Diploma: Mechanical Engineeing

Semester-I			
Course Name:	Mathematics- I	**Course Code:**	DMA101
L P T Scheme:	**2-1-0**	**Credits:**	**3**
Prerequisites: Nil			
Objective:			
This course is designed to give a comprehensive coverage at an introductory level to the subject of Trigonometry, Differential Calculus and Basic elements of algebra.			

Learning Outcomes:

Course Outcome	Description
CO1	The students are expected to acquire necessary background in Trigonometry to appreciate the importance of the geometric study as well as for the calculation and the mathematical analysis.
CO2	The ability to find the effects of changing conditions on a system.
CO3	Complex numbers enter into studies of physical phenomena in ways that most people cannot imagine.
CO4	The partial fraction decomposition lies in the fact that it provides an algorithm for computing the antiderivative of a rational function.

Course Content:

Unit 1:	**Trigonometry:**Concept of angles, measurement of angles in degrees, grades and radians and their conversions, T-Ratios of Allied angles (without proof), Sum, difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa). T- Ratios of multiple angles, sub-multiple angles (2A, 3A, A/2). Graphs of sin x, cos x, tan x and e^x.
Unit 2:	**Differential Calculus:** Definition of function; Concept of limits. Four standard limits $\lim_{x \to a} \frac{x^n - a^n}{x-a}$, $\lim_{x \to 0} \frac{\sin x}{x}$, $\lim_{x \to a} \left(\frac{a^x - 1}{x}\right)$ and $\lim_{x \to a} (1+x)^{\frac{1}{x}}$. Differentiation by definition. Differentiation of sum, product and quotient of functions. Differentiation of function of a function. Differentiation of trigonometric and inverse trigonometric functions, Logarithmic differentiation, Exponential functions.
Unit 3:	**Complex Numbers:** Definition, real and imaginary parts of a Complex number, polar and Cartesian, representation of a complex number and its conversion from one form to other, conjugate of a complex number, modulus and amplitude of a complex number Addition, Subtraction, Multiplication and Division of a complex number. Demovier's theorem, its application.

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Unit 4:	**Partial fractions:** Definition of polynomial fraction proper & improper fractions and definition of partial fractions. To resolve proper fraction into partial fraction with denominator containing non-repeated linear factors, repeated linear factors and irreducible non-repeated quadratic factors. To resolve improper fraction into partial fraction.
Unit 5:	**Permutations and Combinations:** Value of ${}^{n}P_{r}$ and ${}^{n}C_{r}$. **Binomial theorem:** Binomial theorem (without proof) for positive integral index (expansion and general form); binomial theorem for any index (expansion without proof) first and second binomial approximation with applications to engineering problems

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 40th Edition, 2007.
2. G. B. Thomas, R. L. Finney, Calculus and Analytic Geometry, Addison Wesley, 9th Edition, 1995.
3. Reena Garg, Engineering Mathematics, Khanna Publishing House, New Delhi (Revised Ed. 2018)
4. V. Sundaram, R. Balasubramanian, K.A. Lakshminarayanan, Engineering Mathematics,
5. Reena Garg & Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishing House, New Delhi.

Semester-I			
Course Name:	**Applied Physics-I**	**Course Code:**	DPH102
L P T Scheme:	**2-1-0**	**Credits:**	**3**
Prerequisites: Nil			
Objective: This course is aimed at			
Applied Physics includes the study of a large number of diverse topics all related to materials/things that exist in the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which such objects			

behave. Concrete use of physical principles and analysis in various fields of engineering and technology are given prominence in the course content. The course will help the diploma engineers to apply the basic concepts and principles to solve broad based engineering problems and to understand different technology based applications

Learning Outcomes:

Course Outcome	Description
CO1	Identify physical quantities, select their units for use in engineering solutions, and makemeasurements with accuracy by minimizing different types of errors.
CO2	Analyse type of motions and apply the formulation to understand banking of roads/railwaytracks and conservation of momentum principle to describe rocket propulsion, recoil of gunetc.
CO3	Describe forms of friction and methods to minimize friction between different surfaces.
CO4	Compare and relate physical properties associated with linear motion and rotational motionand apply conservation of angular momentum principle to known problems.
CO5	Define stress and strain. State Hooke's law and elastic limits, stress–strain diagram, determine;(a) the modulus of elasticity, (b) the yield strength (c) the tensile strength, and (d)estimate the percent elongation.
CO6	Distinguish between conduction, convection and radiation; identify different methods for reducingheat losses and mode of heat transfer between bodies at different temperatures. State specific heats and measure the specific heat capacity of solids and liquids.

Course Content:

Unit 1:	**Physical world, Units and Measurements:** Physical quantities; fundamental and derived, Units and systems of units (FPS, CGS and SIunits), Dimensions and dimensional formulae of physical quantities, Principle of homogeneity of dimensions, Dimensional equations and their applications (conversion from one system of units to other, checking of dimensional equations and derivation of simple equations), Limitations of dimensional analysis. Measurements: Need, measuring instruments, least count, types of measurement (direct, indirect), Errors in measurements (systematic and random), absolute error, relative error, error propagation, error estimation and significant figures.
Unit 2:	**Force and Motion:** Scalar and Vector quantities – examples, representation of vector, types of vectors. Addition and Subtraction of Vectors, Triangle and Parallelogram law (Statement only), Scalar and Vector Product, Resolution of a Vector and its application to inclined plane and lawn roller. Force, Momentum, Statement and derivation of conservation of linear momentum, its applications such as recoil of gun, rockets, Impulse and its applications. Circular motion, definition of angular displacement, angular velocity, angular acceleration, frequency, time period, Relation between linear and angular velocity, linear acceleration and angular acceleration (related

	numerical), Centripetal and Centrifugal forces with live examples, Expression and applications such as banking of roads and bending of cyclist.
Unit 3:	**Work, Power and Energy:** Work: Concept and units, examples of zero work, positive work and negative work Friction: concept, types, laws of limiting friction, coefficient of friction, reducing friction and its engineering applications, Work done in moving an object on horizontal and inclined plane for rough and plane surfaces and related applications. Energy and its units, kinetic energy, gravitational potential energy with examples and derivations, mechanical energy, conservation of mechanical energy for freely falling bodies, transformation of energy (examples). Power and its units, power and work relationship, calculation of power (numerical problems).
Unit 4:	**Rotational Motion:** Translational and rotational motions with examples, Definition of torque and angular momentum and their examples, Conservation of angular momentum (quantitative) and its applications. Moment of inertia and its physical significance, radius of gyration for rigid body, Theorems of parallel and perpendicular axes (statements only), Moment of inertia of rod, disc, ring and sphere (hollow and solid); (Formulae only).
Unit 5:	**Properties of Matter:** Elasticity: definition of stress and strain, modulus of elasticity, Hooke's law, significance of stress-strain curve. Pressure: definition, units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer and its applications. Surface tension: concept, units, cohesive and adhesive forces, angle of contact, Ascent Formula (No derivation), applications of surface tension, effect of temperature and impurity on surface tension. Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law and effect of temperature on viscosity, application in hydraulic systems.Hydrodynamics: Fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem (only formula and numericals) and its applications.
Unit 6:	**Heat and Thermometry:** Concept of heat and temperature, modes of heat transfer (conduction, convection and radiation with examples), specific heats, scales of temperature and their relationship, Types of Thermometer (Mercury thermometer, Bimetallic thermometer, Platinum resistance thermometer, Pyrometer) and their uses. Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them, Co-efficient of thermal conductivity, engineering applications.

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	

Quiz	5	
Attendance	5	
Total	100	

Books:

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

Semester-I			
Course Name:	**AppliedChemistry**	**Course Code:**	DCH103
L P T Scheme:	**2-1-0**	**Credits:**	**3**
Prerequisites: Nil			
Objective: This course is aimed at			
There are numerous number materials are used in fabricating and manufacturing devices for the comfort of life. The selection, characterization and suitability assessment of natural raw materials essentially requires principles and concepts of Applied Chemistry for technicians. On successful completion of this course content will enable technicians to understand, ascertain and analyse and properties of natural raw materials require for producing economical and eco-friendly finished products. • Use relevant water treatment method to solve domestic and industrial problems. • Solve the engineering problems using knowledge of engineering materials and properties. • Use relevant fuel and lubricants for domestic and industrial applications • Solve the engineering problems using concept of Electrochemistry and corrosion. • Rural raw materials require for producing economical and eco-friendly finished products.			

Learning Outcomes:

Course Outcome	**Description**
CO1	Understand the classification and general properties of engineering materials such as metal alloys, glasses, cement, refractory and composite materials using knowledge of

	chemicalbonding.
CO2	Understand and assess the suitability of water source for domestic and industrial application, effluents and minimize water pollution.
CO3	Qualitatively analyze the engineering materials and understand their properties and applications.
CO4	Choose fuel and lubricants suitable for economical industrial processing to obtain eco-friendlyfinished products.
CO5	a) Ascertain construction, mechanism efficiency of electrochemical cells, solar cell fuel cells, b) Understand corrosion and develop economical prevention techniques.

Course Content:

Unit 1:	**Atomic Structure, Chemical Bonding and Solutions:** Rutherford model of atom, Bohr's theory (expression of energy and radius to be omitted), and hydrogen spectrum explanation based on Bohr's model of atom, Heisenberg uncertainty principle, Quantum numbers – orbital concept. Shapes of s,p and d orbitals, Pauli's exclusion principle, Hund's rule of maximum multiplicity Aufbau rule, electronic configuration. Concept of chemical bonding – cause of chemical bonding, types of bonds: ionic bonding (NaCl example), covalent bond (H_2, F_2, HF hybridization in $BeCl_2$, BF_3, CH_4, NH_3, H_2O), coordination bond in NH_4 , and anomalous properties of NH3, H2O due to hydrogen bonding, andmetallic bonding. Solution – idea of solute, solvent and solution, methods to express the concentration of solution-molarity (*M* = mole per liter), ppm, mass percentage, volume percentage and mole fraction.
Unit 2:	**Water:** Graphical presentation of water distribution on Earth (pie or bar diagram). Classification ofsoft and hard water based on soap test, salts causing water hardness, unit of hardness andsimple numerical on water hardness. Cause of poor lathering of soap in hard water, problems caused by the use of hard water in boiler (scale and sludge, foaming and priming, corrosion etc), and quantitative measurement of water hardness by ETDA method, total dissolved solids (TDS) alkalinity estimation. i). Water softening techniques – soda lime process, zeolite process and ion exchange process. ii). Municipal water treatment (in brief only) – sedimentation, coagulation, filtration, sterilization. Water for human consumption for drinking and cooking purposes from any water sources and enlist Indian standard specification of drinking water (collect data and understandstandards).
Unit 3:	**Engineering Materials:** Natural occurrence of metals–minerals, ores of iron, aluminum and copper, gangue (matrix), flux, slag, metallurgy–brief account of general principles of metallurgy. Extraction of - iron from hematite ore using blast furnace, aluminum from bauxite along with reactions. Alloys – definition, purposes of alloying, ferrous alloys and non-ferrous with suitable examples, properties and applications. General chemical composition, composition based applications (elementary idea only details omitted): Port land cement and hardening, Glasses Refractory

	and Composite materials. Polymers – monomer, homo and co polymers, degree of polymerization, simple reactions involved in preparation and their application of thermoplastics and thermosetting plastics (using PVC, PS, PTFE, nylon – 6, nylon-6,6 and Bakelite), rubber and vulcanization of rubber.
Unit 4:	**Chemistry of Fuels and Lubricants:** Definition of fuel and combustion of fuel, classification of fuels, calorific values (HCV and LCV), calculation of HCV and LCV using Dulong's formula. Proximate analysis of coal solid fuel petrol and diesel - fuel rating (octane and cetane numbers), Chemical composition, calorific values and applications of LPG, CNG, water gas, coal gas, producer gas and biogas. Lubrication – function and characteristic properties of good lubricant, classification with examples, lubrication mechanism – hydrodynamic and boundary lubrication, physical properties (viscosity and viscosity index, oiliness, flash and fire point, could and pour point only) and chemical properties (coke number, total acid number saponification value) of lubricants.
Unit 5:	**Electro Chemistry:** Electronic concept of oxidation, reduction and redox reactions.Definition of terms: electrolytes, non-electrolytes with suitable examples, Faradays laws of electrolysis and simple numerical problems. Industrial Application of Electrolysis – • Electrometallurgy • Electroplating • Electrolytic refining. Application of redox reactions in electrochemical cells – • Primary cells – dry cell, • Secondary cell - commercially used lead storage battery, fuel and Solar cells. Introduction to Corrosion of metals – • Definition, types of corrosion (chemical and electrochemical), H2 liberation andO_2absorption mechanism of electrochemical corrosion, factors affecting rate of corrosion. Internal corrosion preventive measures – • Purification, alloying and heat treatment andExternal corrosion preventive measures: a) metal (anodic, cathodic) coatings, b) organicinhibitors.

