analysis, Similitude and Modelling: **(6 Hrs.)**

Methods of dimensional analysis, Rayleigh's method, Buckingham's theorem, Limitations, Model analysis, Dimensionless number and their significance, Model Laws

Unit-C

Fluid dynamics: **(8 Hrs.)**

Integral equations for the control volume: Reynolds's Transport theorem, equations for conservation of mass, energy and momentum, Bernoulli's equation and its application in flow measurement. Differential equations for the control volume: Mass conservation in 2 and 3dimension in rectangular and cylindrical co-ordinates, Euler's equations in 2,3dimensions

and subsequent derivation of Bernoulli's equation; Navier-Stokes equations in rectangular Cartesian co-ordinates; exact solutions of Navier-Stokes Equations to viscous laminar flow between two parallel planes (Couette flow and plane Poiseuille flow)

Flow Rate and Velocity Measurement device: (4 Hrs.)

Pitot and Pitot-Static Probes, Orifice, Venturimeter and Nozzle Meters, Turbine Flow meters, Rotameters, Ultrasonic Flow meters, Electromagnetic Flow meters, Vortex Flow meters, Thermal (Hot-Wire and Hot-Film) Anemometers, Laser Doppler Velocimetry, Particle Image Velocimetry

Unit-D

Flow through pipes: **(4 Hrs.)**

Loss of energy in pipes, Hydraulic gradient and total energy line, pipe in series and parallel, Equivalent pipe power transmission through pipe, Water hammer in pipes, Turbulent flow in pipes

Internal flows: (4 Hrs.)

Friction factor, Darcy-Weisbach friction factor, Moody's diagram, Boundary Layer theory, Boundary layer equation, Laminar and turbulent boundary layer and its growth over flat plat, Momentum boundary layer and its solutions, separation of boundary layer and its control

Open channel flow: (4 Hrs.)

Types of channels, Classification of flows, most economical section of channel, Introduction of Compressible Flows

Learning Outcome:

- Understand properties of fluids and classification of flows
- Formulate and solve equations of the control volume for fluid flow systems
- Calculate resistance to flow of incompressible fluids through closed conduits and over surfaces
- Apply fundamentals of compressible fluid flows to relevant systems

References:

1. Cengel, Yunus A. *Fluid Mechanics. 2008,*New Delhi: Tata McGraw Hill. Print.
2. Modi, P.N. and Seth, S.M. *Hydraulics and Fluid Mechanics.* New Delhi, 2011: Standard Book House. Print.
3. Shames I.H. *Mechanics of Fluid*. New Delhi, 2007, 4th edition. McGraw Hill. Print.

4. Fox, R.W. and McDonald, A.T., *Introduction to Fluid Mechanics*. John Wiley and Sons, 2015. Print.
5. Streeter, V.L. Wylie E. B. and Bedford, K.W., *Fluid Mechanics*. New Delhi, 1998: McGraw Hill Book. Print.
6. Bansal, R.K. *Fluid Mechanics and Hydraulic Machines.* New Delhi, 2015: Laxmi publication Pvt. Ltd. Print.
7. White, F. M., *Viscous Fluid Flow*. New Delhi, Tata McGraw Hill: 2011Print.
8. Bansal, R.K. *Hydraulic machines.* New Delhi: Laxmi publication Pvt. Ltd, 2015. Print.
9. http://nptel.ac.in/courses/112104118/

Syllabus: Batch 2020 Onwards

Course Title: Design of Machine Elements

Course Code: MEC307A

L	T	P	Credits
3	0	2	4

Course Objectives:

- To learn fundamentals approaches to failure prevention for static and repeated loading.
- To consider the design of common machine elements such as gear, bearing, clutch etc.
- To learn the design of riveted and welded joints

Unit-A

Design Philosophy (6 Hrs.)

Basic concept of design in general, concept of machine design and its types, basic procedure of machine design, basic requirements of machine elements, design of machine elements, concept of concurrent engineering, modes of failure, factor of safety, fracture mechanics, concept of fatigue and endurance strength.

Riveted Joint (4 Hrs.)

Introduction, types of riveted joint, modes of failure of a riveted joint, strength and efficiency of a riveted joint, design of various types of riveted joints under different static loading conditions,

Unit-B

Welded joint (3 Hrs.)

Concept of welding and its types, types of welding joints, Design of welded joints for various loading conditions in torsion, shear or direct loads, eccentrically loaded joints.

Cotter & Knuckle Joints (3 Hrs.)

Design of spigot and socket cotter joint, sleeve and cotter joint, Gib& cotter joint and knuckle joint

Keys & Coupling (3 Hrs.)

Design of keys-Flat, Kennedy keys, splines, coupling design – rigid and flexible couplings

Unit-C

Design of Shaft (3 Hrs.)

Design considerations for shaft, Design based on Strength, Design based on Stiffness, bending and torsion combined.

Syllabus: Batch 2020 Onwards

Belt Rope and Chain Drives (4 Hrs.)

Introduction, Selection of belt, Design of Flat, V-belt and rope (steel wire), design of pulley for the same, design of chain drives with sprockets.

Clutches &Brakes (5 Hrs.)

Various types of clutches in use, Design of friction clutches, single, multidisc, cone & Centrifugal, Torque transmitting capacity. Various types of Brakes, Self-energizing condition of brakes, Design of shoe brakes – Internal & external expanding, band brakes.

Unit-D

Design of Gears (5 Hrs.)

Classification, Selection of gears, Terminology of gears, Force analysis, Selection of material for gears, Beam & wear strength of gear tooth, Form or Lewis factor for gear tooth, Dynamic load on gear teeth –Barth equation and Buckingham equation and their comparison, Design of spur, helical, bevel & worm gear including the Consideration for maximum power transmitting capacity, Gear Lubrication, Design Problems.

Bearings (6 Hrs.)

design of pivot and collar bearing , Selection of ball and roller bearing based on static and dynamic load carrying capacity using load-life relationship, Selection of Bearings from manufacturer's catalogue, Design of journal bearings using Raimondi and Boyd's Charts, Lubrication, Design Problems.

Note: Design data book is allowed in Examination.

Learning Outcomes:

- Students will be able to design a mechanical system with special focus on power transmission.
- Indentify various failures and resisting areas of machine elements.
- Design of machine elements subjected to combined loading.

References:

1. Shigley J.E. *Mechanical Engineering Design.* New York: McGraw Hill. 2008. Print.
2. Kulkarni, S.G. *Machine Design*. New Delhi: Tata McGraw Hill Education, 2008. Print.
3. Dieter, George E. and Schmidt L.C. *Engineering design*. New York: McGraw Hill, 2009. Print.
4. Chitale, A.K. and Gupta, R.C. *Product Design and Manufacturing.* New Delhi:PHI Learning Pvt. Ltd. 2013. Print.

5. Bhandari, V.B. *Design of Machine Elements.* New Delhi: McGraw Hill Education, 2014. Print.
6. Jindal, U.C. *Machine Design*, New Delhi: Pearson, 2010. Print.
7. http://nptel.ac.in/courses/112105125

Syllabus: Batch 2020 Onwards

Title: Non-Conventional Machining Processes

Course Code: MEC308B

L	T	P	Credits
3	0	0	3

Course Objectives:

- To know and identify different non-conventional manufacturing processes for manufacturing different Components.

Unit-A

Introduction (3 Hrs.)

Trends in Manufacturing, concept of Flexible manufacturing system, Limitations of conventional machining processes, Need of non-conventional machining processes, their classification, advantages and major applications

Mechanical process (6 Hrs.)

Introduction, Process principle, Material removal mechanism, Parametric analysis and applications of processes viz. ultrasonic machining (USM), Abrasive flow machining (AFM), Water jet machining (WJM)

Unit-B

Electrochemical process (6 Hrs.)

Principle of operation, elements and applications of Electrochemical Machining, Electrochemical grinding, Electrochemical honing, Electrochemical deburring, Chemical Machining, Photochemical machining.

Hybrid Machining Processes (4 Hrs.)

Concept, classification, application, Advantages

Unit-C

Thermal Process (8 Hrs.)

Electrical discharge machining, mechanism of metal removal, Generators & feed control, dielectric fluid flushing, selection of electrode material, application, Plasma Arc Machining, mechanism of metal removal, PAM parameters, types of torches, accuracy and surface finish, economics and application of plasma jets, plasma arc spraying. Laser Beam machining: Principles of working, thermal aspect, material removal, cutting speed and accuracy, advantages & limitations. Electro-beam machining: generation and control of electron beam, theory of electron beam, process capability and limitations.Hot machining- method of heat, Applications and limitations.

Syllabus: Batch 2020 Onwards

Unit-D

Advanced Metal Forming Processes (6 Hrs.)

Details of high energy rate forming (HERF) process, Electro-magnetic forming, Explosive forming, Electro-hydraulic forming, Stretch forming, Contour roll forming.

Additive Manufacturing (6 Hrs.)

Rapid prototyping: Stereo lithography, Fused Deposition Modelling, Selective laser sintering, solid based curing, 3 D printing and laminated object manufacturing.

Learning Outcomes:

- Students should have the ability to understand the importance of the non-conventional machining processes.
- Student can select suitable manufacturing processes to fabricate an engineering product.

References:

1. Shan, H. S. *Modern Machining Processes* .New Delhi: Tata McGraw Hill Publishing Co., 2002. Print.
2. Rao, P. N. *Manufacturing Technology.* New Delhi: Tata McGraw Hill Publishing Company, 2000. Print.
3. Jain, Serope, Kalpak. *Manufacturing engineering and Technology.* Addison Wesley Publishing Co., 1995. Print.
4. Ghosh, Amitabh. *Manufacturing Processes*. New Delhi: Tata McGraw Hill Publishing Co., 2001. Print.
5. Jain, V.K. *Advanced Machining Processes*. New Delhi: Allied Publishers, 2009. Print.
6. http://nptel.ac.in/courses/112107078/

Syllabus: Batch 2020 Onwards

L	T	P	Credits
3	0	0	3

Course Title: Industrial Engineering

Course Code: MEC309B

Course Objective:

- To conduct time and motion study to improve the methods/system
- To impart the valuable skills to plan and understand concepts of material management

Unit-A

Introduction (6Hrs)

Definition and Significance of Industrial Engineering, Organization Structure of IE, Function and Qualities of an Industrial Engineer in industry, Techniques of Industrial Engineering.

Work-study (6Hrs)

Introduction, History, Scope and Objectives of Work Study, Areas of application of work study in industry; Productivity and Work study, Work Study: A Tool to increase Productivity, Steps to Increase productivity through Work Study

Unit-B

Method Study (6Hrs)

Introduction, Objectives, Procedure of Method Study: Select, Record, Examine, Develop, Define, Install and Maintain, Recording Techniques: Charts, Diagrams, Motion and Film Analysis, Models and Tempelets, Principles of Motion economy

Work Measurement (6Hrs)

Introduction, Objectives, Work measurement techniques, Time study, Time Study Procedure, Determination of time standards, Observed time, Basic time, Normal time and Standard time, Performance Rating and Methods, Allowances, Pre-determined motion time standards (PMTS)

Unit-C

Value Engineering & Value Analysis (4Hrs)

Definition and Concept of VE, Distinction between VE and Cost reduction, Distinction between VE and VA, Reasons of Poor Values, Phases of VE Studies, Techniques of VE, Application &Benefits of VE, Concurrent engineering.

Material Management (8Hrs)

Functions of material management, Advantages, Objectives**Inventory**: Introduction, Significance, Objectives, Functions, Factors Affecting Inventory, Classification (Purchase Manager, Quantities and Measurement, Manufacturer, Large Scale Industry, Store Manager), Classification by Store Manager, Inventory Costs, Concept of EOQ, Limitations of EOQ

Unit-D

Syllabus: Batch 2020 Onwards

Ergonomics (12Hrs)

Introduction, Meaning of Ergonomics, Objectives of Ergonomics, Work Science (Technique of work, Organization of Work), Design Factors, Workplace Design, Effects of Environment (Noise, Thermal Comfort, Lighting), Man Machine System, Workloads (Heavy Load, Light Work, Repetitive Work, Non Repetitive Work), Fatigue, Rules and Regulations to Encounter Fatigue, Adverse effects of fatigue. Job evaluation, incentive schemes, and wage administration.

Learning Outcomes:

- Students will be able to know about various work study techniques.
- Student will able to know about how to increase the value of the product.
- Students will able to know about the various inventory control techniques.
- Students will able to know importance of ergonomics in industrial engineering.

References:

1. Bansal, V.B. *Industrial Engineering and Production Management.* New Delhi: Kapson Publishers. 2015. Print.
2. Raju, N.V.S. *Industrial Engineering and Management*. New Delhi: Cengage Learning. 2013. Print.
3. Chunawala. *Production and Operation Management.* New Delhi: Himalaya Publication. 2013. Print.
4. Dalela, and Ali, Mansoor. *Industrial Engineering and Management Systems*. New Delhi: Standard Publishing Distributors. 2010. Print.
5. Hicks. *Industrial Engineering & Management-A new perspective*. New Delhi: Tata McGraw Hill. 2014. Print.
6. Shankar, Ravi. *Industrial Engineering and Management*. New Delhi: Galgotia Publishers. 2010. Print.
7. Jain and Agarwal. *Production Planning & Control.* New Delhi: Khanna Publishers. 2013. Print.
8. Verma, A.P. *Industrial Engineering and Management*. New Delhi: Katson Books. 2010. Print.
9. http://nptel.ac.in/courses/112107142/

Syllabus: Batch 2020 Onwards

Course Title: **Industrial Engineering Lab**

Course Code: MEC310

L	T	P	Credits
0	0	2	1

Course Objective:

The objectives of the course are

1. To develop the understanding of basic concepts of various plant layouts and suggest improvements in existing Machine Shop Layout.
2. To analyze the requirements of a newly established industry and draw its basic organization structure.
3. To develop the basic understanding of Inventory Control Management through case study on ABC/VED analysis.
4. To develop the complete understanding of organization structure of purchase department and analyze various purchase procedure.
5. To draw a Flow Process Chart and understand its concept, importance and applications.