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	

Attendance	5	
Total	100	

Books:

1. Text Book of Chemistry for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi, 2017-18.
2. Agarwal, & Shikha, Engineering Chemistry, Cambridge University Press; New Delhi, 2015.
3. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
4. Dara, S. S. &Dr.S.S.Umare, Engineering Chemistry, S.Chand. Publication, New Delhi, New Delhi,2015.
5. Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi, 2015.
6. Dr. Vairam, S., Engineering Chemistry, Wiley India Pvt.Ltd., New Delhi, 2013.
7. Dr. G. H. Hugar & Prof A. N. Pathak, Applied Chemistry Laboratory Practices, Vol. I and Vol. II,NITTTR, Chandigarh, Publications, 2013-14.
8. Agnihotri, Rajesh, Chemistry for Engineers, Wiley India Pvt.Ltd., 2014.

Semester-I			
Course Name:	**Communication Skills in English**	**Course Code:**	DHS104
L P T Scheme:	**2-0-0**	**Credits:**	**2**

Prerequisites: Nil

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

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

Learning Outcomes:

Course Outcome	**Description**
CO1	Develop basic speaking and writing skills including proper usage of language and vocabulary so that they can become highly confident and skilled speakers and writers.
CO2	Be informed of the latest trends in basic verbal activities such as presentations, facing interviews and other forms of oral communication
CO3	Also develop skills of group presentation and communication in team.
CO4	Develop non-verbal communication such as proper use of body language and gestures.

Course Content:

Unit 1:	**Communication: Theory and Practice**

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	• Basics of communication: Introduction, meaning and definition, process of communication etc. • Types of communication: formal and informal, verbal, non-verbal and written Barriers to effective communication. • 7 Cs for effective communication (considerate, concrete, concise, clear, complete, correct, courteous). • Art of Effective communication, o Choosing words o Voice o Modulation o Clarity o Time o Simplification of words • Technical Communication.
Unit 2:	**Soft Skills for Professional Excellence** • Introduction: Soft Skills and Hard Skills. • Importance of soft skills. • Life skills: Self-awareness and Self-analysis, adaptability, resilience, emotional intelligenceand empathy etc. • Applying soft skills across cultures. • Case Studies.
Unit 3:	**Reading Comprehension** Comprehension, vocabulary enhancement and grammar exercises based on reading of the following texts: **Section-1** *Malgudi Days*: R.K. Narayan *The Room on Roof*: Ruskin Bond "The Gift of the Magi" by O. Henry "Uncle Podger Hangs a Picture" Jerome K. Jerome **Section-2** Night of the Scorpion by Nissim Ezekiel, Stopping by Woods on a Snowy Evening by Robert Frost, Where the Mind is Without Fear by Rabindranath Tagore, Ode to Tomatoes by Pablo Neruda,
Unit 4:	**Professional Writing** • The art of précis writing, • Letters: business and personnel, • Drafting e-mail, notices, minutes of a meeting etc. • Filling-up different forms such as banks and on-line forms for placement etc.
Unit 5:	**Vocabulary and Grammar** • Vocabulary of commonly used words • Glossary of administrative terms (English and Hindi) • One-word substitution, Idioms and phrases etc. • Parts of speech, active and passive voice, tenses etc., Punctuation

Evaluation Scheme:

Exam	Marks	Course Coverage

Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

1. J.D.O'Connor. Better English Pronunciation. Cambridge: Cambridge University Press, 1980.
2. Lindley Murray. An English Grammar: Comprehending Principles and Rules. London: Wilsonand Sons, 1908.
3. Kulbhushan Kumar, Effective Communication Skills, Khanna Publishing House, New Delhi (RevisedEdition 2018)
4. Margaret M. Maison. Examine your English. Orient Longman: New Delhi, 1964.
5. M. Ashraf Rizvi. Effective Technical Communication. Mc-Graw Hill: Delhi, 2002.
6. John Nielson. Effective Communication Skills. Xlibris, 2008.
7. Oxford Dictionary
8. Roget's Thesaurus of English Words and Phrases
9. Collin's English Dictionary.

Semester-I			
Course Name:	**Engineering Drawing**	**Course Code:**	DME202
L P T Scheme:	**0-0-3**	**Credits:**	**1.5**
Prerequisites: Nil			
Objective: This course is aimed at			
• To understand the language of graphics which is used to express ideas, convey instructions while carrying out engineering jobs. • To develop drafting and sketching skills, to know the applications of drawing equipments, and get familiarize with Indian Standards related to engineering drawings. • To develop skills to visualize actual object or a part of it, on the basis of drawings. • To develop skills to translate ideas into sketches and to draw and read various engineering curves, projections and dimensioning styles. • To understand the basic commands and develop basic skills related to computer aided drafting, of how to draw, modify, and edit basic shapes (2D), using AUTOCAD.			

Learning Outcomes:

Course	Description

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Outcome	
CO1	Select and construct appropriate drawing scales, use drawing equipment's,
CO2	understand Indian Standards of engineering drawing
CO3	Draw views of given object and components 3) Sketch orthographic projections into isometric projections and vice versa.
CO4	Apply computer aided drafting tools to create 2D engineering drawings

List of Experiments:

S. No.	PracticalExercises
1	Draw horizontal, Vertical, 30°, 45°, 60° and 75° lines, different types of lines, dimensioning styles using Tee and Set squares/ drafter. (dothisexercisein sketchbook)
2	Writealphabetsandnumerical(Verticalonly)(dothisexerciseinsketchbook)
3	Drawregulargeometricconstructionsandredrawthegivenfigure(dothisexercisein sketchbook)PartI
4	Drawregulargeometricconstructionandredrawthegivenfigure(dothisexercisein sketchbook)PartII
5	Drawaproblemonorthographicprojectionsusingfirstanglemethodofprojectionhavin g plainsurfacesandslanting.PartI
6	Drawanotherproblemonorthographicprojectionsusingfirstanglemethodofprojectio nhavingslantingsurfaceswithslots.PartII
7	Drawtwoproblemsonorthographicprojectionsusingfirstanglemethodofprojectionha ving cylindricalsurfaces,ribs.PartI
8	Draw twoproblemsonIsometric viewofsimpleobjectshaving plainand slantingsurfaceby usingnaturalscale. PartI
9	DrawsomeproblemsonIsometricprojectionofsimpleobjectshavingcylindricalcalsur faceby usingisometricscale. PartI
10	Draw free hand sketches/ conventional representation of machine elementsin sketch book such as thread profiles, nuts, bolts, studs, set screws, washers,Lockingarrangements.PartI
11	ProblembasedLearning:Giventheorthographicviewsofatleastthreeobjectswith few missing lines, the student will try to imagine the corresponding objects,completetheviewsanddrawtheseviewsinsketchbook.PartI
12	Drawbasic2Dentitieslike:Rectangle,Rhombus,PolygonusingAutoCAD(Printoutsh ouldbeapartofprogressiveassessment).PartI
13	Drawbasic2Dentitieslike:Circles,Arcs,circularusingAutoCAD(Printoutshouldbea partofprogressiveassessment).PartII
14	Drawbasic2Dentitieslike:CircularandrectangulararrayusingAutoCAD(Printoutsho uldbeapartofprogressiveassessment).PartIII
15	Draw blocks of 2D entities comprises of Rectangle, Rhombus, Polygon, Circles,Arcs, circular and rectangular array, blocks using AutoCAD (Print out shouldbe a part of progressive assessment). Part IV
16	Draw basic branch specific components in 2D using AutoCAD (Print out shouldbe a part of term work). Part I

17	Draw complex branch specific components in 2D using AutoCAD (Print shouldbe a part of progressive assessment). Part I

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	25	Full syllabus
DTDW	40	
Discipline and attendance	15	
Lab Record	15	
Total	100	

Books:

1. Bureau of Indian Standards. Engineering Drawing Practice for Schools and Colleges IS: Sp-46. BIS.Government of India, Third Reprint, October 1998; ISBN: 81-7061-091-2.
2. Bhatt, N. D. Engineering Drawing. Charotar Publishing House, Anand, Gujrat 2010; ISBN: 978-93-80358-17-8.
3. Jain & Gautam, Engineering Graphics & Design, Khanna Publishing House, New Delhi (ISBN: 978-93-86173-478)
4. Jolhe, D. A. Engineering Drawing. Tata McGraw Hill Edu. New Delhi, 2010; ISBN: 978-0-07-064837-1
5. Dhawan, R. K. Engineering Drawing. S. Chand and Company, New Delhi; ISBN: 81-219-1431-0.
6. Shah, P. J. Engineering Drawing. S. Chand and Company, New Delhi, 2008, ISBN:81-219-2964-4.
7. Kulkarni, D. M.; Rastogi, A. P.; Sarkar, A. K. Engineering Graphics with AutoCAD. PHI Learning PrivateLimited-New Delhi (2010); ISBN: 978-8120337831.
8. Jeyapoovan, T. Essentials of Engineering Drawing and Graphics using AutoCAD. Vikas PublishingHousePvt. Ltd, Noida, 2011; ISBN: 978-8125953005.
9. Autodesk. AutoCAD User Guide. Autodesk Press, USA, 2015.
10. Sham, Tickoo. AutoCAD 2016 for Engineers and Designers. Dreamtech Press; Galgotia Publication,New Delhi, 2015; ISBN 978-9351199113.

Semester-I			
Course Name:	**Engineering Workshop Practice**	**Course Code:**	DME201
L P T Scheme:	**0-0-3**	**Credits:**	**1.5**

Prerequisites: Nil

Objective: This course is aimed at

- To understand basic engineering processes for manufacturing and assembly.
- To understand, identify, select and use various marking, measuring, and holding, striking and cutting g tools and equipment's
- To understand and interpret job drawings, produce jobs, and inspect the job for specified

- dimensions
- To understand the various types of wiring systems and acquire skills in house wiring
- To understand, operate, control different machines and equipment's adopting safety practices

Learning Outcomes:

CO1	Acquireskillsinbasicengineeringpracticetoidentify,selectandusevariousmarking,measuring,andholding,striking andcuttingtools& equipment'sandmachines
CO2	Understandjobdrawingandcompletejobsasperspecificationsinallottedtime
CO3	Inspectthejobforthedesireddimensionsandshape
CO4	Operate,controldifferentmachinesandequipment'sadoptingsafetypractices

List of Experiments:

S.No.	DetailsOfPracticalContent
I	**Carpentry:**i)Demonstrationofdifferentwoodworkingtools/machines.ii)Demonstrationof different wood working processes, like plaining, marking, chiseling, grooving, turning ofwood etc. iii) One simple job involving any one joint like mortise and tenon dovetail, bridle,halflapetc.
II	**Fitting:** i) Demonstration of different fitting tools and drilling machines and power tools ii)Demonstration of different operations like chipping, filing, drilling, tapping, sawing, cuttingetc. iii) One simple fitting job involving practice of chipping, filing, drilling, tapping, cuttingetc
III	**Welding:** i) Demonstration of different welding tools / machines. ii) Demonstration on ArcWelding, Gas Welding, MIG, MAG welding, gas cutting and rebuilding of broken parts withwelding.iii) Onesimple jobinvolving buttandlapjoint
IV	**Sheet Metal Working:** i) Demonstration of different sheet metal tools / machines. ii)Demonstration of different sheet metal operations like sheet cutting, bending, edging, endcurling, lancing, soldering, brazing, and riveting. iii) One simple job involving sheet metaloperationsandsoldering andriveting.
V	**Electrical House Wiring:** Practice on simple lamp circuits (i) one lamp controlled by oneswitch by surface conduit wiring, (ii) Lamp circuits- connection of lamp and socket by separateswitches,(iii)ConnectionofFluorescentlamp/tubelight,(iv)simplelampcircuits-in-stallbedroomlighting.And(v) Simplelampcircuits-install staircasewiring.
VI	**Demonstration:**i)DemonstrationofmeasurementofCurrent,Voltage,PowerandEnergy.ii)Demonstrationofadvancepowertools,pneumatictools,electricalwiringtoolsandaccessories.iii) Tools forCuttinganddrilling

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	25	Full syllabus
DTDW	40	
Discipline and attendance	15	

Lab Record	15	
Total	100	

Books:

1. S.K.HajaraChaudhary,WorkshopTechnology,MediaPromotersandPublishers,NewDelhi,2015
2. B.S.Raghuwanshi,WorkshopTechnology,DhanpatRaiandsons,NewDelhi2014
3. K.VenkatReddy,WorkshopPracticeManual,BSPublications,Hyderabad2014
4. KentsMechanicalEngineeringHandbook,JohnWileyandSons,NewYork.

Semester-I			
Course Name:	**Applied Physics–I Lab**	**Course Code:**	DPH203
L P T Scheme:	**0-0-2**	**Credits:**	**1**
Prerequisites: Nil			
Objective: This course is aimed at			
• StudyofAppliedPhysicsaimstogiveanunderstandingofphysicalworldbyobservations andpredictions.Concreteuseofphysicalprinciplesandanalysisinvariousfieldsofengineeringandtechnologyis very prominence. • The course aims to supplement the factual knowledge gained in the lecture byfirst hand manipulation of apparatus. • This will develop scientific temper and help to apply the basicconceptsandprinciplesinsolvingengineeringandtechnologybasedproblems.In addition,studentsgetnecessaryconfidenceinhandlingequipmentandthuslearnvariousskillsinmeasurement.			

Learning Outcomes:

CO1	• Differentiate various shapes and determine dimensions of plane, curved and regular surfaces/bodies. • ApplyandVerifylawsofforcesanddetermineresultantforceactingonabody.
CO2	• Appreciateroleoffrictionandmeasureco-efficientoffrictionbetweendifferentsurfaces. • Understandrotationalmotionanddetermine M.I.ofarotatingbody(flywheel).
CO3	• DescribeandverifyHook'slawanddetermineforceconstantofspringbody. • Identifyvariousformsofenergy,energytransformationsandverifylawofconservationofenergy.
CO4	• UnderstandStoke'slawforviscousliquidsanddetermineviscosityofagivenliquid. • Understandhowmaterialsexpandonheatinganddeterminelinearexpansioncoefficientforagivenmaterialrod. • UnderstandworkinganduseFortin'sbarometersfordeterminingpressureataplace.

List of Experiments:

S.	**Experiment detail**

No.	
1	Tomeasurelength,radiusofagivencylinder,atesttubeandabeakerusingaVerniercaliperandfind volumeof eachobject.
2	Todeterminediameterofawire,asolidballandthicknessofcardboardusingascrewgauge.
3	Todetermineradiusofcurvatureofaconvexandaconcavemirror/surfaceusingaspherometer.
4	Toverifytriangleandparallelogramlawofforces.
5	Tofindtheco-efficientoffrictionbetweenwoodandglassusingahorizontalboard.
6	TodetermineforceconstantofaspringusingHook'sLaw.
7	Toverifylawofconservationofmechanicalenergy(PEtoKE).
8	Tofindthemomentofinertiaofaflywheel.
9	Tofindtheviscosityofagivenliquid(Glycerin)byStoke'slaw.
10	Tofindthecoefficientoflinearexpansionofthematerialofarod.
11	TodetermineatmosphericpressureataplaceusingFortin'sbarometer.
12	Tomeasureroomtemperatureandtemperatureofahotbathusingmercurythermometer andconvert it into different scales.

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	15	Full syllabus
DTDW	40	
Discipline and attendance	15	
Lab Record	15	
Total	100	

Books:

1. TextBookofPhysicsforClassXI&XII(Part-I,Part-II);N.C.E.R.T.,Delhi
2. ComprehensivePracticalPhysics,Vol,I&II,JNJaiswal,LaxmiPublications(P)Ltd.,
3. PracticalPhysicsbyC.L.Arora,S.ChandPublication.
4. e-books/e-tools/learningphysicssoftware/YouTubevideos/websitesetc.

Semester-I			
Course Name:	**Applied Chemistry Lab**	**Course Code:**	DCH204
L P T Scheme:	**0-0-2**	**Credits:**	**1**
Prerequisites: Nil			
Objective: This course is aimed at			

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Therearenumerousnumberofmaterialsusedinfabricatingandmanufacturingdevicesf orthecom-fort of life. The selection, characterization and suitability assessment of natural raw materials essentially requires principles and concepts of Applied Chemistry for technicians.The course aims tosupplementthefactualknowledgegainedinthelecturesbyfirsthandmanipulationofp rocessesandapparatus. This will develop scientific temper and help to apply the basic concepts and principles insolvingengineering problems.

Learning Outcomes:

CO1	• Toexpressquantitativemeasurementsaccurately. • Topracticeandadaptgoodmeasuringtechniques.
CO2	• Tousevariousapparatusforprecisemeasurements. • Tounderstandanddifferentiatedifferentmethodsofquantitativeanalysis.
CO3	• Toknowandunderstandprinciplesofquantitativeanalysisusinginstruments. • Toconstructdifferentelectrochemicalcellsusedindevelopingbatteries.
CO4	• Tounderstandandappreciatemethodsofcorrosionabetments.

List of Experiments:

Exp. No.	Experiment detail
VolumetricandGravimetricanalysis:	
1	Preparationofstandardsolutionofoxalicacidorpotassiumpermanganate.
2	Todeterminestrengthofgivensodiumhydroxidesolutionbytitratingagainststandard oxalicacidsolutionusingphenolphthaleinindicator.
3	Standardization of KMnO4 solution using standard oxalic acid and Determine the percentage of iron present in given Hematite ore by KMnO4 solution.
4	Iodometric estimation of copper in the copper pyrite ore.
5	Volumetricestimationoftotalacidnumber(TAN)ofgivenoil.
6	Volumetric estimation of a) TotalhardnessofgivenwatersampleusingstandardEDTAsolution. b) Alkalinityofgivenwatersampleusing0.01Msulphuricacid
7	Proximateanalysisofcoal a) Gravimetric estimation moisture in given coal sample b) Gravimetric estimation ash in given coal sample
Instrumentalanalysis:	
8	Determinetheconductivityofgivenwatersample.
9	DeterminationoftheIroncontentingivencementsampleusingcolorimeter.
10	Determinationofcalorificvalueofsolidorliquidfuelusingbombcalorimeter.
11	DeterminationofviscosityoflubricatingoilusingRedwoodviscometer.
12	DeterminationofflashandfirepointoflubricatingoilusingAble'sflashpointapparatus .

13	Toverifythefirstlawofelectrolysisofcoppersulfateusingcopperelectrode.
14	Constructionandmeasurementof emfofelector chemicalcell(Daniel cell).
15	Tostudytheeffectofdissimilarmetalcombination.

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	15	Full syllabus
DTDW	40	
Discipline and attendance	15	
Lab Record	15	
Total	100	

Books:

1. TextBookofChemistryforClassXI&XII(Part-I,Part-II);N.C.E.R.T.,Delhi,2017-18.
2. Dr.G.H.HugarandProfA.N.Pathak,AppliedChemistryLaboratoryPracti ces,Vol.IandVol.II,NITTTR,Chandigarh, Publications, 2013-14.
3. Agnihotri,Rajesh,ChemistryforEngineers,WileyIndiaPvt.Ltd.,2014.
4. Jain&Jain,EngineeringChemistry,DhanpatRaiandSons;NewDelhi,2015.

Semester-I			
Course Name:	**SportsandYoga**	**Course Code:**	DGE205
L P T Scheme:	**0-0-2**	**Credits:**	**1**

Prerequisites: Nil

Objective: This course is aimed at

- Tomakethestudentsunderstandtheimportanceofsoundhealthandfitnessprinciplesasth eyrelatetobetterhealth.
- Toexposethestudentstoavarietyofphysicalandyogicactivitiesaimedatstimulatingthe ircontinuedinquiryaboutYoga,physicaleducation,healthandfitness.
- Tocreateasafe,progressive,methodicalandefficientactivitybasedplantoenhanceimp rovidentandminimizerisk ofinjury.
- To develop among students an appreciation of physical activity as a lifetime pursuit andameansto better health.

Learning Outcomes:

CO1	- PracticePhysicalactivitiesandHathaYogafocusingonyogaforstrength,flexibility,and relaxation. - Learntechniquesforincreasingconcentrationanddecreasinganxietywhichleadstostro ngeracademicperformance.
CO2	- Learnbreathingexercisesandhealthyfitnessactivities - Understandbasicskillsassociatedwithyogaandphysicalactivitiesincludingstrengthan

	dflexibility,balanceandcoordination
CO3	- Performyogamovementsinvariouscombinationandforms. - Assesscurrentpersonalfitnesslevels. - Identifyopportunitiesforparticipationinyogaandsportsactivities.
CO4	- Developunderstandingofhealth-relatedfitnesscomponents:cardiorespiratoryendurance,flexibilityandbodycompositionetc. - Improvepersonalfitnessthroughparticipationinsportsandyogicactivities. - Developunderstandingofpsychologicalproblemsassociatedwiththeageandlifestyle

List of Experiments:

S. No.	Experiment detail
1	**IntroductiontoPhysicalEducation** • Meaning & definition of Physical Education • Aims & Objectives of Physical Education • Changing trends in Physical Education
2	**OlympicMovement** • Ancient & Modern Olympics (Summer & Winter) • Olympic Symbols, Ideals, Objectives & Values • Awards and Honours in the field of Sports in India (Dronacharya Award, Arjuna Award, • Dhayanchand Award, Rajiv Gandhi Khel Ratna Award etc.)
3	**PhysicalFitness,Wellness&Lifestyle** • Meaning & Importance of Physical Fitness & Wellness • Components of Physical fitness • Components of Health related fitness • Components of wellness • Preventing Health Threats through Lifestyle Change • Concept of Positive Lifestyle
4	**FundamentalsofAnatomy&PhysiologyinPhysicalEducation,SportsandYoga** • Define Anatomy, Physiology & Its Importance • Effect of exercise on the functioning of Various Body Systems. (Circulatory System, Respi- ratory System, Neuro-Muscular System etc.)
5	**Kinesiology,Biomechanics&Sports** • Meaning & Importance of Kinesiology & Biomechanics in Physical Edu. & Sports • Newton's Law of Motion & its application in sports. • Friction and its effects in Sports.
6	**Postures** • Meaning and Concept of Postures. • Causes of Bad Posture. • Advantages & disadvantages of weight training. • Concept & advantages of Correct Posture. • Common Postural Deformities – Knock Knee; Flat Foot; Round Shoulders; Lordosis, Ky- phosis, Bow Legs and Scoliosis.