COURSE CONTENT:

1. To study various plant layouts and suggest improvements in existing Machine shop Layout.
2. To study and draw organization structure of newly established industry.
3. To draw a Flow Process Chart with time estimates for a simple welding process.
4. To improve the assembly and dis-assembly of a Bolt and Nut.
5. Exercise on string chart by taking real time problem.
6. Stop watch time study on drilling machine and lathe machine.
7. Exercise on time study in athletic ground for 4*100 m relay.
8. A case study on ABC/VED analysis.
9. To study various purchase procedures of purchase department.
10. To measure the ambience noise and to check the noise dose of an individual in industrial noisy environment using sound level meter and noise dosimeter.

Learning Outcomes:

After passing the course, students will be able to:

1. Develop the understanding of basic concepts of various plant layouts and suggest improvements in existing Machine Shop Layout.
2. Analyze the requirements of a newly established industry and draw its basic organization structure.

3. Develop the basic understanding of Inventory Control Management through case study on ABC/VED analysis.
4. Develop the complete understanding of organization structure of purchase department and analyze various purchase procedure.
5. Draw a Flow Process Chart and understand its concept, importance and applications.

References:

1. Bansal, V.B. *Industrial Engineering and Production Management.* New Delhi: Kapson Publishers. 2015. Print.
2. Raju, N.V.S. *Industrial Engineering and Management*. New Delhi: Cengage Learning. 2013. Print.
3. Chunawala. *Production and Operation Management.* New Delhi: Himalaya Publication. 2013. Print.
4. Dalela, and Ali, Mansoor. *Industrial Engineering and Management Systems*. New Delhi: Standard Publishing Distributors. 2010. Print.
5. Hicks. *Industrial Engineering & Management-A new perspective*. New Delhi: Tata McGraw Hill. 2014. Print.
6. Shankar, Ravi. *Industrial Engineering and Management*. New Delhi: Galgotia Publishers. 2010. Print.
7. Jain and Agarwal. *Production Planning & Control.* New Delhi: Khanna Publishers. 2013. Print.
8. Verma, A.P. *Industrial Engineering and Management*. New Delhi: Katson Books. 2010. Print.
9. http://nptel.ac.in/courses/112107142/

Syllabus: Batch 2020 Onwards

Course Title: Mechanics of Fluid Lab

Course Code: MEC311

L	T	P	Credits
0	0	2	1

List of Experiments:

1) To Find Coefficient of Discharge of Venturimeter and Orifice Meter.
2) To Find Coefficient of Discharge of Pitot Tube
3) To Find Cd, Cv& Cc of an Orifice
4) To Find Friction Factor of Pipes of Different material & Diameter.
5) To Find Minor Losses with Sudden Enlargement & Contraction.
6) To Find Metacentric Height of Floating Vessel.
7) To Find Reynolds Number.
8) To Find Coefficient of Discharge of Different Notches.
9) To Prove Bernoulli's Theorem.
10) To study Free & Forced Vertex.
11) Experiment on Laminar & Turbulent Flow
12) To determine critical Reynolds' numbers for flow through commercial pipes.
13) To study development of boundary layer over a flat plate.

Syllabus: Batch 2020 Onwards

Course Title: Heat Transfer Lab

Course Code: MEC313

L	T	P	Credits
0	0	2	1

List of Experiments:

1. To determine the thermal conductivity of a metallic rod
2. To determine the thermal conductivity of an insulating powder.
3. To determine the thermal conductivity of a solid by the guarded hot plate method.
4. To find the effectiveness of a pin fin in a rectangular duct natural convective condition and plot temperature distribution along its length.
5. To find the effectiveness of a pin fin in a rectangular duct under forced convective and plot temperature distribution along its length.
6. To determine the surface heat transfer coefficient for a heated vertical tube under natural convection and plot the variation of local heat transfer coefficient along the length of the tube. Also compare the results with those of the correlation.
7. To determine average heat transfer coefficient for a externally heated horizontal pipe under forced convection & plot Reynolds and Nusselt numbers along the length of pipe. Also compare the results with those of the correlations.
8. To measure the emissivity of the gray body (plate) at different temperature and plot the variation of emissivity with surface temperature.
9. To find overall heat transfer coefficient and effectiveness of a heat exchange under parallel and counter flow conditions. Also plot the temperature distribution in both the cases along the length of heat of heat exchanger.
10. To verify the Stefan-Boltzmann constant for thermal radiation.
11. To demonstrate the super thermal conducting heat pipe and compare its working with that of the best conductor i.e. copper pipe. Also plot temperature variation along the length with time or three pipes

Syllabus: Batch 2020 Onwards

Course Title: Professional Communication

Course Code: ENG352

L	T	P	Credits
3	0	0	3

Course Objective:

This paper, with a practice-oriented approach, aims to hone students' skills in the major dimensions of professional communication.

Unit-1

- Professional Communication: Technical Communication and Business Communication
- Verbal and Non-Verbal Communication
- Barriers to Communication

(**N.B.**As the topics are largely theoretical, teacher shall introduce the topics inclassroom in the form of lectures and encourage students to read on their own from the reference books. All these topics will be supported by examples from real life situations.)

Unit-2

- Reading Skills:Active & Passive Reading, Reading strategies, and Developing a Good Reading Speed
- Listening Skills: Types of Listening & Effective Listening Strategies
- Speaking Skills: Basics in Phonetics
- Writing Skills: Topic Sentence and Paragraph (descriptive, narrative, expository, and persuasive)

(**N.B.**Teacher will encourage students to apply the theoretical knowledge while practicing the four skills. Opportunities to practice the language skills should be created for students in the classroom.)

Unit-3

- Conversation: Formal and Informal
- Panel Discussion and Group Discussion
- Oral Presentation

(N.B. Teacher will give supporting examples from the industry and encourage students to do relevant exercises.)

Unit-4

- C.V. and Cover Letter
- Interview Skills
- Professional Letters

- Report Writing and Memo

(N.B. Teacher will give supporting examples from the industry and encourage students to do relevant exercises.)

Learning Outcome: Students will show adequate understanding of professional communication skills.

References:

1. Crystal, David. *The Gift of the Gab – How Eloquence Works*. Connecticut: Yale University, 2016. Print.
2. Gangal, J. K. *A Practical Course in Spoken English*. India: Phi Private Limited, 2012. Print.
3. Hosler, Mary Margaret. *English Made Easy*. Delhi: McGraw, 2013. Print.
4. Koneru, Aruna. *Professional Communication*. Delhi: McGraw, 2008. Print.
5. Mahanand, Anand. *English for Academic and Professional Skills*. Delhi: McGraw, 2013. Print.
6. Rani, D Sudha, TVS Reddy, D Ravi, and AS Jyotsna. *A Workbook on English Grammar and Composition*. Delhi: McGraw, 2016. Print.
7. Rizvi, M. Ashraf. *Effective Technical Communication*. Delhi: McGraw, 2018. Print.
8. Sharma, R.C. and Krishna Mohan. *Business Correspondence and Report Writing*. Delhi: McGraw, 2013. Print.
9. Suzana, Roopa. *A Practical Course in English Pronunciation*. Delhi: McGraw Hill Education, 2017. Print.
10. Tyagi, Kavita and Padma Misra. *Basic Technical Communication*. Delhi: PHI Learning, 2013. Print.

Websites

1. www.youtube.com (to watch standard videos)
2. http://learnenglish.britishcouncil.org/en
3. https://owl.english.purdue.edu/

Syllabus: Batch 2020 Onwards

Course Title: Optimization Techniques

Course Code: MEC358A

L	T	P	Credits
3	1	0	4

Course Objectives:

- To learn about the basic concepts of optimization techniques.
- To learn methods to find out basic feasible solution of a problem.
- To learn optimum utilization of resources through different operations research models.

Unit-A

Introduction: (5 Hrs.)

Origin of OR and its role in solving industrial problems. General approach for solving or problems, Classification of mathematical models, various decision making environments

Linear Programming: (8 Hrs.)

Formulation of linear mathematical models: Graphical and simple x techniques for solution of linear programming problems, Big M method and two phase method, Introduction to duality theory and sensitivity analysis.

Unit-B

Transportation and Assignment Models: (7 Hrs.)

Various initial basic feasible solutions methods, Optimization of transportation and assignment using different methods considering the concept of time and cost function

Dynamic Programming: (6 Hrs.)

Introduction to deterministic and probabilistic dynamic programming

Sequencing Models: Processing n jobs through two machines, processing n jobs through three machines, processing two jobs through m machines, processing n jobs through m machines, Travelling salesman problem. **(6 Hrs.)**

Unit-C

Network models: (8 Hrs.)

Shortest route and travelling sales - man problems, PERT &CPM introduction, analysis of time bound project situations, construction of networks, identification of critical path, slack and float, crashing of network for cost reduction

Queuing Theory: (7 Hrs.)

Types of queuing situation: Queuing models with Poisson's input and exponential service, their application to simple situations.

Inventory Control: Purchase model with instantaneous replenishment and with and without shortages, manufacturing model with and without shortages, Quantity discount. **(6 Hrs.)**

Syllabus: Batch 2020 Onwards

Unit-D

Replacement Models: (9 Hrs.)

Replacement of items that deteriorate, Replacement of items whose maintenance and repair costs increase with time, replacement of items that fail suddenly; replacement of items whose maintenance costs increase with time and value of money also changes, individual replacement policy, group replacement policy.

Optimization Techniques: **(6 Hrs.)**

Introduction, Theory and algorithms, classical method, non-linear optimization- Unconstrained optimization, constrained optimization: Langrangian multiplier method.

Course Outcome:

- Students will learn graphical and analytical methods to find out basic feasible solution of the problem.
- They will learn to formulate their practical problem into linear equations.
- They will be able to tackle with traffic related problems by applying queuing model.
- They will be able to predict the project completion time and cost of project.

References:

1. Wagner, H.M. *Principles of Operations Research*. Prentice Hall. Print.
2. Gupta, P.K. and Hira, D.S. *Operations Research*. New Delhi: S. Chand & Co. Print.
3. Hiller, F.S. and Libermann, G.I. *Introduction to Operation Research*. Holden Ray. Print.
4. Wiest and Levy. *A Management Guide to PERT/CPM*. Prentice Hall. Print.
5. Ackoff and Saseini. *Fundamental of Operations Research*. Wiley Eastern. Print.

Syllabus: Batch 2020 Onwards

L	T	P	Credits
3	0	0	3

Course Title: Automobile Engineering

Course Code: MEC359

Course Objectives:

- To aware the students about a method of ignition system and its characteristics.
- To familiarize the students with methods of power transmission from engine to wheel.
- To familiarize students with different steering, lubrication. Braking system adopted in automobile.

Unit-A

Introduction (5 Hrs.) Basic structure, general layout and type of automotive vehicles, Frameless and unitary Construction; position of power unit, front wheel front drive, front wheel rear drive, rear wheel rear drive and four wheel drive.

Ignition System (4 Hrs.)

Battery ignition system, Magnetic ignition system, Ignition advance methods, Electronic Ignition, Distributer less ignition system (DIS), CDI (capacitor discharge ignition system), TIS (transistor ignition system)

Unit-B

Chassis and Suspension (4 Hrs.)

Loads on the frame, considerations of strength and stiffness, engine mounting, ridged and independent Suspension systems (Mac-Pherson, wishbone, double wishbone, trailing link), shock absorbers and stabilizers and torsion bar

Transmission system (5 Hrs.)

Basic requirements and standard transmission systems; Clutch: various types of clutch; Gear Box: various types of gear box, Principle of Automatic Transmission, CVT (continuously variable transmission), Differential, LSD (limited slip differential), CVT (constant velocity transmission axle), overdrives, propeller shaft and Universal joint

Engine Parts (4 Hrs.)

Cylinder block, cylinder head, crank case, oil pan, cylinder liners, piston, piston rings, connecting rods, crank shaft, valves, valve actuating mechanism, valves layout, materials used, valve and port timing diagrams.

Unit-C

Braking System (5 Hrs.) General braking requirements, mechanical, hydraulic, vacuum, power brake, servo mechanism and ABS, shoe and disc brakes.

Syllabus: Batch 2020 Onwards

Steering System **(5 Hrs.)**

Requirement and steering geometry; castor action, camber and king pin angle, toe-in of front wheels, steering linkages and steering gears; wheel alignment; power steering, Ball re-circulating mechanism

Unit-D

Lubrication & Cooling System **(5 Hrs.)**

Need of lubrication; Desirable properties of lubricants; various types of lubricants and oil additives; systems of lubrication - oil filters, oil pumps and oil pressure indicator; crank case ventilation and dilution. Purpose of cooling, air and water cooling systems; radiator, thermostat, pump and fan

Maintenance **(5 Hrs.)**

Preventive maintenance, trouble shooting and rectification in different systems; engine tuning and servicing, major tools used for maintenance of automobiles, future trends in automobile, safety consideration.

Learning Outcomes:

- Students will be able to clear understanding of how the vehicle steering, braking, cooling system works
- Students will have a clear idea about the selection of gear box for appropriate vehicle
- Students will be able to clear understanding of how suspension system works and its selection

References:

1. Crouse, W.H. *Automotive mechanics*. New Delhi: McGraw Hill. 2007. Print.

2. Heitner, J. *Automotive Mechanics*. New Delhi: East West Press. 2006. Print.

3. Singh, Kirpal. *Automobile Engineering.* New Delhi: Vol. I and II, Standard Publishers. 2012. Print.

4. Ramakrishna, K. *Automobile Engineering.* New Delhi: PHI Learning Pvt. Ltd. 2012. Print.

5. Gill, P.S. *Automobile Engineering*. New Delhi: S.K Kataria. 2011. Print.

Syllabus: Batch 2020 Onwards

Course Title: Fluid Machinery

Course Code: MEC360A

L	T	P	Credits
3	1	0	4

Course Objectives:

- To study the Turbines performance characteristic curves and familiar with Hydropower station.
- To study the pumps operating and main characteristic curves and familiar with pump station.
- To study the fluid machines and fluid power.

Unit-A

Impact of Free Jets: (6 Hrs.)

Impulse momentum principle, Force exerted by the jet on stationary flat and curved plate, hinged plate, Moving plate and Moving curve vanes, velocity diagrams, work done and efficiency, flow over radial vanes, Jet propulsion of ship.