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	• Corrective Measures for Postural Deformities
7	**Yoga** • Meaning & Importance of Yoga • Elements of Yoga • Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas • Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana&Shashankasana) • Relaxation Techniques for improving concentration - Yog-nidra
8	**Yoga & Lifestyle** • Asanas as preventive measures. • Hypertension: Tadasana, Vajrasana, Pavan Muktasana, ArdhaChakrasana, Bhujangasana, • Sharasana. • Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana, Trikonasana,ArdhMatsyendrasana. • Back Pain: Tadasana, ArdhMatsyendrasana, Vakrasana, Shalabhasana, Bhujangasana. • Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana, • Pavan Muktasana, ArdhMatsyendrasana. • Asthema: Procedure, Benefits & contraindications for Sukhasana, Chakrasana, • Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.
9	**Training and Planning in Sports** • Meaning of Training • Warming up and limbering down • Skill, Technique & Style Meaning and Objectives of Planning. • Tournament – Knock-Out, League/Round Robin & Combination.
10	**Psychology & Sports** • Definition & Importance of Psychology in Physical Edu. & Sports • Define & Differentiate Between Growth & Development • Adolescent Problems & Their Management • Emotion: Concept, Type & Controlling of emotions • Meaning, Concept & Types of Aggressions in Sports. • Psychological benefits of exercise. • Anxiety & Fear and its effects on Sports Performance. • Motivation, its type & techniques. • Understanding Stress & Coping Strategies.
11	**Doping** • Eff Meaning and Concept of Doping • Prohibited Substances & Methods • Side ects of Prohibited Substances
12	**Sports Medicine** • First Aid – Definition, Aims & Objectives. • Sports injuries: Classification, Causes & Prevention. • Management of Injuries: Soft Tissue Injuries and Bone & Joint Injuries

13	**Sports / Games** Following sub topics related to any one Game/Sport of choice of student out of: Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball, Yoga etc. • History of the Game/Sport. • Latest General Rules of the Game/Sport. • Specifications of Play Fields and Related Sports Equipment. Important Tournaments and Venues. • Sports Personalities. • Proper Sports Gear and its Importance.

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	15	Full syllabus
DTDW	40	
Discipline and attendance	15	
Lab Record	15	
Total	100	

Books:

1. ModernTrendsandPhysicalEducationbyProf.AjmerSingh.
2. LightOnYogaByB.K.S.Iyengar.
3. HealthandPhysicalEducation–NCERT(11thand12thClasses).

Semester-I			
Course Name:	**Communication Skills in English Lab**	**Course Code:**	DHS206
L P T Scheme:	**0-0-2**	**Credits:**	**1**

Prerequisites: Nil

Objective:

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

1. To develop listening skills for enhancing communication.
2. To develop speaking skills with a focus on correct pronunciation and fluency.
3. To introduce the need for Personality development- Focus will be on developing certain qualities.

Learning Outcomes:

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CO1	At the end of this course the students will be able to communicate effectively with an increasein their confidence to read, write and speak English fluently.
CO2	They will also demonstrate a significant increase in word power.
CO3	The variety of exercises and activities that will be conducted in the Language Lab will develop their skills needed to participate in a conversation like listening carefully and respectfully to others' viewpoints; articulating their own ideas and questions clearly and over all students will be able to prepare, organize, and deliver an engaging oral presentation
CO4	They will also develop non-verbal communication such as proper use of body language andgestures.

List of Experiments:

S. No.	Experiment detail
Unit 1	**Listening Skills:** Listening Process and Practice: Introduction to recorded lectures, poems, interviews and speeches, listening tests.
Unit II	**Introduction to Phonetics:** Sounds: consonant, vowel, diphthongs, etc. transcription of words (IPA), weak forms, syllable division, word stress, intonation, voice etc.
Unit III	**Speaking Skills:** Standard and formal speech: Group discussion, oral presentations, public speaking, business presentations etc. Conversation practice and role playing, mock interviews etc.
Unit IV	**Building vocabulary:** Etymological study of words and construction of words, phrasal verbs, foreign phrases, idioms and phrases. Jargon/ Register related to organizational set up, word exercises and word games to enhance self-expression and vocabulary of participants.

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	15	Full syllabus
DTDW	40	
Discipline and attendance	15	
Lab Record	15	
Total	100	

Books:

1.Daniel Jones. The Pronunciation of English. Cambridge: Cambridge University Press, 1956.
2. James Hartman& et al. Ed. English Pronouncing Dictionary. Cambridge: Cambridge UniversityPress, 2006.
3. Kulbhushan Kumar, Effective Communication Skills, Khanna Publishing House, New Delhi(Revised Ed. 2018)
4. J.D.O'Connor. Better English Pronunciation. Cambridge: Cambridge University Press, 1980.
5. Lindley Murray. An English Grammar: Comprehending Principles and Rules. London: Wilsonand Sons, 1908.
6. Margaret M. Maison. Examine your English. Orient Longman: New Delhi, 1964.
7. J.Sethi& et al. A Practice Course in English Pronunciation. New Delhi: Prentice Hall, 2004.

8. Pfeiffer, William Sanborn and T.V.S Padmaja. Technical Communication: A Practical Approach. 6th ed. Delhi: Pearson, 2007.

Semester-II			
Course Name:	Mathematics - II	**Course Code:**	DMA105
L P T Scheme:	**3-1-0**	**Credits:**	**4**
Prerequisites: Nil			
Objective: This course is aimed at			
This course is designed to give a comprehensive coverage at an introductory level to the subject ofmatrices, Integral Calculus coordinate geometry, Basic elements of vector algebra and First OrderDifferential Equations.			

Learning Outcomes:

Course Outcome	Description
CO1	Able to encoding the inherent geometry of the original shape.
CO2	Understanding ofthe cumulative effect of the original quantity or equation is the Integration
CO3	Understanding of the coordinate geometry provides a connection between algebra and geometry throughgraphs of lines and curves.
CO4	Differentiate between a resultant and a concurrent force to model simple physical problems in the form of a differential equation, analyze and interpret the solutions.

Course Content:

Unit 1:	**Determinants and Matrices:** Elementary properties of determinants up to 3rd order, consistency of equations, Crammer's rule. Algebra of matrices, Inverse of a matrix, matrix inverse method to solve a system of linear equations in 3 variables.
Unit 2:	**Integration as inverse operation of differentiation:**Simple integration by substitution, by parts $\int_0^{\frac{\pi}{2}} \sin^n x\,dx \int_0^{\frac{\pi}{2}} \cos^n x\,dx$ and $\int_0^{\frac{\pi}{2}} \sin^m x\,\cos^n x\,dx$ by partial fractions (for linear factors only). Use of formulas **,** and for solving problems Where m and n are positive integers. Applications of integration for i. Simple problem on evaluation of area bounded by a curve and axes.ii. Calculation of Volume of a solid formed by revolution of an area about axes. (Simple problems).
Unit 3:	**Co-Ordinate Geometry:** Equation of straight line in various standard forms (without proof), inter section of two straight lines, angle between two lines. Parallel and perpendicular lines, perpendicular distance formula. General equation of a circle and its characteristics. To find the equation of a circle, given: i. Centre and radius,

	ii. Three points lying on it and iii. Coordinates of end points of a diameter; Definition of conics (Parabola, Ellipse, Hyperbola) their standard equations without proof. Problems on conics when their foci, directories or vertices are given.
Unit 4:	**Vector Algebra:** Definition notation and rectangular resolution of a vector. Addition and subtraction of vectors. Scalar and vector products of 2 vectors. Simple problems related to work, moment and angular velocity.
Unit 5:	**Differential Equations:** Solution of first order and first degree differential equation by variable separation method (simple problems). MATLAB – Simple Introduction.

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

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

Semester-II			
Course Name:	**AppliedPhysics-II**	**Course Code:**	DPH106
L P T Scheme:	**2-1-0**	**Credits:**	**3**
Prerequisites: Nil			
Objective:			
Applied Physics aims to give an understanding of this world both by observation and by predictionof the way in which objects behave. Concrete use of physical principles and analysis in various fieldsof engineering and technology are given prominence in			

the course content. The course will help the diploma engineers to apply the basic concepts and principles to solve broad-based engineering problems and to understand different technology based applications.

Learning Outcomes:

Course Outcome	Description
CO1	a. Describe waves and wave motion, periodic and simple harmonic motions and solve simpleproblems. Establish wave parameters: frequency, amplitude, wavelength, and velocity andable to explain diffraction, interference, polarization of waves. b. Explain ultrasonic waves and engineering, medical and industrial applications of Ultrasonics. Apply acoustics principles to various types of buildings for best sound effect.
CO2	a. State basic optical laws, establish the location of the images formed by mirrors and thin converging lens**,** design and assemble microscope using lenses combination. b. Describe refractive index of a liquid or a solid and will be able to explain conditions for total internal reflection. c. Define capacitance and its unit, explain the function of capacitors in simple circuits, and solve simple problems. d. Differentiate between insulators, conductors and semiconductors, and define the terms: potential, potential difference, electromotive force.
CO3	a. Express electric current as flow of charge, concept of resistance, measure of the parameters: electric current, potential difference, resistance. b. List the effects of an electric current and its common applications, State Ohm's law, calculate the equivalent resistance of a variety of resistor combinations, distinguish between AC and DC currents, determine the energy consumed by an appliance, c. State the laws of electromagnetic induction, describe the effect on a current-carrying conductor when placed in a magnetic field.
CO4	a. Explain the operation of appliances like moving coil galvanometer, simple DC motors. b. Apply the knowledge of diodes in rectifiers, power adapters and various electronic circuits. Use the knowledge of semiconductors in various technical gadgets like mobile phones, computers, LED, photocells, solar lights etc. c. Illustrate the conditions for light amplification in various LASER and laser based instruments and optical devices.
	a. Appreciate the potential of optical fiber in fields of medicine and communication. b. Express importance of nanoscience and nanotechnology and impact of nanotechnology to the society.