Introduction to turbo machinery: (6Hrs.)

Basic principles, Classification, Impulse & Reaction type, Fundamental equations, Euler's equation, Introduction to hydro-electric power plants, major components, Surge tanks etc.

Unit-B

Impulse Turbine: (4 Hrs.)

Classification of turbine, Impulse turbine, Pelton wheel, Construction and working, work done, Head efficiency and Design aspects, governing of impulse turbine.

Reaction Turbine: (6 Hrs.)

Radial flow reaction turbine, Francis turbine: construction, working, work done, efficiency, design aspect, advantages & disadvantages over pelton wheel.

Axial flow reaction turbine: (6 Hrs.)

Propeller and Kaplan turbine, Bulb or tubular turbine, Draft tube, Specific speed, Unit quantities, Cavitation, Degree of reaction, Performance characteristics, Surge tanks, Governing of reaction turbine.

Unit-C

Centrifugal Pumps: (8 Hrs.)

Classification of Pumps, Construction, working, Work done, Heads, Efficiencies, Multistage centrifugal pump, Pump in series and parallel, Specific speed, model testing of pumps, Characteristic curves, Minimum starting speed, Net positive suction head, Cavitation.

Syllabus: Batch 2020 Onwards

Reciprocating Pumps: (6 Hrs.)

Classification, Construction and working, types of reciprocating pumps, work done and power required, Coefficient of discharge, effect of acceleration of piston on velocity and pressure in the suction and delivery pipes, Indicator diagram, slip, air vessels, and characteristics curves of reciprocating pump.

Unit-D

Fluid system: (10 Hrs.)

Hydraulic accumulator, Hydraulic intensifier, Hydraulic Press, Hydraulic crane, Hydraulic lift, Hydraulic Ram, Hydraulic coupling, Hydraulic torque converter, Air lift pump, fluid coupling, Jet pump.

Learning Outcome:

- Understand the working of impulse and reaction turbines and performance characteristics curves
- Familiar with Hydropower station and enhance the technical skills about the selection of fluid machines.

References:

1. White, F. M. *Viscous Fluid Flow*, 2011 McGraw Hill.Print
2. Som, S.K. and Biswas, G. *Introduction to Fluid Mechanics and Fluid Machines*. New Delhi, 2015: Tata McGraw Hill.Print.
3. Cengel, Younus. *Fluid Mechanics*, New Delhi, 2008: Tata McGraw Hill. Print.
4. Vasandhani, V.P. *Hydraulic Machines: Theory & Design*. New Delhi, 2015: Khanna Publication. Print.
5. Rajput, R. K. *Hydraulic Machines*, New Delhi: S. Chand & co Ltd, 2011.Print.
6. Modi, P.N. and Seth S.M. *Hydraulics & Fluid Mechanics*. New Delhi, 2011: Standard Book House. Print.
7. Bansal, R.K. *Fluid Mechanics and Hydraulic machines*. New Delhi, 2015: Laxmi publication Pvt.Ltd.Print.
8. http://nptel.ac.in/courses/112104117/

Syllabus: Batch 2020 Onwards

Course Title: Fluid Machinery Lab

Course Code: MEC361

L	T	P	Credits
0	0	2	1

List of Experiments:

1. To study the performance characteristics of Pelton turbine and draw constant head, constant speed and constant efficiency curves.
2. To draw the constant head, constant speed and constant efficiency performance characteristics of Francis turbine.
3. To draw the constant head, speed and efficiency curves for a Kaplan turbine.
4. To study the constructional details of a Centrifugal Pump and draw its characteristic curves.
5. To study the constructional details of a Reciprocating Pump and draw its characteristics curves.
6. To study the construction details of a Gear oil pump and its performance curves.
7. To study the constructional details of a Hydraulic Ram and determine its various efficiencies.
8. To study the model of Hydro power plant and draw its layout.
9. Study and perform test on a Torque Convertor.

Syllabus: Batch 2020 Onwards

Course Title: Automobile Engineering Lab

Course Code: MEC363

L	T	P	Credits
0	0	2	1

List of Experiments:

1. To study the constructional details, working principles and operation of Carburettors, Multi-Point Fuel Injection system and Common Rail Direct Injection System.
2. To study the constructional details, working principles and operation of different Ignition Systems.
3. To study the constructional details, working principles and operation of the Engine Cooling & Lubricating Systems.
4. To study the constructional details, working principles and operation of the Hydraulic & Pneumatic Brake systems.
5. To study the constructional details, working principles and operation of the Drum Brake System, Disk Brake System and Antilock Brake System.
6. To study the constructional details, working principles and operation of Front Suspension System and Rear Suspension System.
7. Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance.
8. To study the constructional details, working principles and operation of single plate &Multi-Plate Clutch.
9. To study the constructional details, working principles and operation of Differential.

Syllabus: Batch 2020 Onwards

Course Title: Numerical Methods

Paper Code: MTH256A

L	T	P	Credits
3	0	0	3

Course Objectives

The aim of this course is to teach the applications of various numerical techniques for a variety of problems occurring in daily life. At the end of the course, the students will be able to understand the basic concepts in Numerical Analysis of differential equations.

Unit-A **(15 Hrs.)**

Approximate numbers, Significant figures, rounding off numbers, Error Absolute, Relative and percentage

Non-Linear Equations: Bisection, Regula-Falsi, Secant, Newton-Raphson, General Iteration Method. Rate of convergence

Unit-B **(14 Hrs.)**

Systems of Simultaneous Linear Equations: Direct methods: Gauss elimination method, Gauss Jordon method, Matrix inversion method; Iterative methods: Jacobi method and Gauss-Seidel method, Power method for finding largest Eigen value.

Unit-C **(13 Hrs.)**

Operators: Forward, Backward and Shift (Definitions and some relations among them).

Newton forward and backward, Gauss backward and forward interpolation, Stirling formula, Bessel formula, Lagrange's interpolation, Hermite Interpolation, Newton divided difference Interpolation. Numerical Differentiation, Maximum and Minimum values of a tabulated function.

Unit-D **(14 Hrs.)**

Numerical Integration: General Quadrature formula, Trapezoidal Rule, Simpson's 1/3-Rule, Simpson's 3/8-Rule, Boole's rule, Weddle's Rule.

Numerical solutions to first order ordinary differential equations: Taylor's Series method, Picard's Method, Euler's and modified Euler's methods, Runge-Kutta methods

References:

1. Jain, M.K. *Numerical Analysis for Scientists and Engineers*. New Delhi: S.B.W. Publishers, 1971.Print.
2. Grewal, B.S.*Numerical Methods in Engineering & Science With Programs In C& C++.* New Delhi: Khanna Publishers, 2012.Print.

3. Golub, G.H.and Ortega, J.M. *Scientific Computing and Differential Equations: An Introduction to Numerical Methods*. London: Academic Press, 1992.Print.
4. John, H. Mathews and Kurtis, D. Fink, *Numerical Methods using Matlab*, 4th Ed., PHI Learning Private Limited, 2012. Print.
5. Moler, Cleve B., *Numerical Computing with MATLAB*. MathWorks Store.

Syllabus: Batch 2020 Onwards

Course Name: Maintenance and Reliability

Course Code: MEC451

L	T	P	Credits
3	0	0	3

Course Objectives:

- To develop your ability in formulating suitable maintenance strategies to achieve reliable a manufacturing system.
- To empower you with the skills to manage a manufacturing system to achieve continuous system availability for production.
- To equip you with essential system diagnosis techniques so that you can identify and take appropriate actions on error symptoms and causes of failures.

Unit-A

Maintenance Management (4 Hrs.)

Introduction, Objectives of maintenance and plant engineering, State of plant, Functions and responsibilities of plant engineering, total productive maintenance

Maintenance Planning (6 Hrs.)

Introduction, planning function in maintenance, Organising plant engineering and maintenance, Staffing in plant engineering, Directing in plant engineering, Coordinating by plant engineering and management, Interface between plant engineer and management and other departments

Unit-B

Maintenance Strategies (6 Hrs.)

Introduction, Maintenance strategies (FBM, Contractual maintenance, RCM, TBM, CBM, TPM), Factors influencing the selection of maintenance policy, Maintenance strategy- formulation, Maintenance procedure and their selection, characteristics of maintenance strategy, Top down – Bottom up approach.

Maintenance Scheduling (6 Hrs.)

Introduction, Maintenance scheduling and its importance, Scheduling strategies in maintenance, Scheduling policies in maintenance, Scheduling by sequencingtechniques, Scheduling procedure for breakdown maintenance,Scheduling procedure for preventive maintenance, check sheets, Scheduling formats.

Unit-C

Reliability Oriented Maintenance Systems and Evaluation (10 Hrs.)

Introduction, Identification of problem and data collection, Procedure of reliability cantered maintenance modelling and analysis, Reliability improvement, Reliability Systems, Modular

design, Difference between Quality and Reliability, Definitions and terms used in Reliability calculations, Availability, Maintainability, Overall equipment effectiveness.

Unit-D

Failure Mode, Effect and Critically Analysis (10 Hrs.)

Introduction, FMECA- Outline and Jargon, Elements of FMECA, Basic information required for FMECA, Basic analysis procedure for FMECA, Environmental influence, FMECA Planning, Block diagrams, Severity classification, Failure models by FMECA, Process FMEA, Design FMEA, Comparison between Process and Design FEMA, Applications and Merits of FMEA/FMECA

Learning Outcome:

- Understand the relationship of key concepts in reliability engineering and application to maintenance strategies in a manufacturing environment
- Establish maintenance strategies according to system characteristics and design transition programs to implement these strategies.
- Manage the manufacturing organisation with highest possible availability.

Reference Books:

1. Raju N.V.S, *Plant Maintenance and Reliability*.Cengage. 2014. Print.
2. Manna, A. *A Textbook of Reliability and Maintenance Engineering*, I. K. Publication. 2011. Print.
3. Lewis, E.E. J. *Introduction to Reliability Engineering.* Wiley & Sons, 2015 reprint.
4. Mishra, R.C. and Pathak K. *Maintenance Engineering and Management*, 2nd Edition, 2013, PHI. Print.
5. http://nptel.ac.in/courses/105108128/

Syllabus: Batch 2020 Onwards

Course Title: Robotics and Automation

Course Code: MEC461B

L	T	P	Credits
3	0	0	3

Course Objectives:

- To impart knowledge about the basic concepts of automation.
- To know the concepts ofthe fluid power and various control valves.
- To give understanding about the robotics and its programming.

Unit-A

Introduction to Robotic (6Hrs.)

Introduction, terminology, laws of robotics, classification based on geometry, machine vision, robot components, degree of freedom, coordinators, reference frames,

Robot Sensors and End Effectors (8Hrs.)

Types of Sensors in robots, exteroceptors, proprioceptors, tactile, proximity, range, velocity and machine vision sensors, robot end-effectors, classification, gripper, gripper mechanism, type of gripper.

Unit-B

Robot Programming (8Hrs.)

Robot programming, techniques of programming, robot languages, requirement for a standard robot language, types of languages.

Industrial applications (6Hrs.)

Applications of robots in welding, machine loading, fabrication, spray painting, assembly and unusual applications.

Unit-C

Industrial Automation (5Hrs.)

Basic principles of automation; Hard Automation, Flexible Automation, Low Cost Automation Elements of Automation

Fluid Power (9Hrs.)

Fluid power control elements, Construction and performance of fluid power generators; Hydraulic and pneumatic cylinders - construction, design and mounting; Hydraulic and pneumatic valves for pressure, flow and direction control.

Unit-D

Logic Circuits (8Hrs.)

Design of pneumatic logic circuits for a given time displacement diagram or sequence of operations

Fluidics (6Hrs.)

Syllabus: Batch 2020 Onwards

Boolean algebra; Truth tables; Conda effect; Fluidic elements – their construction working and performance characteristics

Learning Outcome:

- Students will learn about the basic concepts of automation.
- Students will learn about the fluid power and various control valves.
- Students will learn about the robotics, about the robotics and its programming.

References:

1. Deb, S.R. *Robotics and Flexible Automation*. New Delhi: Tata McGraw-Hill Publishing Company Ltd. 2010. Print.
2. Majumdar, S.R. *Pneumatic Systems.* New Delhi: Tata McGraw-Hill Publishing Company Ltd. Sixteenth reprint 2006. Print.
3. Asfahl, C.R. *Robotics and Manufacturing Automation.* Wiley India. 1992. Print.
4. Niku, S.B. *Introduction to Robotic Analysis systems and applications.* Wiley India. 2001. Print.
5. http://nptel.ac.in/courses/112101098/
6. http://nptel.ac.in/courses/112102011/

Syllabus: Batch 2020 Onwards

Course Title: Robotics and Automation Lab

Course Code: MEC471

L	T	P	Credits
0	0	2	1

List of Experiments:

1. Study of robotic arm and its configuration
2. Study the robotic end effectors
3. Study of different types of hydraulic and pneumatic valves
4. Study of reciprocating movement of double acting cylinder using pneumatic direction control valves
5. Use of direction control valve and pressure control valves clamping devices for jig and fixture
6. Design and assembly of meter in and out circuits.
7. Design and assembly of pneumatic regenerative circuit
8. Design and assembly of pneumatic circuit for sequence operation.

Syllabus: Batch 2020 Onwards

Course Title: Numerical Methods Lab

Course Code: MTH257B

L	T	P	Credits
0	0	2	1

List of Programs:

1. WAP on Basic Operations (Conditional statement If, for loop).
2. WAP on Bisection, False Position and Secant Method.
3. WAP Newton Raphson Method.
4. WAP to solve the system of linear equations using Gauss Elimination Method.
5. WAP to solve the system of linear equations using Gauss Jacobi Method.
6. WAP to solve the system of linear equations using Gauss Seidel Method
7. WAP on Newton interpolation.
8. WAP on Lagrange's Interpolation.
9. WAP on Trapezoidal rule.
10. WAP on Simpson's rules.
11. WAP on Euler's Method.
12. WAP on Runge-Kutta Methods.