Course Content:

Unit 1:	**Wave motion and its applications:** Wave motion, transverse and longitudinal waves with examples, definitions of wave velocity, frequency and wave length and their relationship, Sound and light waves and their properties, wave equation ($y = r \sin\omega t$) amplitude, phase, phase difference, principle of superposition of waves and beat formation. Simple Harmonic Motion (SHM): definition, expression for displacement, velocity, acceleration, time period, frequency etc. Simple harmonic progressive wave and energy transfer, study of vibration of cantilever and determination of its time period, Free, forced and resonant vibrations with examples. Acoustics of buildings – reverberation, reverberation time, echo, noise, coefficient of

	absorption of sound, methods to control reverberation time and their applications, Ultrasonic waves – Introduction and properties, engineering and medical applications of ultrasonic.
Unit 2:	**Optics:** Basic optical laws; reflection and refraction, refractive index, Images and image formation by mirrors, lens and thin lenses, lens formula, power of lens, magnification and defects. Total internal reflection, Critical angle and conditions for total internal reflection, applications of total internal reflection in optical fiber. Optical Instruments; simple and compound microscope, astronomical telescope in normal adjustment,magnifying power, resolving power, uses of microscope and telescope, optical projection systems.
Unit 3:	**Electrostatics:** Coulombs law, unit of charge, Electric field, Electric lines of force and their properties, Electric flux, Electric potential and potential difference, Gauss law: Application of Gauss law to find electric field intensity of straight charged conductor, plane charged sheet and charged sphere. Capacitor and its working, Types of capacitors, Capacitance and its units. Capacitance of a parallel plate capacitor, Series and parallel combination of capacitors (related numerical), dielectric and its effect on capacitance, dielectric break down.
Unit 4:	**Current Electricity:** Electric Current and its units, Direct and alternating current, Resistance and its units, Specific resistance, Conductance, Specific conductance, Series and parallel combination of resistances. Factors affecting resistance of a wire, carbon resistances and colour coding. Ohm's law and its verification, Kirchhoff's laws, Wheatstone bridge and its applications (slide wire bridge only), Concept of terminal potential difference and Electro motive force (EMF) Heating effect of current, Electric power, Electric energy and its units (related numerical problems), Advantages of Electric Energy over other forms of energy
Unit 5:	**Electromagnetism:** Types of magnetic materials; dia, para and ferromagnetic with their properties, Magnetic field and its units, magnetic intensity, magnetic lines of force, magnetic flux and units, magnetization. Concept of electromagnetic induction, Faraday's Laws, Lorentz force (force on moving charge in magnetic field). Force on current carrying conductor, force on rectangular coil placed in magnetic field. Moving coil galvanometer; principle, construction and working, Conversion of a galvanometer into ammeter and voltmeter.
Unit 6:	**Semiconductor Physics:** Energy bands in solids, Types of materials (insulator, semi-conductor, conductor), intrinsic and extrinsic semiconductors, p-n junction, junction diode and V-I characteristics, types of junction diodes. Diode as rectifier – half wave and full wave rectifier (centre taped). Transistor; description and three terminals, Types- pnp and npn, some electronic applications (list only). Photocells, Solar cells; working principle and engineering applications.
Unit 7:	**Modern Physics:** Lasers: Energy levels, ionization and excitation potentials; spontaneous and stimulated emission; population inversion, pumping methods, optical feedback, Types of lasers; Ruby, He-Ne and semiconductor,laser characteristics, engineering and medical applications of lasers. Fiber Optics: Introduction to optical fibers, light propagation,

	acceptance angle and numerical aperture, fiber types, applications in; elecommunication, medical and sensors. Nanoscience and Nanotechnology: Introduction, nanoparticles and nanomaterials, properties at nanoscale, nanotechnology, nanotechnology based devices and applications.

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

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

Semester-II			
Course Name:	**Introduction to IT Systems**	**Course Code:**	DCS107
L P T Scheme:	**2-0-0**	**Credits:**	**2**
Prerequisites: Nil			
Objective:			
This course is intended to make new students comfortable with computing environment – Learningbasic computer skills, Learning basic application software tools, Understanding Computer Hardware, Cyber security awareness			

Learning Outcomes:

Course Outcome	**Description**

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CO1	Able to comfortably work on computer, and connect it to external devices.
CO2	Install andconfigure OS, assemble a PC
CO3	write documents, createworksheets, prepare presentations
CO4	protect information and computers from basic abuses/attacks.

Course Content:

Unit 1:	Basic Internet skills: Understanding browser, efficient use of search engines, awareness about Digital India portals (state and national portals) and college portals. General understanding of various computer hardware components – CPU, Memory, Display, Keyboard, Mouse, HDD and other Peripheral Devices.
Unit 2:	OS Installation (Linux and MS Windows), Unix Shell and Commands, vi editor.
Unit 3:	HTML4, CSS, making basic personal webpage.
Unit 4:	Office Tools: OpenOffice Writer, OpenOffice Spreadsheet (Calc), OpenOffice Impress.
Unit 5:	Information security best practices. Class lectures will only introduce the topic or demonstrate the tool, actual learning will take place in the Lab by practicing regularly.

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

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

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Semester-II			
Course Name:	**Fundamentals of Electrical & Electronics Engineering**	**Course Code:**	DEC108
L P T Scheme:	**2-1-0**	**Credits:**	**3**

Prerequisites: Nil

Objective: This course is aimed at

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

Learning Outcomes:

Course Outcome	Description
CO1	Understand the different electrical elements
CO2	Learning of concepts of various active and passive electronic components
CO3	Understand and Applications of electrical engineering principles
CO4	Digital Electronics and their industrial applications

Course Content:

Unit 1:	**Overview of Electronic Components & Signals:**Passive Active Components: Resistances, Capacitors, Inductors, Diodes, Transistors, FET, MOS and CMOS and their Applications. Signals: DC/AC, voltage/current, periodic/non-periodic signals, average, rms, peak values, different types of signal waveforms, Ideal/non-ideal voltage/current sources, independent/dependent voltage current sources..
Unit 2:	**Overview of Analog Circuits:** Operational Amplifiers-Ideal Op-Amp, Practical op amp, Open loop and closed loop configurations, Application of Op-Amp as amplifier, adder, differentiator and integrator.
Unit 3:	**Overview of Digital Electronics:** Introduction to Boolean Algebra, Electronic Implementation of Boolean Operations, Gates-Functional Block Approach, Storage elements-Flip Flops-A Functional block approach, Counters: Ripple, Up/down and decade, Introduction to digital IC Gates (of TTL Type).
Unit 4:	**Electric and Magnetic Circuits:**EMF, Current, Potential Difference, Power and Energy; M.M.F, magnetic force, permeability, hysteresisloop, reluctance, leakage factor and BH curve; Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law; Dynamically induced emf; Statically induced emf; Equations of self and mutual inductance; Analogy between electric and magnetic circuits
Unit 5:	**A.C. Circuits:** Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor Peak Factor, impedance,

	phase angle, and power factor; Mathematical and phasor representation of alternating emf and current; Voltage and Current relationship in Star and Delta connections; A.C in resistors, inductors and capacitors; A.C in R-L series, R-C series, R-L-C series and parallel circuits;Power in A. C. Circuits, power triangle.
Unit 6:	**Transformer and Machines:** General construction and principle of different type of transformers; Emf equation and transformation ratio of transformers; Auto transformers; Construction and Working principle of motors; Basic equations and characteristic of motors.

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

1. RituSahdev, Basic Electrical Engineering, Khanna Publishing House
2. Mittle and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN: 978-0-07-0088572-5
3. Saxena, S. B. Lal, Fundamentals of Electrical Engineering, Cambridge University Press, latestedition ISBN : 9781107464353
4. Theraja, B. L., Electrical Technology Vol – I, S. Chand Publications, New Delhi, 2015, ISBN:9788121924405
5. Theraja, B. L., Electrical Technology Vol – II, S. Chand Publications, New Delhi, 2015, ISBN:9788121924375
6. Jegathesan, V., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, 2015,ISBN : 97881236529513
7. Sedha, R.S., A text book of Applied Electronics, S.Chand, New Delhi, 2008, ISBN-13: 978-8121927833
8. Malvino, Albert Paul, David, Electronics Principles, McGraw Hill Education, New Delhi,2015,ISBN-13: 0070634244-978
9. Mehta, V.K., Mehta, Rohit, Principles of Electronics, S. Chand and Company, New Delhi, 2014,ISBN-13-9788121924504
10. Bell Devid, Fundamental of Electronic Devices and Circuits, Oxford University Press, NewDelhi 2015 ISBN : 9780195425239.

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Semester-II			
Course Name:	**EngineeringMechanics**	**Course Code:**	DME101
L P T Scheme:	**2-1-0**	**Credits:**	**3**
Prerequisites: Nil			
Objective: This course is aimed at			
• To obtain resultant of various forces • To calculate support reactions through conditions of equilibrium for various structures • To understand role of friction in equilibrium problems • To know fundamental laws of machines and their applications to various engineering problems			

Learning Outcomes:

Course Outcome	Description
CO1	Identify the force systems for given conditions by applying the basics of mechanics.
CO2	Determine unknown force(s) of different engineering systems.
CO3	Apply the principles of friction in various conditions for useful purposes.
CO4	Find the centroid and centre of gravity of various components in engineering systems.Select the relevant simple lifting machine(s) for given purposes

Course Content:

Unit 1:	**Basics of mechanics and force system:** Significance and relevance of Mechanics, Applied mechanics, Statics, Dynamics.Space, time, mass, particle, flexible body and rigid body.Scalar and vector quantity, Units of measurement (SI units) - fundamental units and derivedunits. Force – unit, representation as a vector and by Bow's notation, characteristics and effects of a force, Principle of transmissibility of force, Force system and its classification. Resolution of a force - Orthogonal components of a force, moment of a force, Varignon's Theorem. Composition of forces – Resultant, analytical method for determination of resultant for concurrent,non-concurrent and parallel co-planar force systems – Law of triangle, parallelogram and polygon of forces.
Unit 2:	**Equilibrium:** Equilibrium and Equilibrant, Free body and Free body diagram, Analytical and graphical methods of analysing equilibrium Lami's Theorem – statement and explanation, Application for various engineering problems. Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (verticaland inclined point load, uniformly distributed load, couple), Beam reaction for cantilever, simply supported beam with or without overhang – subjected tocombination of Point load and uniformly distributed load.Beam reaction graphically for simply supported beam subjected to vertical point loads only.
Unit 3:	**Friction:** Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction,

	angle of friction, angle of repose, relation between co-efficient of friction and angle of friction. Equilibrium of bodies on level surface subjected to force parallel and inclined to plane. Equilibrium of bodies on inclined plane subjected to force parallel to the plane only.
Unit 4:	**Centroid and centre of gravity:** Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle)Centroid of composite figures composed of not more than three geometrical figures Centre of Gravity of simple solids (Cube, cuboid, cone, cylinder, sphere, hemisphere) Centre of Gravity of composite solids composed of not more than two simple solids.
Unit 5:	**Simple lifting machine:** Simple lifting machine, load, effort, mechanical advantage, applications and advantages. Velocity ratio, efficiency of machines, law of machine. Ideal machine, friction in machine, maximum Mechanical advantage and efficiency, reversible and non-reversible machines, conditions for reversibilityVelocity ratios of Simple axle and wheel, Differential axle and wheel, Worm and worm wheel, Single purchase and double purchase crab winch, Simple screw jack, Weston's differential pulley block, geared pulley block.

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

1. D.S. Bedi, Engineering Mechanics, Khanna Publications, New Delhi (2008)
2. Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.
3. Bansal R K, A text book of Engineering Mechanics, Laxmi Publications.
4. Ramamrutham, Engineering Mechanics, S. Chand & Co. New Delhi.
5. Dhade, Jamadar &Walawelkar, Fundamental of Applied Mechanics, Pune VidhyarthiGruh.
6. Ram, H. D.; Chauhan, A. K., Foundations and Applications of Applied Mechanics, CambridgeUniversity Press.
7. Meriam, J. L., Kraige, L.G., Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.

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Semester-II			
Course Name:	**Applied Physics–II Lab**	**Course Code:**	DPH207
L P T Scheme:	**0-0-2**	**Credits:**	**1**
Prerequisites: Nil			
Objective: This course is aimed at			
Concrete use of physical principles and analysis in various fields of engineering and technology isvery prominence. The course aims to supplement the factual knowledge gained in the lecture by firsthand manipulation of apparatus. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering and technology based problems. In addition, students getnecessary confidence in handling equipment and thus learn various skills in measurement.			

Learning Outcomes:

CO1	a. Apply concept of vibrations and determine the time period of vibrating objects. b. Use of equipment for determining velocity of ultrasonics in different liquids. c. Verify optical laws; reflection, refraction from plane interfaces and surfaces.
CO2	a. Apply knowledge of optics to determine focal length and magnifying power of optical lenses. b. Understand uses of electrical components and meters and verify Ohm's law for flow ofcurrent. c. Quantify resistances and verify laws of series and parallel combination of resistances.
CO3	a. Apply concept of electrical vibrations in determine frequency of AC main. b. Analyse electrical circuits and verify Kirchhoff's law governing electrical circuits. c. Measure resistance of a galvanometer and how it is converted into an ammeter and voltmeter.
CO4	a. Investigate characteristics of semiconductor diodes, photoelectric cells and determine operational parameters associated with their performance. b. Work with laboratory lasers and understand method to measure the wavelength of the light

List of Experiments:

S.No.	DetailsOfPracticalContent
1	To determine and verify the time period of a cantilever.
2	To determine velocity of ultrasonic in different liquids using ultrasonic interferometer.
3	To verify laws of reflection from a plane mirror/ interface.
4	To verify laws of refraction (Snell's law) using a glass slab.
5	To determine focal length and magnifying power of a convex lens..
6	To verify Ohm's law by plotting graph between current and potential difference.
7	To verify laws of resistances in series and parallel combination.
8	To find the frequency of AC main using electrical vibrator.

9	To verify Kirchhoff's law using electric circuits.
10	To study the dependence of capacitance of a parallel plate capacitor on various factors anddetermines permittivity of air at a place.
11	To find resistance of a galvanometer by half deflection method.
12	To convert a galvanometer into an ammeter.
13	To convert a galvanometer into a voltmeter.
14	To draw V-I characteristics of a semiconductor diode (Ge, Si) and determine its knee voltage.
15	To verify inverse square law of radiations using a photo-electric cell.
16	To measure wavelength of a He-Ne/diode laser using a diffraction grating.
17	To measure numerical aperture (NA) of an optical fiber.
18	Study of an optical projection system (OHP/LCD) - project report.

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	15	Full syllabus
DTDW	40	
Discipline and attendance	15	
Lab Record	15	
Total	100	

Books:

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

Semester-II			
Course Name:	**Introduction to IT Systems Lab**	**Course Code:**	DCS208
L P T Scheme:	**0-0-4**	**Credits:**	**2**
Prerequisites: Nil			
Objective:			
This Lab course is intended to practice whatever is taught in theory class of 'Introduction of IT Systems and become proficient in using computing environment -			

basic computer skills, basic application software tools, Computer Hardware, cyber security features, etc.

Learning Outcomes:

CO1	Able to work on computer, install and configure OS, assemble a PC and connect it to external devices,
CO2	Write documents, create worksheets, prepare presentations,
CO3	Protect information and computers from basic abuses/attacks.

List of Experiments:

S.No.	DetailsOfPracticalContent
1	Browser features, browsing, using various search engines, writing search queries
2	Visit various e-governance/Digital India portals, understand their features, services offered
3	Read Wikipedia pages on computer hardware components, look at those components in lab, identify them, recognise various ports/interfaces and related cables, etc.
4	Install Linux and Windows operating system on identified lab machines, explore various options, do it multiple times
5	Connect various peripherals (printer, scanner, etc.) to computer, explore various features of peripheral and their device driver software.
6	Practice HTML commands, try them with various values, make your own Webpage
7	Explore features of Open Office tools, create documents using these features, do it multiple times
8	Explore security features of Operating Systems and Tools, try using them and see what happens.

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	15	Full syllabus
DTDW	40	
Discipline and attendance	15	
Lab Record	15	
Total	100	

Books:

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

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Semester-II			
Course Name:	**FundamentalsofElectrical&ElectronicsEngineering Lab**	**Course Code:**	DEC209
L P T Scheme :	**0-0-2**	**Credits :**	**1**

Prerequisites: Nil

Objective: This course is aimed at

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

Learning Outcomes:

CO1	Understand basic principle and operation of electric circuits and machines.Solve basic problems related to electrical circuits and machines. Explain the operation ofdifferent electrical technologies.
CO2	Demonstrate an understanding of the control systems.Understand the basic circuit elements.
CO3	Understand different types of signal waveforms.Understand logic gates and apply them in various electronic circuits.
CO4	Understand the basic concepts of op-amps, and their applications. Use relevant electric/electronic protective devices safely.

List of Experiments:

S.No.	DetailsOfPracticalContent
1	Determine the permeability of magnetic material by plotting its B-H curve.
2	Measure voltage, current and power in 1-phase circuit with resistive load.
3	Measure voltage, current and power in R-L series circuit.
4	Determine the transformation ratio (K) of 1-phase transformer.
5	Connect single phase transformer and measure input and output quantities.
6	Make Star and Delta connection in induction motor starters and measurethe line and phase values.
7	Identify various passive electronic components in the given circuit
8	Connect resistors in series and parallel combination on bread board andmeasure its value using digital multimeter.
9	Connect capacitors in series and parallel combination on bread board andmeasure its

	value using multimeter.
10	Identify various active electronic components in the given circuit.
11	Use multimeter to measure the value of given resistor.
12	Use LCR-Q tester to measure the value of given capacitor and inductor.
13	Determine the value of given resistor using digital multimeter to confirmwith colour code.
14	Test the PN-junction diodes using digital multimeter.
15	Test the performance of PN-junction diode.
16	Test the performance of Zener diode.
17	Test the performance of LED.
18	. Identify three terminals of a transistor using digital multimeter.
19	Test the performance of NPN transistor. 02*20.
20	Determine the current gain of CE transistor configuration.
21	Test the performance of transistor switch circuit.
22	Test the performance of transistor amplifier circuit.
23	Test Op-Amp as amplifier and Integrator

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	15	Full syllabus
DTDW	40	
Discipline and attendance	15	
Lab Record	15	
Total	100	

Books:

1. RituSahdev, Basic Electrical Engineering, Khanna Publishing House, 2018
2. Mittle and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN :978-0-07-0088572-5
3. Saxena, S. B. Lal, Fundamentals of Electrical Engineering, Cambridge University Press, latestedition ISBN : 9781107464353
4. Theraja, B. L., Electrical Technology Vol – I, S. Chand publications, New Delhi, 2015, ISBN:9788121924405
5. Theraja, B. L., Electrical Technology Vol – II, S. Chand publications, New Delhi, 2015, ISBN:9788121924375
6. Jegathesan, V., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, 2015,ISBN : 97881236529513
7. Sedha, R.S., A text book of Applied Electronics, S.Chand ,New Delhi, 2008, ISBN-13: 978-8121927833
8. Malvino, Albert Paul, David, Electronics Principles, McGraw Hill Eduction, New Delhi,2015,ISBN-13: 0070634244-978
9. Mehta, V.K., Mehta, Rohit, Principles of Electronics, S. Chand and Company, New Delhi, 2014,ISBN-13-9788121924504

10. Bell Devid, Fundamental of Electronic Devices and Circuits, Oxford University Press, NewDelhi 2015 ISBN : 9780195425239.

Semester-II			
Course Name:	**EngineeringMechanicsLab**	**Course Code:**	DME203
L P T Scheme:	**0-0-2**	**Credits:**	**1**
Prerequisites: Nil			
Objective: This course is aimed at			
1) To obtain resultant of various forces 2) To calculate support reactions through conditions of equilibrium for various structures 3) To understand role of friction in equilibrium problems 4) To know fundamental laws of machines and their applications to various engineering problems			

Learning Outcomes:

CO1	Identify the force systems for given conditions by applying the basics of mechanics.
CO2	Determine unknown force(s) of different engineering systems.
CO3	Find the centroid and centre of gravity of various components in engineering systems.
CO4	Apply the principles of friction in various conditions for useful purposes.Select the relevant simple lifting machine(s) for given purposes.

List of Experiments:

S.No.	DetailsOfPracticalContent
1	To study various equipments related to Engineering Mechanics.
2	To find the M.A., V.R., Efficiency and law of machine for Differential Axle and Wheel.
3	To find the M.A., V.R., Efficiency and law of machine for Simple Screw Jack.
4	Derive Law of machine using Worm and worm wheel.
5	Derive Law of machine using Single purchase crab.
6	Determine resultant of concurrent force system applying Law of Polygon of forces using force table.
7	Derive Law of machine using double purchase crab.
8	Derive Law of machine using Weston’s differential or wormed geared pulley block.
9	Determine resultant of concurrent force system graphically.
10	Determine resultant of parallel force system graphically.
11	Verify Lami’s theorem.
12	Study forces in various members of Jib crane.

13	Determine support reactions for simply supported beam.
14	Obtain support reactions of beam using graphical method.
15	Determine coefficient of friction for motion on horizontal and inclined plane.
16	Determine centroid of geometrical plane figures.

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	15	Full syllabus
DTDW	40	
Discipline and attendance	15	
Lab Record	15	
Total	100	

Books:

1.Bedi D.S., Engineering Mechanics, Khanna Publishing House
2. Khurmi, R.S., Applied Mechanics, S.Chand& Co. New Delhi.
3. Bansal R K, A text book of Engineering Mechanics, Laxmi Publications.
4. Ramamrutham, Engineering Mechanics, S.,S Chand & Co. New Delhi.
5. Dhade, Jamadar &Walawelkar, Fundamental of Applied Mechanics, Pune VidhyarthiGruh.
6. Ram, H. D.; Chauhan, A. K. Foundations and Applications of Applied Mechanics, Cambridge UniversityPress.
7. Meriam, J. L., Kraige, L.G. , Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.

Semester-II			
Course Name:	**EnvironmentalScience**	**Course Code:**	DGE001
L P T Scheme:	**2-0-0**	**Credits:**	**0**
Prerequisites: Nil			
Objective: This course is aimed at			
Technicians working in industries or elsewhere essentially require the knowledge of environmentalscience so as to enable them to work and produce most efficient, economical and eco-friendly finished products. 1. Solve various engineering problems applying ecosystem to produce eco – friendly products. 2. Use relevant air and noise control method to solve domestic and industrial problems. 3. Use relevant water and soil control method to solve domestic and industrial problems.			

4. To recognize relevant energy sources required for domestic and industrial applications. 5. Solve local solid and e-waste problems.

Learning Outcomes:

Course Outcome	Description
CO1	Understand the ecosystem and terminology and solve various engineering problems applying ecosystem knowledge to produce eco – friendly products.
CO2	Understand the suitable air, extent of noise pollution, and control measures and acts.
CO3	Understand the water and soil pollution, and control measures and acts.
CO4	Understand different renewable energy resources and efficient process of harvesting.
CO5	Understand solid Waste Management, ISO 14000 & Environmental Management.