Reference Books:

1. Gottfried, S. Byron. *Programming with C*. Delhi: Tata McGraw Hill, 2010. Print.
2. Balagurusamy, E. *Programming in ANSI C*. Delhi: McGrawHill, 2012. Print.
3. Pratap, R. *Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers* Oxford Publications. 2010
4. Hanly R. Jeri, and Elliot B. Koffman. *Problem Solving and Program Design in C*. USA: Addison Wesley, 2013. Print.
5. Kanetker, Yashwant. *Let us C*. Delhi: BPB Publications, 2005. Print.
6. Balagurusamy, E. *Object oriented programming with C++*. Delhi: McGrawHill, 2008. Print.

Syllabus: Batch 2020 Onwards

Course Title: CAD/CAM

Course Code: MEC404

L	T	P	Credits
3	0	0	3

Course Objectives:

- To provide the basic analytical fundamentals those are used to create and manipulate geometric models in a computer program.
- To provide basic knowledge of NC/CNC/DNC systems.
- To familiar the student different aspects of computer aided manufacturing.

Unit-A

Fundamentals of CAD (8 Hrs.)

Introduction, Design Process, Application of computers in design, Creating manufacturing database, benefits of CAD, Software configuration of a graphics system, functions of a graphics package, geometric modeling, Fundamentals of Computer Graphics, Visual realism- hidden line-surface-solid removal algorithms, Product cycle, sequential and concurrent engineering

Geometric Transformations (3 Hrs.)

Mathematics preliminaries, matrix representation of 2 and 3 dimensional transformation, Concatenation of transformation matrices, Application of geometric transformations

Unit-B

Geometric modeling (12 Hrs.)

Need of Geometric Modeling, types of geometric modeling, geometric modeling representation, and geometric modeling techniques and uses, parametric representation of analytical and synthetic curves, parametric representation of surfaces, Coons and bicubic.

Patches, Solid modeling, CSG and Boundary Representation, CAD standards- Graphical Kernel System (GKS), Data exchange standards- IGES, STEP

Unit-C

Numerical Control (7 Hrs.)

Types of NC systems, MCU and other components, NC manual part programming, coordinate systems, G & M codes, Part program for simple parts, computer assisted part programming. Direct numerical control, Adaptive control in machining system, DNC/CNC systems

Group Technology (4 Hrs.)

Part families, part classification and coding system, Group technology machine cells, Advantages of group technology.

Unit-D

Syllabus: Batch 2020 Onwards

Flexible Manufacturing Systems (4 Hrs.)

Introduction, FMS components, types of FMS, FMS layouts, planning for FMS.

Computer Aided Process Planning (4 Hrs.)

Introduction and benefits of CAPP, types of CAPP, Steps in variant process planning, planning for CAPP, machinability data selection systems in CAPP

Learning Outcomes:

- Students will be able to describe the principles of Computer Aided Designing systems and the concepts of Geometric transformations and modelling
- Students will be able to explain the basic concepts of CNC programming and machining.
- Students will able to know about group technology, Flexible Manufacturing Systems and Computer Aided Process Planning.

References:

1. Groover and Zimmer. *CAD/ CAM.* Prentice Hall. Print. 2010.
2. Zeid, I. *CAD/ CAM Theory and Practice.* McGraw Hill. 2009
3. Bedworth, D.D., Henderson, M.R. & Wolfe, P.M. *Computer Integrated Design and Manufacturing*. New Delhi: Tata McGraw Hill. 1991
4. W. M. Neumann and R.F. Sproul, *Principles of Computer Graphics*, McGraw Hill, 1989.
5. Mikell P. Groover, *Automation, Production Systems, and Computer-integrated Manufacturing*, prentice Hall, 2007
6. YoramKoren, *Computer control of manufacturing system*, 1st edition, 2005
7. Rogers, D. and Edams, *Mathematical Elements For Computer Graphics*, Mc Graw Hill, 2017.
8. http://nptel.ac.in/courses/112102102/
9. http://nptel.ac.in/courses/112102103/

Syllabus: Batch 2020 Onwards

Course Title: Inspection and Quality Control

Course Code: MEC462B

L	T	P	Credits
3	0	0	3

Course Objective:

- To understand the fundamentals of Quality, Economics of Quality and T.Q.M.
- To understand the basic statistical concepts, decision preparatory of the control charts, their applications and Process Capability Behaviour.
- To understand the concepts of Acceptance Sampling, Sampling Plans and their applications.
- To understand the concepts of latest concepts of quality such as JIT, KAIZEN etc.

Unit-A

Introduction: (10 Hrs)

Introduction, Definition, Objectives, Types, Role, Quality – Basic Concepts: Issues in Quality, factors affecting quality, creating quality by design, product development cycle, economics of quality, various definitions, ISO definition of quality and its meanings.Various phases till TQM and its meaning to industries, customers and employees, contribution of quality gurus etc. towards quality concepts. Total Quality management: its scope application and implementation. Variability concept in manufacturing –cycle, fishbone diagrams, charts in time philosophy.

Unit-B

Quality Control (10 Hrs)

Basic statistical concepts, various types of distributions, General theory X and R chart. Decision preparatory to the control charts. Trial control limits. Selection of sub-groups.Charts with variable subgroups. Reject and Revoke, limits for average on X charts, modified control limits, specification limits, practical limitations. Control charts for fraction defectives, calculation and plotting of control limits, sensitivity of p chart, applications, and Control charts for Defects, difference between defect and defective, calculation and plotting of control limits, application. Pi charts and u charts, plotting of charts. Tests for various control charts. Tests for various control charts, process capability- inherent and potential capability.

Unit-C

Acceptance Sampling (10 Hrs)

Purpose, Acceptance by Attributes, single sampling plans.OC.curve selection of sampling plans, Acceptance number, Type A and Type B errors, O.C. curves, Double sampling plan and its analysis, Multiple and sequential sampling , A.O.Q.L., Acceptance sampling plans under risk.

Syllabus: Batch 2020 Onwards

Design of various sampling plans, Dodge- Roming type system for acceptance sampling by attributes (use of various tables). Determination of process average, Acceptance sampling by variables.

Unit-D

Quality systems and Emerging Concepts: (8Hrs)

Introduction, ISO 9000 Quality System, Zero Defect Program, Poka-Yoke System, Benchmarking, JIT, Kanban & Pull system, Kaizen, Quality Function Deployment, Approach to six sigma quality, Quality circle: its objectives, structure and techniques.

Learning Outcome:

- Students will be able to understand the fundamentals of Quality, Economics of Quality and T.Q.M.
- Students will be able to understand the basic statistical concepts, decision preparatory of the control charts their applications and Process Capability Behaviour.
- Students will be able to understand the concepts of Acceptance Sampling, Sampling Plans and their applications
- Students will be able to understand the latest concepts of quality.

References Books:

1. Mitra, A. *Fundamentals of quality control and improvement*, New Delhi, John Wiley and Sons, 2016 Print.
2. Raju, N.V.S. *Industrial Engineering and Management*, New Delhi: Cengage Learning. 2013. Print.
3. Montgomery**,** Douglas C. *Statistical quality control*, New Delhi: Wiley. 2013. Print.
4. Grant, E. and Leavenworth R. *Statistical quality control*, New Delhi: Tata McGraw Hill. 2003. Print.
5. Mahajan, M. *Statistical quality control*, New Delhi: DhanpatRai and Co. 2012. Print.

Syllabus: Batch 2020 Onwards

Course Title: CAD/CAM Lab

Course Code: MEC414

L	T	P	Credits
0	0	2	1

The students will be required to carry out the following exercises using software packages (3D modeling package/ Pro Engineer/ I-Deas/ Solid Edge etc.)

List of Experiments:

1. Introduction to Creo.
2. To study various commands used in sketcher mode.
3. To study the dimensioning & constrains in sketcher mode.
4. Development of 2-d models in sketcher mode.
5. Development of advanced 2-d models in sketcher mode
6. To study various commands used in part mode.
7. Development of 3-d models in part mode.
8. To develop the assembly using assembly module.
9. To develop engineering drawings from 3-d models.
10. Introduction to Finite Element Analysis software.

DEPARTMENT SPECIFIC ELECTIVES

Syllabus: Batch 2020 Onwards

Course Title: **Finite Element Method**

Course Code: MEC457

L	T	P	Credits
4	0	0	4

Course Objectives:

- Students will learn about the basic concepts of FEM.
- To provide the knowledge of one, two dimensional and axisymmetric Problems in FEM.
- To provide the information of static, scalar field and dynamic problems.

Unit-A

Introduction: Historical Background, Mathematical modeling of field problems in engineering, governing equations, discrete and continuous models, boundary and initial value problems, Weighted Residual Methods, Variational formulation of boundary value problems, Ritz technique, Basic concept of Finite Element Method. (8)

UNIT –B

One Dimensional Problems: One dimensional second order equation, discretization, linear and higher order elements, derivation of shape functions, Stiffness matrix and force vectors, assembly of elemental matrices, solution of problems from solid mechanics. (6)

Two Dimensional Problem: Finite Element Modeling, Constant Strain Triangle (CST), problem modelling and boundary conditionsThe Four Node Quadrilateral, Numerical Integration, Higher Order Elements; Nine Node Quadrilateral, Eight Node Quadrilaterals, Six Node Triangle. (6)

UNIT –C

Beams:-Introduction, Finite element modelling formulation, load vector, boundary considerations, shear force and bending moment, beams on elastic supports. (6)

Scalar Field Problems: Introduction, Steady-state heat transfer, Torsion (6)

UNIT –D

Dynamic Considerations: Element Mass Matrices, Evaluation of Eigen Values and Eigen Vectors. (4)

Computer Implementation: Introduction; Computer Program Organization for Calculation of System Matrices, Introduction to FE software. (4)

Syllabus: Batch 2020 Onwards

Learning Outcomes:

- A close insight of discretization of the domain in finite element method.
- Understand the basic finite element formulation techniques.
- Be able to derive equations in finite element methods for one and two dimensionalproblems.
- Be able to formulate and solve basic problems in axisymmetric, heat transfer and solid mechanics
- Be able to write computer program based on finite element methods.
- Be able to use any commercial software, to solve basic engineeringproblems in heat transfer and solid mechanics

References:

1. Chandrupatla, T.R and Belegundu A.D, T.S. *Introduction to Finite Elements in Engineering*, New Delhi: Pearson Education: 2015. Print.
2. Alavala, C. R.*Finite Element Methods*, New Delhi: PHI Learning Pvt. Ltd.2015.Print.
3. Moaveni, S. *Finite Element Analysis*, New Delhi: PHI Learning Pvt. Ltd. 2015.Print.
4. Seshu, P. *Textbook of Finite Element Analysis*, New Delhi: PHI Learning Pvt. Ltd. 2015.Print.
5. Reddy, J. N.*An Introduction to the Finite Element Method*, New Delhi: McGraw Hill Education.2015. Print.
6. http://nptel.ac.in/courses/112104116/

Syllabus: Batch 2020 Onwards

Course Title: Tool Design

Course Code: MEC422

L	T	P	Credits
4	0	0	4

Course Objectives:

- So it's imperative that you create a design tool - and really turn it into a design experience; so that every customer can get exactly what they want at a price they are willing to pay.

Unit-A

Materials and Geometry of cutting tools:

Introduction, Desirable Properties of Tool Materials, Characteristics of Cutting Tool Materials, Cutting tool geometry, Chip flow direction, Tool angles specification systems, Cutting parameters and Tool geometry, Index able inserts, chip breakers, Tools of unusual geometry.

Thermal aspects in machining and cutting fluid:

Regions of heat generation; Heat In the Primary Shear Zone, Heat at the Tool/work Interface, Heat Flow at the Tool Clearance Face, Average shear plane temperature; Average chip - tool interface temperature; method of tool temperature measurement, temperature distribution in tool, Cutting Fluid: Types and composition of cutting fluids, selection of cutting fluid

Unit-B

Mechanics of metal cutting:

Merchant's circle diagram - determination of cutting and thrust forces; Coefficient of friction; shear plane angle, Velocity and force relationship, shear stress and strain and strain rate in orthogonal cutting, stress distribution along rake face, theories of Lee and Shaffer's, Oxley's, etc. Cutting force measuring techniques i.e. dynamometer

Jigs and Fixture:

Principles of jig and fixture design, Principle of degrees of freedoms, methods of locations and clamping, Various devices for location and clamping, indexing devices, Hydraulic and pneumatic actuation of clamping devices, jig bushes, use of standard parts of jig design, type of drilling jigs, milling fixtures, lathe fixture, grinding fixtures and their classification.

Unit-C

Die Design:

Components of die design, design of die blocks, punches and strippers, methods of holding punches, sketches of stock stops, Design procedure for progressive dies, compound dies and

combination dies for press tool operation forging die design for drop and machine forging parts.

Tool Wear, Tool Life and Machinability:

Tool wear mechanisms, Types of tool damage during cutting, Wear and chipping characteristics of different tool materials, Tool wear equations, tool failure criteria, Tool life equations, Effect of process

Parameters on Tool life, Tool life testing, Machinability, Surface finish and surface integrity.

Unit-D

Tooling Costs:

Estimating cost of a product, estimating costs of tools, Economics of tooling, Breakeven point analysis, minimum cost analysis.

Surface Finish:

Elements of surface finish, Factors affecting surface finish, Effect of surface quality on Functional properties of machine parts, Evaluation of surface finish, Indian Standards on surface finish. Measurement of surface finish, Relationship of surface finish to the production methods, finishing operations like honing, lapping, buffing super finishing etc.

Learning Outcomes:

- Students should have the ability to understand the importance of the tool design and manufacturing.

References Books:

1. Sharma P.C. A Textbook of Production Engineering, New Delhi: S. Chand Publication. Print.
2. Cole: Tool Design.
3. Donaldson C. Tool Design, McGraw Hill.
4. ASTM, Fundamentals of Tool Design.
5. F. Koenigsberger: Design Principles of Metal-Cutting Machine Tools.
6. N. K. Mehta: Machine Tool Design McGraw Hill Publishing
7. Acherkan Machine Tool Design Mir publishing.
8. S.K, Basu Machine Tool Design Oxford and IBH Publishing.

Syllabus: Batch 2020 Onwards

Course Title: **Total Quality Management**

Course Code: MEC421A

L	T	P	Credits
4	0	0	4

Course Objectives:

- To equip the students with knowledge about statistical control, control charts and different sampling
- To provide the knowledge about quality levels, concept of total quality management and inspection control.
- To provide the information about different types of audit and economics of product inspection.

UNIT-A

Introduction to quality and statistical tools

Introduction, need for quality, evolution for quality, definition of quality, product quality and service quality, Basic concepts of TQM, review of statistical concepts, test of normality for a given data, causes of variation, chance and assignable causes, statistical basis for control charts, basic control charting principles. TPM- concepts, improvement needs, performance measures. TQM implementation in manufacturing and service sectors. Introduction to control charts for variables and attributes, Process capability analysis: Introduction, specification limits and control limits, process capability indices, the Cp index, upper and lower capability indices, theCpk index.

UNIT-B

Total Quality Management and tools

Principles, leadership, strategic quality planning, Philosophies and frameworks, pillars of TQM: Leadership, Customer focus, Customer orientation and satisfaction, Customer complaints, Customer retention, Costs to quality, Quality Councils, Human Aspects in Management of Quality, Employee Involvement, motivation, Empowerment, team and teamwork, zero defects, quality circles, recognition and reward, Contribution of Deming, Continuous Process Improvement, PDCE cycle, 5S, Kaizen, Supplier partnership, Partnering, supplier rating and selection. TQM Tools: Benchmarking, Quality Function Deployment (QFD) – House of Quality, Taguchi Quality Loss Function, Juran and crosby, Barriers to TQM, Seven traditional tool of quality, New management tools, PDCA methodology.

Syllabus: Batch 2020 Onwards

UNIT-C

Six Sigma

Statistical basis for six sigma, concepts of six sigma, DMAIC methodology, project selection for six sigma, tools and techniques, FMEA- stages and types.

Quality assurance and systems:

Definition, Activities associated with quality assurance, Quality statement, characteristics of quality assurance system Quality systems, need for ISO 9000, ISO 9001-2015, documentation requirement, guidelines for preparation of quality manual. Steps for certification, benefits of ISO –9000 implementation.

UNIT-D

Audit

Quality audit: definition, internal audit, second party, third party audit, pre-assessment and compliance audit, procedure of auditing, audit planning, audit execution.

Economics of product Inspection

Use of Break-even analysis in decision for selection of economic acceptance plan option, Dodge - Romig Tables, MIL-STD-105D

Learning Outcomes:

- Students will be able to know about statistical quality control and various sampling theories.
- Students will be able to know about the different control charts and quality assurance.
- Students will also be acquainted with the concept of six sigma quality level.

References:

1. Grant, E. L. and Leavenworth, R. S. *Statistical Quality Control, Englewood Cliffs, NJ* : McGraw Hill, Sixth Edition, 2000. Print.
2. Evans and Lindsay. *The Management and control of Quality*. Thompson South-Western, Sixth Edition, 2005. Print.
3. Mitra,Amitav. *Fundamentals of Quality Control and Improvement*. Pearson Education Asia. Print.
4. Zaidi, A. *SPC: Concepts, Methodologies and Tools*. Prentice Hall of India, First Edition, 1995. Print.
5. http://nptel.ac.in/courses/110104080/

Syllabus: Batch 2020 Onwards

Course Title: Refrigeration and Air Conditioning

Course Code: MEC356

L	T	P	Credits
4	0	0	4

Course Objective:

- Students will cover the broad area of refrigeration including refrigeration cycles.
- Students will understand refrigeration load calculation, refrigeration control.
- Students will recognise the relation b/w the refrigeration and psychometric.

Unit-A

Introduction (5Hrs)

Definition of refrigeration & air conditioning; Necessity; Methods of refrigeration; Unit of refrigeration; Coefficient of performance (COP), Fundamentals of air-conditioning system; Refrigerants- Definition, Classification, Nomenclature, Desirable properties, Comparative study, secondary refrigerants, Introduction to eco-friendly Refrigerants; Introduction to Cryogenics.

Air Refrigeration System (8Hrs)

Carnot Refrigeration cycle, Temperature Limitations; Brayton refrigeration or the Bell Coleman air refrigeration cycle; Necessity of cooling the aero plane; Air craft refrigeration systems, Simple cooling and Simple evaporative types, Boot strap and Boot strap evaporative types, Regenerative type and Reduced Ambient type system, Comparison of different systems, problems.

Unit-B

Vapour Compression Refrigeration Systems (10Hrs)

(a) Simple Vapour Compression (VC) Refrigeration Systems-Limitations of Reversed Carnot cycle with vapour as the refrigerant; Analysis of VC cycle considering degrees of sub cooling and superheating; VC cycle on p-v, t-s and p-h diagrams; Effects of operating conditions on COP; Comparison of VC cycle with Air Refrigeration cycle.

(b) Multistage Ref. Systems- Necessity of compound compression, Compound VC cycle , Inter-cooling with liquid sub –cooling and / or water inter cooler: Multistage compression with flash inter-cooling and / or water inter-cooling; systems with individual or multiple expansion valves; Individual compression system with individual or multiple expansion valves; Individual compression systems with individual or multiple expansion valves but with and without intercoolers.

Other Refrigeration Systems (7Hrs)

(a) Vapour Absorption Refrigeration Systems – Basic Systems, Actual COP of the System, Performance, Relative merits and demerits; Properties of aqua ammonia; Electrolux Refrigeration; Problems.

(b) Steam Jet Refrigerating System- Introduction, Analysis, Relative merits and demerits, Performance Applications, Problems.

(c) Cascade Refrigerating Systems-Necessity Selection of Pairs of refrigerants for the system, Concept of cascade temperature, Analysis, Multistage, Comparison with V.C. systems, Applications, Problems.

Unit-C

Psychometry of Air & Air Conditioning Processes (10Hrs)

Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temp., Thermodynamics wet bulb temp., Psychometric chart; Psychometry of air-conditioning processes, Mixing Process, Basic processes in conditioning of air; Psychometric processes in air washer, Problems.

Air-Conditioning Load Calculations (6Hrs)

Outside and inside design conditions; Sources of heating load; Sources of cooling load; Heat transfer through structure, Solar radiation, Electrical applications, Infiltration and ventilation, Heat generation inside conditioned space; Apparatus selection; Comfort chart, Problems. Cooling Load Calculation for Industrial and commercial applications

Unit-D

Air Conditioning Systems with Controls & Accessories (5Hrs)

Classifications, Layout of plants; Equipment selection; Air distribution system; Duct systems Design; Filters; Refrigerant piping; Design of summer air-conditioning and Winter air conditioning systems; Temperature sensors, Pressure sensors, Humidity sensors, Actuators, Safety controls; Accessories; Problems.

Refrigeration and Air Conditioning Equipment's (5Hrs)

Type of compressors and their performance curves; Types of Condensers, Heat transfer in condensers; Types of expansion devices; types of evaporators, Cooling and Dehumidifying coils, Problems.

Learning Outcomes:

- Students will be capable to know about the working of VCR, Air refrigeration and VAC.
- Student will able to know the cascade system and cryogenic refrigeration

- Students will able to distinguish the refrigeration and Psychometric.
- Students will able to solve the load calculation problem.

References:

1. Arora, C.P. *Refrigeration & Air conditioning.* New Delhi: Tata McGraw Hill, 2013 Print.
2. Arora and Domkundwar. *A course in Refrigeration & Air Conditioning.* New Delhi: DhanpatRai& Sons, 2015Print.
3. Jordan, R.C. and Priester, G.B. *Refrigeration & Air conditioning*. Prentice Hall of India, 2013Print.
4. Stocker, W.F. and Jones, J.W. *Refrigeration & Air conditioning*. New Delhi: Tata McGraw Hill, 2011Print.
5. http://nptel.ac.in/courses/112105129/

Syllabus: Batch 2020 Onwards

Course Title: Mechanical Vibrations

Course Code: MEC402

L	T	P	Credits
4	0	0	4

Course Objectives:

- This course will enable students to fully understand and appreciate the importance of vibration in mechanical design of machine parts that operate in vibratory conditions.
- Students will able to write the differential equation of motion of vibratory systems.
- This course will enable students to make free and forced (Periodic, non-periodic, harmonic etc.) vibration analysis of single and multi-degree of freedom linear systems.

Unit-A

Introduction (6 Hrs.)

Types of vibrations, Simple Harmonic Motion (S.H.M), principle of super position applied to Simple Harmonic Motions. Beats, Fourier theorem and simple problems

Undamped Free Vibrations (6 Hrs.)

Single degree of freedom systems, Mass Undamped free vibration-natural frequency of free vibration, stiffness of spring elements, effect of mass of spring, Compound Pendulum

Unit-B

Damped Free Vibrations (8 Hrs.)

Single degree freedom systems, different types of damping, concept of critical damping and its importance, study of response of viscous damped systems for cases of under damping, critical and over damping, Logarithmic decrement.

Forced Vibration (8 Hrs.)

Single degree freedom systems, steady state solution with viscous damping due to harmonic force, Solution by Complex algebra, Reciprocating and rotating unbalance, vibration isolation-transmissibility ratio. Due to harmonic excitation and support motion

Unit-C

Vibration Measuring Instruments (6 Hrs.)

Whirling of shafts, Vibrometer meter and accelerometer, Whirling of shafts with and without air damping, Discussion of speeds above and below critical speeds, Combined with shear, strain energy under combined loading

Syllabus: Batch 2020 Onwards

Systems with Two Degrees of Freedom (8 Hrs.)

Introduction, principle modes and Normal modes of vibration, co-ordinate coupling, generalized and principal co-ordinates, free vibration in terms of initial conditions. Geared systems, Forced Oscillations-Harmonic excitation Applications: a) Vehicle suspension b) Dynamic vibration absorber. c) Dynamics of reciprocating Engines.

Unit-D

Continuous systems (5 Hrs.)

Introduction, vibration of string, longitudinal vibration of rods, Torsional vibration of rods, Euler's equation for beams

Numerical Methods for Multi Degree Freedom Systems (9 Hrs.)

Introduction, Influence coefficients, Maxwell reciprocal theorem, Dunkerley's equation, Orthogonality of principal modes, Method of matrix iteration-Method of determination of all the natural frequencies using sweeping matrix and Orthogonality principle, Holzer's method, Stodola method.

Learning Outcomes:

After passing the course, students will be able to:

- Appreciate the need and importance of vibration analysis in mechanical design of machine parts that operate in vibratory conditions.
- Analyse the mathematical model of a linear vibratory system to determine its response.
- Obtain linear mathematical model of real life engineering systems
- A general notion on frequency and time response of vibratory systems.

References:

1. Leonard, Meirovitch. *Elements of Vibrations Analysis.* , Tata McGraw Hill,1986. Print.
2. Rao, S.S. *Mechanical Vibrations.* Pearson Education, 2003. Print.
3. Kelly, S. G. *Mechanical Vibrations: Schaum's Outline Series.* New Delhi: Tata McGraw Hill,2007. Print.
4. Bhave, Shrikant.*Mechanical Vibrations: Theory and Practice*. Pearson Education, New Delhi. 2010. Print.
5. Venkatachalam R., *Mechanical Vibrations*.PHI Learning Pvt. Ltd. New Delhi. 2014. Print.
6. http://nptel.ac.in/courses/112103111/

Syllabus: Batch 2020 Onwards

Course Title: Flexible Manufacturing System

Course Code: MEC424A

L	T	P	Credits
4	0	0	4

Course Objectives: Students will learn about the basic concepts of automation, about the automated assembly line, about the types of group technology, about the types of robotic technology and programming

Unit-A

Automation (7 Hrs.)

Types of automation, reasons for automating, automation strategies, Detroit-type automation: Automated flow lines, methods of work part transport, Transfer mechanisms, buffer storage, automation for machining operations

Automated assembly systems (8 Hrs.)

Design for automated assembly, types of automated assembly systems, part feeding devices, quantitative analysis of the delivery system operation, and analysis of a single-station assembly machine, numerical.

Unit-B

Group Technology (7 Hrs.)

Part families, parts classification and coding, types of classification and coding systems, Machine cell design: The composite part concept, types of cell designs, determining the best machine arrangement, benefits of group technology

Flexible Manufacturing Systems (10 Hrs.)

Components of an FMS, types of systems, where to apply FMS technology, FMS work stations, Material handling and storage system: Functions of the handling system, FMS layout configurations. Material handling equipment, Computer control system: Computer function, FMS data file, system reports. Planning the FMS, analysis methods for FMS, applications and benefits

Unit-C

Robotic Technology (10 Hrs.)

Joints and links, common robot configurations, work volume, types of robot control, accuracy and repeatability, other specifications, end effectors, sensors in robotics

Syllabus: Batch 2020 Onwards

Unit-D

Robot programming **(12 Hrs.)**

Types of programming, lead through programming, motion Programming, interlocks, advantages and disadvantages. Robot languages: Motion programming, simulation and off-line programming, work cell control

Learning Outcome

After passing this course, students will able to

- Design a system, component or process to meet the desired standard.
- Overcome different constraint (like economic, social, political, health and safety) in production.
- General notion of robotic movements and their programming.

References:

1. Groover, M.P. *Automation, Production Systems and Computer Integrated Manufacturing*. Prentice Hall of India, 2007. Print.
2. Singh, Nanua. *Approach to Computer Integrated Design and Manufacturing.* John Wiley and Sons,2006. Print.
3. Browne, J., Harhen, J. and Shivnan, J. *Production Management Systems: A CIM Perspective*. Addison Wesley,1989. Print.
4. http://nptel.ac.in/courses/110106044

Syllabus: Batch 2020 Onwards

Course Title: **Entrepreneurship Development and Management**

Course Code: MEC425

L	T	P	Credits
4	0	0	4

Course Objectives:

- To identify steps for starting up the small scale industries.
- To identify the various components of management and the importance of management process in business.
- To impart the knowledge and awareness about various rules, regulations and act concerned with business.

Unit-A

Entrepreneur and Entrepreneurship (4 Hrs.)

Introduction, Definition, Concept, Characteristics, Classification, Types, Functions and Competencies

Entrepreneurship (2 Hrs.)