Course Content:

Unit 1:	**Ecosystem:** Structure of ecosystem, Biotic & Abiotic componentsFood chain and food webAquatic (Lentic and Lotic) and terrestrial ecosystemCarbon, Nitrogen, Sulphur, Phosphorus cycle.Global warming -Causes, effects, process, Green House Effect, Ozone depletion
Unit 2:	**Air and, Noise Pollution:** Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants,I.C.Engine, Boiler)Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone separator,Electrostatic Precipitator)Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants,I.C. Engine, Boiler.Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000
Unit 3:	**Water and Soil Pollution:** Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition, calculationWaste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis).Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.
Unit 4:	**Renewable sources of Energy:** Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills. Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas. Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmentalbenefits and problem of wind energy.New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion.) Concept, origin and power plants of geothermal energy
Unit 5:	**Solid Waste Management, ISO 14000 & Environmental Management 06**

	hours: Solid waste generation- Sources and characteristics of : Municipal solid waste, E- waste, biomedicalwaste. Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste Air quality act 2004, air pollution control act 1981 and water pollution and control act1996. Structure and role of Central and state pollution control board. Concept of Carbon Credit, Carbon Footprint. Environmental management in fabrication industry. ISO14000: Implementation in industries, Benefits.

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

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

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Semester-III			
Course Name:	**Basic Mechanical Engineering**	**Course Code:**	DME102
L P T Scheme:	**3-1-0**	**Credits:**	**4**
Prerequisites: Nil			
Objective: This course is aimed at			
• To understand General Principles of Mechanical Engineering. • To understand laws of thermodynamics, thermal and thermodynamic Processes. • To understand working principles of power developing and power absorbing devices. • To understand basic materials and manufacturing processes			

Learning Outcomes:

Course Outcome	Description
CO1	Understand basics of thermodynamics and components of a thermal power plant
CO2	Understand basics of heat transfer, refrigeration and internal combustion engines
CO3	Understand mechanism of thermal power plant and boiler operation
CO4	Identify engineering materials, their properties, manufacturing methods encountered in engineering practice
CO5	Understand functions and operations of machine tools including milling, shaping, grinding and lathe machines

Course Content

Unit 1:	**Introduction to Thermodynamics:** Role of Thermodynamics in Engineering and Science, Types of Systems, Thermodynamic Equilibrium, Properties, State, Process and Cycle, Elementary introduction to Zeroth, First and Second laws of thermodynamics, Heat and Work Interactions for various non-flow and flow processes; Concept of Heat Engine, Heat Pump & Refrigerator, Efficiency/COP; Kelvin-Planck and Clausius Statements, Carnot Cycle, Carnot Efficiency, T-S and P-V Diagrams, Concept of Entropy (Definition only).
Unit 2:	**Heat transfer & Thermal Power Plant:** Modes of Heat Transfer; Conduction: Composite Walls and Cylinders, Combined Conduction and Convection: Overall Heat Transfer Co-efficient, Simple Numerical Problems: Thermal Power Plant Layout; Rankine Cycle; Fire Tube and Water Tube boilers, Babcock & Wilcox, Cochran Boilers;
Unit 3:	**Steam Turbines:** Impulse and Reaction Turbines; Condensers: Jet & Surface Condensers, Cooling Towers; **Internal Combustion Engines and Refrigeration:** Otto, Diesel and Dual cycles; P-V and T-S Diagrams; IC Engines: 2 - Stroke and 4 - Stroke I.C. Engines, S.I. and C.I. Engines
Unit 4:	**Materials and Manufacturing Processes:** Engineering Materials, Classification and their Properties; Metal Casting, Moulding, Patterns, Metal Working: Hot Working and Cold Working, Metal Forming:

	Extrusion, Forging, Rolling, Drawing, Gas Welding, Arc Welding, Soldering, and Brazing.
Unit 5:	**Machine Tools and Machining Processes:** Machine Tools: Lathe Machine and types, Lathe Operations, Milling Machine and types, Milling Operations, Shaper and Planer Machines: Differences, Quick-Return Motion Mechanism, Drilling Machine: Operations, Grinding Machine: Operations

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

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

Semester-III			
Course Name:	**Computer Aided Machine Drawing Practice**	**Course Code:**	DME103
L P T Scheme:	**0-0-2**	**Credits:**	**2**
Prerequisites: Engineering Graphics			
Objective: This course is aimed at			
• To use computer aided drafting, • To prepare geometrical model of various machine elements • To draw the different views of machine elements • To interpret the drawing in engineering field and illustrate three dimensional objects			

Learning Outcomes:

Course Outcome	Description
CO1	Understand the representation of materials used in machine drawing
CO2	Draw the development of surfaces for sheet metal working applications.

CO3	Draw the machine elements including keys, couplings, cotters, riveted, bolted and welded joints.
CO4	Construct an assembly drawing using part drawings of machine components
CO5	Represent tolerances and the levels of surface finish of machine elements.

Course Content

S.No.	Topics for practice
I	Introduction to CAD software.
II	Drawing aids and editing commands.
III	Basic dimensioning, hatching, blocks and views.
IV	Isometric drawing, printing and plotting
V	Machine Drawing practice using Auto CAD: Detailed drawings of following machine parts are to be given to the students to assemble and draw the sectional or plain elevations, plans and side views with dimensioning and bill of materials using cad software (12 exercises). 1) Sleeve & Cotter Joint 2) Spigot & Cotter Joint 3) Knuckle Joint 4) Stuffing Box 5) Screw Jack 6) Foot Step Bearing 7) Universal Coupling 8) Plummer Block 9) Simple Eccentric 10) Machine Vice 11) Connecting Rod 12) Protected Type Flanged Coupling.

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	15	Full syllabus
DTDW	40	
Discipline and attendance	15	
Lab Record	15	
Total	100	

Books:

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

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Semester-III			
Course Name:	**Material Science & Engineering**	**Course Code:**	DME104
L P T Scheme:	**3-0-0**	**Credits:**	**3**

Prerequisites: Nil

Objective: This course is aimed at

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

Learning Outcomes:

Course Outcome	Description
CO1	Explain about crystal structures and atomic bonds.
CO2	Describe about classification of ferrous metals and their properties.
CO3	Explain about non-ferrous metals, cutting tool materials and composites along with their properties.
CO4	Describe about the various metallic failures and knowledge in testing of materials.
CO5	Explain the principle of corrosion, their types and its prevention methods along with the various surface engineering processes.

Course Content

Unit 1:	**Crystal structures and Bonds:** Unit cell and space lattice: Crystal system: The seven basic crystal systems; Crystal structure for metallic elements: BCC, FCC and HCP; Coordination number for Simple Cubic, BCC and FCC; Atomic radius: definition, atomic radius for Simple Cubic, BCC and FCC; Atomic Packing Factor for Simple Cubic, BCC, FCC and HCP; Simple problems on finding number of atoms for a unit cell. **Bonds in solids:** Classification - primary or chemical bond, secondary or molecular bond; Types of primary bonds: Ionic, Covalent and Metallic Bonds; Types of secondary bonds: Dispersion bond, Dipole bond and Hydrogen bond.
Unit 2:	**Phase diagrams, Ferrous metals and its Alloys:** Isomorphs, eutectic and eutectoid systems; Iron-Carbon binary diagram; Iron and Carbon Steels; flow sheet for production of iron and steel; Iron ores – Pig iron: classification, composition and effects of impurities on iron; Cast Iron: classification, composition, properties and uses; Wrought Iron: properties, uses/applications of wrought Iron; comparison of cast iron, wrought iron and mild steel and high carbon steel; standard commercial grades of steel as per BIS and AISI; Alloy Steels – purpose of alloying; effects of alloying elements – Important alloy steels: Silicon steel, High Speed Steel (HSS), heat resisting steel, spring steel, Stainless Steel (SS): types of SS, applications of SS – magnet steel – composition, properties and uses
Unit	**Non-ferrous metals and its Alloys:** Properties and uses of aluminium,

3:	copper, tin, lead, zinc, magnesium and nickel; Copper alloys: Brasses, bronzes – composition, properties and uses; Aluminium alloys: Duralumin, hindalium, magnelium – composition, properties and uses; Nickel alloys: Inconel, monel, nicPerome – composition, properties and uses. Anti-friction/Bearing alloys: Various types of bearing bronzes - Standard commercial grades as per BIS/ASME.
Unit 4:	**Failure analysis & Testing of Materials:** Introduction to failure analysis; Fracture: ductile fracture, brittle fracture; cleavage; notch sensitivity; fatigue; endurance limit; characteristics of fatigue fracture; variables affecting fatigue life; creep; creep curve; creep fracture; Destructive testing: Tensile testing; compression testing; Hardness testing: Brinell, Rockwell; bend test; torsion test; fatigue test; creep test. Non-destructive testing: Visual Inspection; magnetic particle inspection; liquid penetrant test; ultrasonic inspection; radiography.
Unit 5:	**Corrosion & Surface Engineering:** Nature of corrosion and its causes; Electrochemical reactions; Electrolytes; Factors affecting corrosion: Environment, Material properties and physical conditions; Types of corrosion; Corrosion control: Material selection, environment control and design; Surface engineering processes: Coatings and surface treatments; Cleaning and mechanical finishing of surfaces; Organic coatings; Electroplating and Special metallic plating; Electro polishing and photo-etching ;– Conversion coatings: Oxide, phosphate and chromate coatings; Thin film coatings: PVD and CVD; Surface analysis; Hard-facing, thermal spraying and high-energy processes; Process/material selection. Pollution norms for treating effluents as per standards.

Evaluation Scheme:

Exam	**Marks**	**Course Coverage**
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

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

Diploma: Mechanical Engineeing

Semester-III			
Course Name:	**Fluid Mechanics & Hydraulic Machinery**	**Course Code:**	DME105
L P T Scheme:	**2-1-0**	**Credits:**	**3**
Prerequisites: Nil			
Objective: This course is aimed at			
• To understand fluid flow & related machinery for power generation, water supply and irrigation. • To Select and use appropriate flow measuring device. • To Select and use appropriate pressure measuring device. • To understand and analyze the performance of pumps and turbines.			

Learning Outcomes:

Course Outcome	Description
CO1	Measure various properties such as pressure, velocity, flow rate using various instruments.
CO2	Calculate different parameters such as co-efficient of friction, power, efficiency etc. of various Systems.
CO3	Describe the construction and working of turbines and pumps.
CO4	Test the performance of turbines and pumps.
CO5	Plot characteristics curves of turbines and pumps.

Course Content

Unit 1:	**Properties of fluid:** Density, Specific gravity, Specific Weight, Specific Volume, Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity, Vapour Pressure, Compressibility. **Fluid Pressure & Pressure Measurement:** Fluid pressure, Pressure head, Pressure intensity, Concept of vacuum and gauge pressures, atmospheric pressure, absolute pressure, Simple and differential manometers, Bourdon pressure gauge, Concept of Total pressure on immersed bodies, center of pressure, Simple problems on Manometers.
Unit 2:	**Fluid Flow:** Types of fluid flows, Path line and Stream line, Continuity equation, Bernoulli's theorem, Principle of operation of Venturi meter, Orifice meter and Pitot tube, Derivations for discharge, coefficient of discharge and numerical problems. **Flow Through Pipes:** Laminar and turbulent flows; Darcy's equation and Chezy's equation for frictional losses, Minor losses in pipes, Hydraulic gradient and total gradient line, Numerical problems to estimate major and minor losses
Unit 3:	**Impact of jets:** Impact of jet on fixed vertical, moving vertical flat plates, Impact of jet on curved vanes with special reference to turbines & pumps, Simple Numericals on work done and efficiency.
Unit 4:	**Hydraulic Turbines:** Layout of hydroelectric power plant, Features of Hydroelectric power plant, Classification of hydraulic turbines, Selection of turbine on the basis of head and discharge available, Construction and working principle of Pelton wheel,

	Francis and Kaplan turbines, Draft tubes – types and construction, Concept of cavitation in turbines, Calculation of Work done, Power, efficiency of turbines, Unit quantities and simple numericals.
Unit 5:	**Centrifugal Pumps:** Principle of working and applications, Types of casings and impellers, Concept of multistage, Priming and its methods, Cavitation, Manometric head, Work done, Manometric efficiency, Overall efficiency. Numericals on calculations of overall efficiency and power required to drive pumps. **Reciprocating Pumps:** Construction, working principle and applications of single and double acting reciprocating pumps, Concept of Slip, Negative slip, Cavitation and separation.