Definition, Concept, Need, Entrepreneurship as a career option

Entrepreneurship Support System (4 Hrs.)

Concept and Need of entrepreneurship support system, DICs, SFCs, SISIs, CBs, SIDBI, MFIs (Micro Financing Institutions), NBARD, NSIC, Small Scale industries Cooperation, Technical Consultancy Organizations (TCO), KVIC, SIDO, SIDCs, NIESBUD,

Unit-B

Business Ownership and its Features (6 Hrs.)

Sole proprietorship, Partnership, Joint Stock Companies, Cooperative, Private Limited, Public Limited and PPP mode

Market Survey and Opportunity (6 Hrs.)

Introduction, Industry and its Classification, Small Scale Industries (SSI): Definition, Objectives, Features and importance, Steps for starting SSIs, Procedure for registration of SSIs, Understanding business opportunity, Consideration in product selection, Data collection for setting up small venture**.**

Unit-C

Project Report Preparation (8 Hrs.)

Project: Introduction, Definition and Concept

Project identification: Introduction, Definition and Concept, Ways for selecting a project, Guidelines for selecting a project.

Syllabus: Batch 2020 Onwards

Project Report: Definition and Concept, Need of project report, Contents of a project report, Salient features of a project report, Uses of the project report, Preliminary Project Report (PPR), Detailed Project Report (DPR)

Project Formulation: Definition and Concept, Elements of project formulation

Project Appraisal: Definition and Concept, Objectives, Need, Stages of project appraisal

Industrial Legislation and Laws **(6 Hrs.)**

Introduction, Need of industrial legislation, Types of taxes: Income tax, Sales tax, Excise duty, Provident fund, Legal aspects of small business, Factory Act, 1948, Payment of wages act, 1936, Workmen Compensation Act, 1947, Industrial dispute act, 1947, Employee state insurance act, 1948, Minimum wages act, 1948.

Unit-D

Managerial Aspects of Small Business Management **(4 Hrs.)**

Fayol's principles, Functions of management, Levels of Management, Organization Structure, Principles of marketing management, Marketing Strategies, Personnel Management, Training and Development,

Labour Welfare **(4 Hrs.)**

Definition and Concept, Significance, Features, Labour welfare schemes

Wage Payment **(4 Hrs.)**

Introduction, Wage, Type of wages, Wage differentials, Objective of good wage –incentive plan, Basis of good wage incentive plan, System of wage payment.

Miscellaneous **(4 Hrs.)**

Workers Participation in Management, Accident and Safety, Intellectual Property Rights (IPRs)

Learning Outcomes:

- Students will be able to know about entrepreneurship, types of business and market opportunities.
- Student will also get a practical insight into project development, formulation and preparation of project report.
- Students will be able to know about Industrial legislations, labour and wage schemes and about Intellectual Property Rights.

Reference:

1. Negendra. *Entrepreneurship and Management,*New Delhi: Pearson.1995. Print.
2. Singh, A.K. *Entrepreneurship Development and Management,*New Delhi: Laxmi Publication. . Second Edition. 2009. Print.
3. Saravate, Dilip. *Entrepreneurship Development and Project Managemen, Pune:* EverestPublication. Print.
4. Sharma Pritosh. *Entrepreneurship Development and Management, New Delhi:*DhanpatRai&CoPrint.
5. Bansal. *Entrepreneurship Development and Management*, New Delhi: Kapson. Print.
6. Lal, A. K. *Entrepreneurship Development and Management,* Vayu Education. Print.

Syllabus: Batch 2020 Onwards

Course Title: **Gas Dynamics**

Course Code: MEC434

L	T	P	Credits
4	0	0	4

Course Objectives:

- To provide conceptual knowledge about compressible flow fundamentals.
- To impart the knowledge of various gas turbines and its accessories.
- To provide in depth knowledge of rocket propulsion system and compressors and its applications.

Unit-A

Introduction **(6 Hrs.)**

Gas turbine, Classification and working of gas turbine cycles-open and closed type

Compressible Flow **(8 Hrs.)**

Wave propagation and sound velocity; Mach number and compressible flow regimes; basic equations for one-dimensional compressible flow, isentropic flow relations; area-velocity relation; normal shock waves, relation between upstream and downstream flow parameter

Unit-B

Gas Turbine Systems and Cycles **(8 Hrs.)**

System of operation of gas turbines-constant volume and constant pressure gas turbines; thermodynamics of Brayton cycle; regeneration-inter cooling, reheating and their combinations; closed cycle and semi-closed cycle gas turbines; gas v/s I.C engines and steam turbines.

Compressors **(8 Hrs.)**

Classification-positive displacement and dynamic compressors, Operation of single stage reciprocating compressors; best value of index of compression; isothermal efficiency; effect of clearance and volumetric efficiency; multi-stage compression; air motors.

Unit-C

Centrifugal compressors **(6 Hrs.)**

Static and total head values; velocity vector diagrams; slip factor; pressure coefficient and pre-whirl. Axial flow compressors; degree reaction and polytropic efficiency Performance characteristics; surging, choking and stalling

Combustion Systems **(6 Hrs.)**

Types, combustion process, combustion intensity efficiency and pressure loss.

Syllabus: Batch 2020 Onwards

Unit-D

Air-breathing Propulsion Systems (7 Hrs.)

Principle of jet propulsion; analysis and performance characteristics of turbojet, turboprop, ramjet and pulsejet; thrust power and propulsion efficiency.

Rocket Propulsion (7 Hrs.)

Operating principle; solid and liquid propellants, performance analysis-calculations for specific impulse and propulsive efficiency

Learning Outcomes:

- Students will be able to apply momentum, mass and energy conservation equations to various one dimensional compressible flows.
- Students will have the knowledge about various gas turbine systems and compressors.
- Students will also be able to learn about propulsion systems.

References:

1. Cohen and Rogers. *Gas Turbine Theory*, *Canada:*Pearson Education. Sixth Edition, 2009. Print.
2. Zucrow, M. J. *Principle of Jet Propulsion and Gas Turbine: USA:*John Wiley & Sons, 1948. Print.
3. Vasandani, V. P. and Kumar, D. S. *Heat Engineering, New Delhi*: Metropolitan Book Co Pvt Ltd., 2009. Print.
4. http://nptel.ac.in/courses/112103021/

Syllabus: Batch 2020 Onwards

Course Title: Tribology

Course Code: MEC432

L	T	P	Credits
4	0	0	4

Course Objectives:

- Design of surfaces in contact is a critical problem for mechanical engineering. Tribology is an interdisciplinary course which deals with fundamentals of surface contact, friction, wear and lubrication.
- Topics in Tribology include description and modeling of engineering surfaces, popular surface contact theories, major modes of friction, wear, lubrication and adhesion.

Unit-A

Introduction: **(8 Hrs.)**

friction, wear and lubrication, types of engineering contacts: conforming and non-conforming, Types of motion: rubbing, sliding, oscillating, rolling, surface of interaction, elastic and plastic deformations, properties of materials, surface energy and flash temperature theory.

Friction: **(6 Hrs.)**

Laws of sliding friction, concept of adhesion, Tabor's model of elastic thermo friction, rolling friction, measurement of friction

Unit-B

Wear **(8 Hrs.)**

Laws of wear types of wear such as adhesive, declamation, abrasive, corrosive, fretting, erosive and oxidative, Measurement of wear and friction in atmosphere and different environments, Prevention and control of wear and friction in machines, wear of cutting tools and dies, study of abrasion in grading, lapping/ honing

Lubrication: **(8 Hrs.)**

Mechanism of lubrication, Boundary, squeeze film hydrodynamic and elasto hydrodynamic and hydrostatic lubrication, plasto hydrodynamic lubrication, solution of Reynolds's equation in two and three dimensional flow, pressure distribution load carrying capacity friction forces in oil film and coefficient of friction in journal bearing, Solid, Liquid and Gas lubricants types and their applications

Unit-C

Bearing Design: **(8 Hrs.)**

Design of bearing clearance in journal bearing, minimum film thickness, sommar field number, oil grooves and flow of oil in axial and circumferential grooves cavitation's and turbulence in oil bearings, Heat generation and cooling or bearing hydrostatic and dynamic and their applications in machine tools, Design of air bearings and other gas bearings.

Syllabus: Batch 2020 Onwards

Rolling Friction: **(6 Hrs.)**

Reynold slip, Heathe cote concept selection of roller bearings and their methods of lubrication design aspects and modes of bearing failures and elasto hydrodynamic lubrication

Unit-D

Tests and Instrumentation in Tribology: **(10 Hrs.)**

Sliding friction and wear abrasion test, rolling contact and fatigue test, solid particle and erosion test, Corrosion test Special instruments for lubricant analysis such as optical and infrared spectroscopy and infra-red spectroscopy, atomic absorption and emission spectroscopy, mass spectroscopy, NMR spectroscopy, X ray diffraction and chromatographic techniques, Use of transducers and instruments in Tribology- film thickness measurement using modern techniques – Development of test rigs for Tribology research.

Learning Outcomes:

- Have a clear overall picture about the basics of tribology and related sciences, theoretical background about processes in tribological system, mechanisms and forms of interaction of friction surfaces;
- Understand smooth contact and rough surface contact;
- Be familiar with adhesion theories and the effect of adhesion on friction and wear;
- Know the methods to reduce the friction for engineering surface

References:

1. Gwidon, W. Stachowiah and Gwidon, W. *Engineering Tribology,* 2013. Print.
2. Bhusan, Bharat. *Principles and Application of Tribology*, 1999. Print.
3. Khonsari, and Booser*Applied Tribology: Bearing Design and Lubrication,* 2008. Print.
4. Srivastva, Sushilkumar. *Tribology in Industries.* 2001.Print.
5. Majumdar, B.C. *Introduction to Tribology of Bearing,* 1999. Print.
6. http://nptel.ac.in/courses/112102015/

Syllabus: Batch 2020 Onwards

Course Title: Advanced Materials

Course Code: MEC427

L	T	P	Credits
4	0	0	4

Course Objectives

To introduce the students with the advance material like composites, Nano materials and plastics and to make them familiar with recent innovation in design of these materials

UNIT A

Introduction

Demand of advanced materials, design principles and processing, Introduction, Types and constituents, reinforcement and matrices, interface and mechanism of strengthening, Production of fibres, properties mechanics of composites

Metal matrix composites

Manufacturing of metal matrix, Metal Matrix Composites: Processing: Liquid state processes, solid state processes and in situ processes, testing of composite material, areas of application.

UNIT B

Polymer Matrix Composites

Processing, Hand layup and spray technique, filament winding, pultrusion, resin transfer molding, bag and injection molding, applications

Ceramic Matrix Composites

Processing, Cold pressing & sintering, hot pressing reaction bonding processes, infiltration, in-situ chemical reaction, Sol-Gel and polymer pyrolysis, applications

UNIT C

Non Metallic Materials

Plastics, rubber, foams, adhesives and coatings - Structure, properties and applications of engineering polymers - Advanced structural ceramics, WC, TiC, TaC, AI_2O_3, SiC, Si3N4, CBN and diamond - properties, processing and applications.

Smart Materials

Shape memory alloys, hydrogen storage alloys, functionally gradient materials, Concept of nano materials, scale/dimensional aspects, top down and bottom up approaches for preparing nano materials, advantages and limitations at the nano level, applications

Syllabus: Batch 2020 Onwards

UNIT D

Modern Metallic Materials

Dual phase steels, Micro alloyed, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) steel, Maraging steel - Intermetallics, Ni and Ti aluminides - Smart materials, Metallic glass - Quasi crystal and nano crystalline materials, bio materials, applications.

References:

1. Gandhi, M.V., Thompson, B.S., Smart Materials and Structures, Chapman and Hall
2. Ray, A.K. (ed), Advanced Materials, Allied publishers.
3. Chawla, Composite Materials Science and Engineering, Springer
4. Hull, An introduction to composite materials, Cambridge.
5. Mathews and Rawlings, Composite materials: Engineering and Science, Chapman and Hall.
6. Flinn, R.A. and Trojan, P.K., “Engineering Materials and their Applications ", (4th Edition), Jaico Publishing, 1999.
7. Charles J.A., Crane, F.A.A and Furness, J.A.G., “Selection and use of Engineering Materials", 3rd Edition, Butterworth-Heinemann, 1977.
8. http://nptel.ac.in/courses/101104010/

Syllabus: Batch 2020 Onwards

Title: Non Destructive Testing

Course Code: MEC455A

L	T	P	Credits
4	0	0	4

Course Objectives:

- To aware the students description of non-destructive methods and their importance
- To give knowledge about the interpretation of results of various NDT

Unit-A

Introduction: Non-destructive versus destructive testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation, applications in NDT.

Visual Inspection: Introduction,basic terms associated with visual inspection, equipment and accessories used for visual inspection, Visual Detection of Discontinuities, Evaluation of test results, application, advantage and limitations.

UNIT –B

Liquid Penetration Testing: Introduction, principle, equipment, characteristics of penetrants and their types, developer, hazards precautions, Evaluation of test results, application, advantage and limitations.

Radiographic Testing: X-ray radiography principle, equipment & methodology-Type of industrial sources and application –Radiographic exposure factor and Technique-gamma ray and X-Ray equipment-Radiographic procedure, interpretation. Precautions against radiation hazards, application, advantage and limitations.

UNIT –C

Magnetic Particle Testing: Principle of magnetic particle testing, basic terms associated with magnetic particle testing, different methods to generate fields, Magnetic particle testing equipment, Magnetic particle testing procedures, method of de-magnetization, magnetic particle medium, Evaluation of indication, application, advantage and limitations.

Ultrasonic Testing: Introduction, principle of operation, basic terms associated with ultrasonic testing, type of ultrasonic propagation and probes, type of transducers, data representation, A-Scan, B-scan, C-scan, and Method for evaluating discontinuities, elastic study of wood, application, advantage and limitations.

UNIT –D

Eddy Current Testing: Introduction, principle of operation,basic terms associated with eddy current testing, Factor effecting eddy current-defect-frequency-geometry-conductivity-

Proximity (Lift off & Fill Factor),eddy current flow characteristics, test equipment, types of probes, eddy current application and signal display, advantage and limitations.

Learning outcome:

- Students will be able to learn the various techniques of NDT and their applications

References:

1. Davies, Troxell, and Hauck G.F.W.*The testing of Engineering materials*, New York: McGraw Hill. Print.
2. Armstrong, W.H. *Mechanical Inspection*, New York: McGraw Hill. Print.
3. http://nptel.ac.in/courses/113106070/

Syllabus: Batch 2020 Onwards

Course Title: Industrial Safety

Course Code: MEC453A

L	T	P	Credits
4	0	0	4

Course Objective:

- To impart the valuable skills to plan and understand importance of Industrial Safety
- To know the socio-techno-economic aspects related to the Occupational health and safety.
- To have the understanding about the hazards.

Unit-A

Safety: Meaning & need for safety. Relationship of safety with plant design, equipment design and work environment. Industrial accidents, their nature, types and causes. Assessment of accident costs; prevention of accidents. Industrial hazards, Hazard identification techniques, Accident investigation, reporting and analysis. Safety and economics, safety and productivity. Employee's participation in safety. Safety legislation.

Unit-B

Environment: Environmental factors in industry. Effect of temperature, Illumination, humidity noise and vibrations on human body and mind. Physiology of heat regulation. Thermal environment and its measurement. Thermal comfort. Indices of heat stress. Thermal limits for comfort, efficiency and freedom from health risk. Natural ventilation. Mechanical ventilation. Air conditioning Process ventilation. Control of heat exposures, control at source, insulation, and local exhaust ventilation. Control of radiant heat, dilution ventilation. Local relief.

Unit-C

Industrial Lighting: Purpose of lighting, benefits of good illumination. Phenomenon of lighting and safety. Lighting and the work. Sources and types of artificial lighting. Principles of good illumination. Recommended optimum standards of illumination. Design of lighting installation.

Noise and Vibrations: Continuous and impulse noise. The effect of noise on man. Noise measurement and evaluation of noise. Noise isolation. Noise absorption techniques. Silencers Vibrations: Effect, measurement and control measures.

Syllabus: Batch 2020 Onwards

Unit-D

Operational Safety: General safety considerations in material handling – manual and mechanical, safety in machine shop, safety in use of hand and portable (power) tools, safety in use of electricity, safety in welding and cutting, principles of guarding, safety in grinding, safety in heat treatment shop, safety in gas furnace operation.

Learning Outcome:

- Students will be able to plan and understand importance of Industrial Safety.
- Students will be able to get aware of the socio-techno-economic aspects related to the Occupational health and safety.
- Students will be able to know various hazards and preventive measures.

References:

1. Krishnan N V, *"Safety management in Industry",* Jaico Publishing House, Delhi (1993).

2. Kocurek Dianna and Woodside Gayle, *"Environment, Safety, and Health Engineering"*, John Wiley and Sons, New York (1997).

3. McCormick J, *"Human Factors in Engineering and Design"*, Tata McGraw Hill Publishing Company Limited, New Delhi (1979).

4. Willie Hammer, Dennis Price, "Occupational Safety Management and Engineering", 5th Ed., Pearson Education (2000).

5. David Goetsch, "The Safety and Health Handbook", Pearson Education (1999).

Syllabus: Batch 2020 Onwards

Course Title: Non-Conventional Energy Resources

Course Code: MEC456

L	T	P	Credits
4	0	0	4

Course Objective

- To impart the knowledge information about the various non-conventional energy resources.
- To provide the information about the use of solar energy to produce electricity; ways to utilize wind energy for human usage; understand the issue of fuel availability.
- To discover the pros and cons of conventional energy sources

Unit-A

Introduction (6 Hrs.)

Statistics on conventional energy sources and supply in developing countries, Definition-Concepts of NCES, Limitations of RES, Criteria for assessing the potential of NCES, Classification of NCES-Solar, Wind, Geothermal, Bio-mass, Ocean Energy Sources, comparison of these energy sources

Solar Energy(14 Hrs.)

Solar Energy-Energy available from Sun, Solar radiation data, Solar energy conversion into heat, Flat plate and Concentrating collectors, Mathematical analysis of Flat plate collectors and collector efficiency, Principle of Natural and Forced convection, Solar engines-Stirling, Brayton engines, Photovoltaic, p-n junction, solar cells, PV systems, Stand-alone, Grid connected solar power satellite.

Unit-B

Wind Power (12 Hrs.)

Wind energy conversion, General formula -Lift and Drag- Basis of wind energy conversion - Effect of density, frequency variances, angle of attack, and wind speed. Windmill rotors- Horizontal axis and vertical axis rotors. Determination of torque coefficient, Induction type generators- working principle.

Geothermal Energy (8 Hrs.)

Nature of Geothermal sources, Definition and classification of resources, Utilization for electric generation and direct heating, Well Head power generating units, Basic features- Atmospheric exhaust and condensing, exhaust types of conventional steam turbines.

Syllabus: Batch 2020 Onwards

Unit-C

Bio Mass **(6 Hrs.)**

Pyrolysis of Biomass to produce solid, liquid and gaseous fuels, Biomass gasification, Constructional details of gasifier, usage of biogas for chulhas, various types of chulhas for rural energy needs.

Unit-D

Ocean Energy **(10 Hrs.)**

Wave, Tidal and OTEC energy- Difference between tidal and wave power generation, Principles of tidal and wave power generation, OTEC power. Visit to OTEC plants, Operational of small cycle experimental facility, Design of 5 Mw OTEC pro-commercial plant, Economics of OTEC, Environmental impacts of OTEC. Status of multiple product OTEC systems

Learning Outcomes:

- Students will learn about the non-conventional energy resources.
- Student will learn about the use of solar energy to produce electricity; ways to utilize wind energy for human usage; understand the issue of fuel availability.
- Students will able to know about the fuel availability and analyse the supply and demand of fuel in the world.

References:

1. Desai, Ashok V. *Non-Conventional Energy*, New Delhi: Wiley Eastern Ltd., 2003.
2. Mittal, K. M. *Non-Conventional Energy Systems*. New Delhi: Wheeler Publishing Co. Ltd. 2003.
3. Ramesh and Kumar, K. U. *Renewable Energy Technologies*, New Delhi: Narosa Publishing House, 2004.
4. Sukhatme, S.P. Solar Energy. New Delhi, Tata McGraw Hill 3rd Edition 1996.
5. http://nptel.ac.in/courses/121106014/

Syllabus: Batch 2020 Onwards

Course Title: Mechanical Behaviour of Materials

Course Code: MEC445

L	T	P	Credits
4	0	0	4

Course Objectives:

- To aware the students about basic atomic structure and mechanical properties.
- To familiarize the students with elastic, plastic deformation and strengthen mechanisms.
- To familiarize with the fracture mechanism, fatigue and creep behavior.

Unit-A

Introduction: (7Hrs.)

Atomic structure and chemical bond, Metals- metallic bond, crystal structures, polycrystalline metals, Ceramics- covalent bond, ionic bond, dipole bond, Vander Walls bond, hydrogen bond, crystal structure of ceramics, amorphous ceramic, Polymers- chemical structure of polymers, structure of polymers.

Mechanical Properties: (6Hrs.)

Introduction**,** Static mechanical properties-tensile strength, compressive strength, ductility, malleability, stiffness, toughness, creep strength, hardness, Dynamic mechanical properties-impact strength, fatigue strength, hardness, Structure mechanical properties relationship.

Unit-B

Deformation of Metals: (8Hrs.)

Introduction, significance of elastic modulus in elastic deformation, Plastic deformation-deformation by slip, type of loading for plastic deformation, potential slip planes and directions in crystals, critical resolved shear stress, strain hardening in single crystal, structural changes cold worked polycrystalline metals and alloys, annealing of cold worked metals.

Strengthening mechanisms in materials: (10Hrs.)

Introduction, grain boundary strengthening, solid solution strengthening, Second phase particle strengthening, Strain hardening, martensitic strengthening, Composite strengthening-fibre strengthened composites, dispersion strengthened composites, particle strengthened composites, Plastic strengthening-strengthening by high average molecular weight, strengthening by crystallinity, strengthening, strengthening by bulky pendant atomic group, Strengthening thermoplastics by presence of polar atoms, introducing non carbon atoms in the main carbon chain, introduction of aromatic groups in the main chain, Strengthening of ceramics, applications of strengthening mechanisms to obtain high strength materials.

Syllabus: Batch 2020 Onwards

Unit-C

Fracture: (6Hrs.)

Introduction, ductile fracture, mechanism of ductile fracture, brittle fracture, mechanism of brittle fracture, factors affecting the type of fracture.

Fatigue Behaviour: (7Hrs.)

Introduction, stress cycles, macrography of fatigue fracture, fatigue test (S-N curve), fatigue behaviour in iron & steel, Mechanism of fatigue-Orowan's theory of fatigue, Wood's theory of fatigue, fatigue crack growth, low cycle fatigue, variables affecting fatigue.

Unit-D

Creep Behaviour: (12Hrs.)

Introduction, creep curve, design curves, Andrade's analysis of creep, creep at lower temperature, activation energy for steady state creep, creep at high temperature, equicohesive temperature, Deformation at elevated temperature-deformation by slip, grain boundary deformation, Mechanisms of creep deformation- dislocation glide, dislocation creep, diffusion creep, grain boundary sliding, Metallurgical factors affecting creep behaviour-effect of lattice structure, effect of prestrain, effect of soluble impurities and alloying elements, effect of second phase particles, grain size, Creep resistant materials.

Learning Outcomes:

- Students will be able to clear understanding of various factors that controls the strengthening mechanism.
- Students will have a clear idea about the fractures that control the brittle and ductile behaviour.
- Students will be able to describe factors that controls the creep and fatigue behaviour

References:

1. Courtney, Thomas H. *Mechanical Behaviour of Materials*. New Delhi: McGraw Hill Education Pvt. Ltd. 2012. Print.
2. Bhargava, A.K. and Sharma, C.P. *Mechanical Behaviour and Testing of Materials.* New Delhi: PHI Learning Pvt. Ltd. 2014. Print.
3. Shetty M.N. *Dislocation and Mechanical Behaviour of Materials*. New Delhi: PHI Learning Pvt. Ltd. 2014. Print.
4. Roesler, J., Harders, H. and Baeker, M. *Mechanical Behaviour of Engineering Materials*. New York: Springer Berlin Heidelberg, 2007. Print.
5. http://nptel.ac.in/syllabus/113107048/

Syllabus: Batch 2020 Onwards

Course Title: **Product Design and Development**

Course Code: MEC452A

L	T	P	Credits
4	0	0	4

Course Objectives:

- To facilitate the development of new concepts for innovative products.
- To relate project activity to the discussion and analysis of social and cultural aspects of contemporary manufacturing.

Unit-A

Introduction To product Design (6 Hrs.)

Introduction-Introduction to product design, Significance of product design, product design and development process, sequential Engineering design method, the challenges of product development, Development Process and Organizations-Generic Development Process, Concept Development, Adapting the generic PD process flows, AMF development Process, Product Development Organizations, The AMF Organization.

Product Planning (8 Hrs.)

Product Planning and Identifying Customer Needs-Product Planning process, Interpret raw data in terms of customers need, organize needs in hierarchy and establish the relative importance of needs, review of the process. Product Specifications-Establish target specifications, setting final specifications.

Unit-B

Concept Consideration in Product Design (6 Hrs.)

Concept Generation-Activities of concept generation, clarifying problem, search both internally and externally, explore the output,

Concept Selection-Overview, concept screening and concept scoring, methods of selection.

Concept Testing-Elements of testing: qualitative and quantitative methods including survey, measurement of customers‟ response.

Designing of product (6 Hrs.)

Product Architecture-Modular & Integral architecture, implications, establishing the architecture, Delayed differentiation, Platform Planning.

Industrial Design-Assessing need for industrial design, Impact of industrial Design, Industrial design process, management of industrial design process, assessing quality of industrial design.

Syllabus: Batch 2020 Onwards

Unit-C

Value Engineering and product Design (8 Hrs.)

Introduction, Historical perspective, what is value? Nature and Measurement of value, Maximum value, normal Degree of value, Importance of value, The value Analysis job plan, Creative, Steps to problem – solving and value Analysis, value Analysis Test, value Engineering Idea Study on Tap Switch Control Assembly, Material and process Selection in value Engineering. Designer contributes, Role of Aesthetics in product Design, Functional Design Practice.

Modern Approaches to Product Design (2 Hrs.)

Concurrent Design, Quality Function Deployment (QFD)

Unit-D

Human Engineering Considerations in Product Design (6 Hrs.)

Introduction, Human being as Applicator of Forces, Anthropometry: Man as occupant of Space, the Design of Controls, The Design of Displays, Man/Machine Information Exchange.

Embodiment Design: (6 Hrs.)

Design for Manufacturing, prototyping. Robust Design. Intellectual Property and Environmental Guidelines-Intellectual Property: Elements and outline, patenting procedures, claim procedure, Environmental regulations from government, ISO system.

Learning Outcomes:

- Students will be able to know about the concept of product development.
- Student will be able to know about the different approaches to product design.
- Students will be able to know about the various considerations in product design.
- Students will be able to relate value engineering and product design.

References:

1. Ulrich Karl T. &Epinger Steven D. *Product Design & Development*– Tata- McGraw Hill - 3 rd Edition, New Delhi, 2004
2. Jones Tim, Heinmam Butterworth, *New product Development*, Oxford - UIC, 1997
3. EngeneKinetoviczRoland,*New product Development: Design & Analysis*, Wiley and Sons Inc., New York, 1990.
4. Hollins Bill, Pugh Stwout,*Successful Product Design*, Butterworth, London,1990
5. Otto Kevin and Wood Kristini. *Product Design,*Pearson India, New Delhi, 2004.
6. http://nptel.ac.in/courses/112107217/

Syllabus: Batch 2020 Onwards

Course Title: Ergonomics and Work Place Design

Paper Code: MEC446

L	T	P	Credits
4	0	0	4

Course Objectives:

- To impart the knowledge of various principles of ergonomics.
- To know various considerable factors of workplace design.
- To understand the compatibility of man and machine.

Unit-A

Introduction to Human Factors: **(5Hrs.)**

Scope of human factors, Study of human factors as a science, Cost/benefit analysis of human factors contributions, Human factors in the product design lifecycle, User centered design, Sources for design work.

Front End Analysis: **(4Hrs.)**

User analysis, Environmental analysis, Function and task analysis, Perform, Collect, Summarize and Analyse task data, Identify user preferences and requirements.

Iterative Design and Testing: **(4Hrs.)**

Providing input for system specifications, Organization design, Prototype, Heuristic evaluation, Usability testing, final test and evaluation

Unit-B

Human Variability and Statistics: **(2Hrs.)**

Human variability, Statistical analysis

Anthropometric Data: **(3Hrs.)**

Measurement devices and methods, Civilian and Military data, Structural and functional data, Use of anthropometric data in design.

General Principles of Workspace Design: **(5Hrs.)**

Clearance requirements of the largest users, Reach requirements of the smallest users, Special requirement of maintenance people, Adjustability requirements, Visibility and normal line of sight, Component arrangement.

Design of Standing and Seated Work Areas: **(3Hrs.)**

Choice between standing and seated work areas, Work surface height, Work surface depth, Work surface inclination.

Unit-C

Muscle Structure and Metabolism: **(3Hrs.)**

Muscle Structure, Aerobic and Anaerobic metabolism

Circulatory and Respiratory Systems: (3Hrs.)

The circulatory systems, the respiratory systems

Energy Cost of Work and Workload Assessment: **(3Hrs.)**

Energy cost of work, Measurement of Workload.

Physical Work Capacity and Whole Body Fatigue: (4Hrs.)

Short term and Long term work capacity, Causes and Control of whole body fatigue, Static work and Local muscle fatigue

Unit-D

Environmental Stressors: (3Hrs.)

Motion, Thermal Stress, Air quality

Psychological Stressors: (4Hrs.)

Cognitive appraisal, Ethical issues, Level of arousal, Performance changes with over arousal, Remedial of psychological stress.

Life Stress (3Hrs.)

Workload Overload:

Remediation, Mental workload measurement

Fatigue and Sleep Disruption: (4Hrs.)

Vigilance and under arousal, Sleep disruption and Performance effects, Remediation of sleep disruption.

Safety Accidents and Human Errors (2Hrs.)

Learning Outcome:

- Students will learn about the basic concepts ergonomics.
- Students will learn how to design the workplace keeping considering various parameters.
- Students will learn about the fatigue between the man and the machine.

References:

1. Wickens and Lee. *An introduction to Human Factor Engineering*. New Delhi: PHI. 2014. Print.
2. Murrell, K.F.H, Champan& Hall. *Ergonomics: Man in his working environment*. London. 2012.Print.
3. Alexander, D.C. *The Practice and Management of Industrial Ergonomics.* Prentice-Hall, Englewood Cliffs, NJ. 1986. Print.
4. Astrand, P.O. and Rhodahl, K. *Textbook of Work Physiology.* New York: McGraw-Hill. 2003. Print.
5. http://nptel.ac.in/courses/107103004

Syllabus: Batch 2020 Onwards

Course Title: Power Plant Engineering

Paper Code: MEC447

L	T	P	Credits
4	0	0	4

Course Objective:

To acquaint students with both steam generation and electricity production and to present some of the engineering calculations encountered in practice

Unit-A

Introduction

Energy resources and their availability, types of power plants, selection of the plants, review of basic thermodynamic cycles used in power plants.

Hydro Electric Power Plants

Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, power plants design, construction and operation of different components of hydro-electric power plants, site selection, comparison with other types of power plants.

Unit-B

Power Plants

Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, site selection, coal storage, preparation, coal handling systems, feeding and burning of pulverized fuel, ash handling systems, dust collection-mechanical dust collector and electrostatic precipitator. Combined Cycles: Constant pressure gas turbine power plantsUnit IV Steam, Arrangements of combined plants (steam & gas turbine power plants), repowering systems with gas production from coal, using PFBC systems, with organic fluids, parameters affecting thermodynamic efficiency of combined cycles Problems

Unit-C

Nuclear Power Plants

Principles of nuclear energy, basic nuclear reactions, nuclear reactors-PWR, BWR, CANDU, Sodium graphite, fast breeder, homogeneous; gas cooled. Advantages and limitations, nuclear power station, waste disposal.

Syllabus: Batch 2020 Onwards

Power Plant Economics

Load curve, different terms and definitions, cost of electrical energy, tariffs methods of electrical energy, performance & operating characteristics of power plants- incremental rate theory, input-output curves, efficiency, heat rate, economic load sharing, Problems.

Unit-D

Non-Conventional Power Generation

Solar radiation estimation, solar energy collectors, low, medium & high temperature power plants, OTEC, wind power plants, tidal power plants, geothermal power plants.

Direct Energy Conversion Systems

Fuel cell, MHD power generationprinciple, open & closed cycles systems, thermoelectric power generation, thermionic power generation.

Reference:

1. Skrotzki, Bernhardt G.A. and Vopat , William A.*, Power station Engineering and Economy.* New Delhi, Tata McGraw Hill Publishing Company Ltd. Print.
2. Nag, P.K. *Power Plant Engineering*. New Delhi: Tata McGraw Hill,Second Edition, 2001. Print.
3. El-Wakil, M.M. *Power Plant Engineering*, McGraw Hill 1985.Print.
4. http://nptel.ac.in/courses/108105058/

Open Electives

Syllabus: Batch 2020 Onwards

Course Title: Industrial Engineering Techniques

Course Code: MEC801

L	T	P	Credits
4	0	0	4

Course Objective:

- To conduct time and motion study to improve the methods/system and to increase productivity
- To impart the valuable skills to plan and understand concepts of material management

Unit-A

Industrial Engineering (5Hrs)

Introduction, Definition and concept, Place of industrial engineer in an organization, Activities of Industrial Engineering, Industrial Engineering Approach, Objectives of Industrial Engineering, Functions of the Industrial Engineer, Techniques of Industrial Engineering, Industrial Engineering in Services Sector, Qualities of Industrial Engineer

Production and Productivity (5Hrs)

Introduction, Production & Productivity Concept, Difference between production and productivity, Expectations from productivity, Tools of productivity, Reasons of low productivity, Productivity Measurement System, Technical Methods to Improve Productivity, Advantages from Increased Productivity

Value Engineering (4Hrs)

Introduction and Concept of Value Engineering, Objectives of Value Engineering, When to Apply Value Engineering, Applications of Value Engineering, Benefits of Value Engineering, Value Engineering Procedures

Unit-B

Production Planning and Control (7Hrs)

Introduction, Key Terms - Production; Planning; Control, Production Planning and Control, Difference between production planning and production control, Objectives and Functional Elements of PPC, Types of Production System (Job, Batch and Continuous), Break even analysis

Plant Location and Layout (6Hrs)

Introduction, Site Selection, Reasons for appropriate location selection, Factors to choose site of plant, Urban, Rural and Suburban areas, Economic survey of site selection, Plant Layout, Objectives and Principles of plant layout, Factors affecting plant layout, Plant layout procedure, Types of plant layout, Flow patterns, Symptoms of bad layout, Work Station Design.

Syllabus: Batch 2020 Onwards

Unit-C

Material Handling (5Hrs)

Introduction, Definition and Concept, Benefits and negative aspects of material handling, Principles of economic material handling, Relationship to plant layout, Selection of Material Handling Equipment, Safety Required While Using Material Handling Equipment, Material Handling Equipment's and its types.

Work Study (8Hrs)

Introduction, Work Study: Need, Applications, Advantages, Work Study Procedure

Method Study: Definition, Objectives, Procedure, Charts, Diagrams, Motion and Film Analysis, Therbligs, Models, Principles of Motion Economy

Work Measurement: Definition, Objectives, Procedure, Techniques of work measurement (Time Study, PMTS), Performance Rating, and Allowance.

Unit-D

Repair and Maintenance (5Hrs)

Introduction, Definition of Maintenance: Objectives, Benefits, Organization of maintenance department, Types of Maintenance, Nature of Maintenance Problem, Range of Maintenance Activities, Preventive Maintenance and its procedure, Schedule of preventative maintenance, Maintenance Performance Evaluation, Essential Requirements of a Good Preventive Maintenance, Eliminating Wastage in Maintenance Work

Cost Estimation and Control (5Hrs)

Introduction, Cost and Its Classification, Costing, Cost Estimation, Difference between Cost Estimation and Costing, Elements of Cost, Ladder of Cost, Overhead Expenses, Mathematical Formulae to Calculate Volume of Components, Densities of Metals, Depreciation, Cost Control

Material Management (6Hrs)

Material Management (Functions, Advantages, Objectives),Purchasing (Functions, Objectives, VPR, Purchasing Procedure),Store Management (Functions and Duties, Location and Layout of Stores, Principles of efficient store layout, Approaches of store location, Types of store layouts,) Inventory (Inventory Control, Classification, Need, Benefits, Disadvantage, Objectives), Various levels of Inventory Control, Inventory Control Techniques, Introduction to JIT

Syllabus: Batch 2020 Onwards

Learning Outcomes:

- Students will be able to know about various work study techniques.
- Student will able to know about how to increase the value of the product.
- Student will able to calculate the cost of the product.
- Students will able to know about the various material management techniques.

References:

1. Bansal, V.B. *Industrial Engineering and Production Management.* New Delhi: Kapson Publishers. 2015. Print.
2. Raju, N.V.S. *Industrial Engineering and Management*. New Delhi: Cengage Learning. 2013. Print.
3. Chunawala. *Production and Operation Management.* New Delhi: Himalaya Publication. 2013. Print.
4. Dalela, and Ali, Mansoor. *Industrial Engineering and Management Systems*. New Delhi: Standard Publishing Distributors. 2010. Print.
5. Hicks. *Industrial Engineering & Management-A new perspective*. New Delhi: Tata McGraw Hill. 2014. Print.
6. Shankar, Ravi. *Industrial Engineering and Management*. New Delhi: Galgotia Publishers. 2010. Print.
7. Jain and Agarwal. *Production Planning & Control.* New Delhi: Khanna Publishers. 2013. Print.
8. Verma, A.P. *Industrial Engineering and Management*. New Delhi: Katson Books. 2010. Print.
9. http://nptel.ac.in/courses/112107143/
10. http://nptel.ac.in/courses/112107142/

Syllabus: Batch 2020 Onwards

Course Title: **Energy Resources**

Course Code: MEC802

L	T	P	Credits
4	0	0	4

Course Objectives:

- To impart the knowledge of Conventional and non-conventional resources..
- Understanding the definition, scope and limitation of energy, sustainability and their measures.
- Estimate the advantage and disadvantage of biomass energy, geothermal energy and Fuel cell technology.

Unit-A

Introduction (4 Hrs.)

Conventional (fossil energy) and non-conventional (alternative energy) resources & reserves, Global Energy production & consumption pattern, Production & consumption pattern in India. Present Scenario of Non-conventional energy resources in India.

Conventional (6Hrs.)

Introduction to Biomass, Wood and Charcoal, theory of coal, Constituents of Biomass materials, Classification & Rank of Coal, Peat, Lignite, Sub-Bituminous coal, Bituminous coal, Anthracite coal, Cannel & Bog head coal. Physical Properties of coal, Proximate & Ultimate Analysis of Coal, cleaning, washing & Storage of coal

Unit-B

Non-Conventional Energy Resources

Solar energy (8 Hrs.)

Direct Solar energy systems : Solar energy supply, Technologies for converting and capturing solar energy, Solar photovoltaic simple and hybrid system, Solar radiation and its measurements, Types of solar thermal collectors - Flat and concentrating collectors, solar thermal applications - Water heaters, dryers, stills, refrigeration, air-conditioning, solar pond, central receiver power generation.

Wind Energy (7 Hrs.)

Principle of wind blow, Design of windmills, Wind turbines sizes, Energy Estimation - Site selection considerations, components of WECS - Advantages and disadvantages of WECS - Design consideration wind mills, Aerofoil theory, analysis of aerodynamic forces acting on the blade.

Syllabus: Batch 2020 Onwards

Unit-C

Latest Trends in Energy Resources

Ocean Energy (6Hrs.)

Ocean Thermal Energy Conversion, Wave and tidal energy - Availability, geographical distribution, Power generation using OTEC, Scope and economics - Geothermal energy, availability., power plants - Small, mini and micro hydro power plants.

Geothermal Energy (3 Hrs.)

Introduction and history, Present utilization, Energy extraction, Geothermal fields, Limitation of Geothermal Energy, Future Scope.

Energy Conversion Systems (6Hrs.)

Basic principle of thermo-electric and thermo-ionic power generations, Fuel cell principle, types, conversion efficiency, applications, Magneto hydrodynamic power generation, Hydrogen energy - Production, storage, transportation.

Unit-D

Bio –Fuel and Bio-Energy (8 Hrs.)

Biomass as fuel, Biochemical conversion of biomass for energy production, Liquid biofuel Biodiesel mechanism of transesterification, fuel characteristics of biodiesel, technical aspects o f biodiesel engine utilization,Alcohol production from biomass- types of materials of alcohol pr oduction-process description, utilization Chemical conversion of biomass for energy production, Synthesis bio fuel, Thermo chemical conversion of biomass

Waste Recycling Management (8 Hrs.)

Common source of waste domestic, commercial, industrial, biomedical and agricultural waste, Different type of waste municipal waste, industrial solid waste, biomedical waste, Commercial, waste management, recycling, recycling process, waste recycling management, advantages and disadvantages of recycling product. Recycling plant

Learning Outcomes:

- Students will learn about the conventional and non-conventional energy resources.
- Student will learn about the energy scenario around the world.
- Students will able to know about the detail classification of fuel viz, solid, gaseous and liquid fuels.

References:

1. Boyle, G.*Renewable energy: Power for a sustainable future.*Oxford University press, 2004. Print.
2. Rai G. D.*Non conventional energy sources*, Khanna Publishers, New Delhi, 2006.Print.
3. Kothari, D. P. *Renewable Energy Resources and Emerging Technology,* Prentice Hall-India 2011. Print.
4. Khan B H, *Non Conventional Energy Resource*s, Tata McGraw Hill Second edition 2009. Print.