Evaluation Scheme:

Exam	**Marks**	**Course Coverage**
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

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

Diploma: Mechanical Engineeing

Semester-III			
Course Name:	**Manufacturing Engineering**	**Course Code:**	DME106
L P T Scheme:	**3-0-0**	**Credits:**	**3**
Prerequisites: Basic Mechanical Engineering			
Objective: This course is aimed at			
• To understand the importance of cutting fluids & lubricants in machining. • To study various types of basic production processes. To select, operate and control the appropriate processes for specific applications. • To understand the concept of gear making and list various gear materials. • To understand the importance of press tools and understand various die operations. • To understand Grinding and finishing processes.			

Learning Outcomes:

Course Outcome	Description
CO1	Know and identify basic manufacturing processes for manufacturing different components.
CO2	Operate & control different machines and equipments.
CO3	Produce jobs as per specified dimensions and inspect the job for specified dimensions.
CO4	Select the specific manufacturing process for getting the desired type of output.
CO5	Adopt safety practices while working on various machines.

Course Content

Unit 1:	**Cutting Fluids & Lubricants:** Introduction; Types of cutting fluids, Fluids and coolants required in turning, drilling, shaping, sawing & broaching; Selection of cutting fluids, methods of application of cutting fluid; Classification of lubricants (solid, liquid, gaseous), Properties and applications of lubricants. **Lathe Operations:** Types of lathes – light duty, Medium duty and heavy duty geared lathe, CNC lathe; Specifications; Basic parts and their functions; Operations and tools – Turning, parting off, Knurling, facing, Boring, drilling, threading, step turning, taper turning.
Unit 2:	**Broaching Machines:** Introduction to broaching; Types of broaching machines – Horizontal type (Single ram & duplex ram), Vertical type, pull up, pull down, and push down; Elements of broach tool; broach teeth details; Nomenclature; Tool materials. **Drilling:** Classification; Basic parts and their functions; Radial drilling machine; Types of operations; Specifications of drilling machine; Types of drills and reamers.
Unit 3:	**Welding:** Classification; Gas welding techniques; Types of welding flames; Arc Welding – Principle, Equipment, Applications; Shielded metal arc welding; Submerged arc welding; TIG / MIG welding; Resistance welding - Spot welding, Seam welding, Projection welding; Welding defects; Brazing and soldering: Types, Principles, Applications. **Milling:** Introduction; Types of milling machines: plain, Universal, vertical; constructional details – specifications; Milling operations: simple, compound and differential indexing; Milling cutters – types; Nomenclature of teeth; Teeth materials;

	Tool signature of milling cutter; Tool & work holding devices.
Unit 4:	**Gear Making:** Manufacture of gears – by Casting, Moulding, Stamping, Coining Extruding, Rolling, Machining; Gear generating methods: Gear Shaping with pinion cutter & rack cutter; Gear hobbing; Description of gear hob; Operation of gear hobbing machine; Gear finishing processes; Gear materials and specification; Heat treatment processes applied to gears. **Press working:** Types of presses and Specifications, Press working operations - Cutting, bending, drawing, punching, blanking, notching, lancing; Die set components- punch and die shoe, guide pin, bolster plate, stripper, stock guide, feed stock, pilot; Punch and die clearances for blanking and piercing, effect of clearance.
Unit 5:	**Grinding and finishing processes:** Principles of metal removal by Grinding; Abrasives – Natural & Artificial; Bonds and binding processes: Vitrified, silicate, shellac, rubber, bakelite; Factors affecting the selection of grind wheels: size and shape of wheel, kind of abrasive, grain size, grade and strength of bond, structure of grain, spacing, kinds of bind material; Standard marking systems: Meaning of letters & numbers sequence of marking, Grades of letters; Grinding machines classification: Cylindrical, Surface, Tool & Cutter grinding machines; Construction details; Principle of centerless grinding; Advantages & limitations of centre less grinding; Finishing by grinding: Honing, Lapping, Super finishing; Electroplating: Basic principles, Plating metals, applications; Hot dipping: Galvanizing, Tin coating, Parkerising, Anodizing; Metal spraying: wire process, powder process and applications; Organic coatings: Oil base Paint, Lacquer base, Enamels, Bituminous paints, rubber base coating; Finishing specifications.

Evaluation Scheme:

Exam	**Marks**	**Course Coverage**
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

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

Diploma: Mechanical Engineeing

Semester-III			
Course Name:	**Thermal Engineering - I**	**Course Code:**	DME107
L P T Scheme:	**3-0-0**	**Credits:**	**3**

Prerequisites: Basic Mechanical Engineering

Objective: This course is aimed at

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

Learning Outcomes:

Course Outcome	Description
CO1	Know various sources of Energy and their applications.
CO2	Classify I.C. engines and understand their working and constructional features.
CO3	Draw the energy flow diagram of an I.C. engine and evaluate its performance.
CO4	Describe the constructional features of air compressor and working of different air compressors.
CO5	Know the applications of refrigeration and Classify air-conditioning systems.

Course Content

Unit 1:	**Sources of Energy:** Brief description of energy Sources: Classification of energy sources - Renewable, Non-Renewable; Fossil fuels, including CNG, LPG; Solar Energy: Flat plate and concentrating collectors & its applications (Solar Water Heater, Photovoltaic Cell, Solar Distillation); Wind Energy; Tidal Energy; Ocean Thermal Energy; Geothermal Energy; Biogas, Biomass, Bio-diesel; Hydraulic Energy, Nuclear Energy; Fuel cell.
Unit 2:	**Internal Combustion Engines:** Assumptions made in air standard cycle analysis; Brief description of Carnot, Otto and Diesel cycles with P-V and T-S diagrams; Internal and external combustion engines; advantages of I.C. engines over external combustion engines; classification of I.C. engines; neat sketch of I.C. engine indicating component parts; Function of each part and materials used for the component parts - Cylinder, crank case, crank pin, crank, crank shaft, connecting rod, wrist pin, piston, cooling pins cylinder heads, exhaust valve, inlet valve; Working of four-stroke and two-stroke petrol and diesel engines; Comparison of two stroke and four stroke engines; Comparison of C.I. and S.I. engines; Valve timing and port timing diagrams for four stroke and two stroke engines.
Unit 3:	**I.C. Engine Systems:** Fuel system of Petrol engines; Principle of operation of simple and Zenith carburetor; Fuel system of Diesel engines; Types of injectors and fuel pumps; Cooling system - air cooling, water cooling system with thermo siphon method of circulation and water cooling system with radiator and forced circulation (description with line diagram). Comparison of air cooling and water cooling system;

	Ignition systems – Battery coil ignition and magneto ignition (description and working). Comparison of two systems; Types of lubricating systems used in I.C. engines with line diagram; Types of governing of I.C. engines – hit and miss method, quantitative method, qualitative method and combination methods of governing; their applications; Objective of super charging.
Unit 4:	**Performance of I.C. Engines:** Brake power; Indicated power; Frictional power; Brake and Indicated mean effective pressures; Brake and Indicated thermal efficiencies; Mechanical efficiency; Relative efficiency; Performance test; Morse test; Heat balance sheet; Methods of determination of B,P., I.P. and F.P.; Simple numerical problems on performance of I.C. engines.
Unit 5:	**Air Compressors:** Functions of air compressor; Uses of compressed air; Types of air compressors; Single stage reciprocating air compressor - its construction and working (with line diagram) using P-V diagram; Multi stage compressors – Advantages over single stage compressors; Rotary compressors: Centrifugal compressor, axial flow type compressor and vane type compressors. **Refrigeration & Air-conditioning:** Refrigeration; Refrigerant; COP; Air Refrigeration system: components, working & applications; Vapour Compression system: components, working & applications; Air conditioning; Classification of Air-conditioning systems; Comfort and Industrial Air-Conditioning; Window Air-Conditioner; Summer Air-Conditioning system, Winter Air-Conditioning system, Year-round Air-Conditioning system.

Evaluation Scheme:

Exam	**Marks**	**Course Coverage**
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

1. Manufacturing technology – P N Rao, Tata McGraw-Hill Publications
2. Elements of workshop Technology (Volume I & II) – S. K. HajraChaudary, Bose & Roy, Media
   Promoters and Publishers Limited.
3. Production Technology (Volume I & II) – O. P. Khanna & Lal, Dhanpat Rai Publications.
4. Fundamental of metal cutting and machine tools– B. L. Juneja, New age international limited.
5. Manufacturing Technology, Metal Cutting & Machine tools– P. N. Rao, Tata McGraw-Hill Publications
6. Production Technology – R.B. Gupta, Satya Prakashan, New Delhi

Diploma: Mechanical Engineeing

Semester-III			
Course Name:	**Manufacturing Engineering Lab-I**	**Course Code:**	DME204
L P T Scheme:	**0-0-2**	**Credits:**	**2**
Prerequisites: Basic Mechanical Engineering () Manufacturing Engineering)			
Objective: This course is aimed at			
• To Practice the casting principles and operations in foundry. • To Practice the operation of Lathe. • To Practice the joining of metals using different Welding techniques.			

Learning Outcomes:

Course Outcome	Description
CO1	Prepare a mould sand mix and molten metal and calculate the amount of metal to be poured in the mould.
CO2	Centre the job and select the proper tool to perform the job on lathe machine.
CO3	Calculate the taper angle and practice different taper turning methods on lathe.
CO4	Prepare the edges for welding and select the suitable electrode, voltage and current.
CO5	Operate the welding transformer and generator to perform various weld joint operations.

Course Content

S.No.	Topics for practice
I	Moulding & casting of (i) Connecting rod (ii) Solid bearing (iii) V-Pulley/Gear Pulley
II	Arc welding (i) Lap Joint (ii) Butt Joint (iii) T- Joint
III	Gas welding (i) Lap Joint (ii) Butt Joint
IV	Spot welding (i) Lap Joint
V	Turning Exercise (i) Facing, Step Turning & Chamfering (ii) Step Turning & Taper Turning (iii) Step Turning & Groove Cutting (iv) Step Turning && Knurling (v) Step Turning & Thread Cutting (vi) Turning and Drilling
VI	Grinding the Lathe Cutting tools to the required angles
VII	Study of Lathe, Drilling machine, shaping machine and slotting machine
VIII	The dismantling some of the components of lathe and then assemble the same
IX	List the faults associated with lathe and its remedies
X	The routine and preventive maintenance procedure for lathe

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	15	Full syllabus
DTDW	40	
Discipline and attendance	15	
Lab Record	15	
Total	100	

Books:

1. Elements of Workshop Technology (Volume I & II) – Hajra Choudhary & Bhattacharya, Media Promoters, 11th Edition, 2007
2. Introduction of Basic Manufacturing Processes and Workshop Technology – Rajender Singh, New Age International (P) Ltd. NewDelhi, 2006
3. Workshop Technology – Raghuwanshi, Khanna Publishers. Jain &Gupta, New Delhi, 2002
4. Production Technology – Jain & Gupta, Khanna Publishers, New Delhi, 2006.
5. Production Technology – HMT, 18th edition, Tata McGraw Hill, New Delhi
6. Manufacturing process – Myron N Bean, 5 th edition, Tata McGraw Hill, New Delhi

Semester-III			
Course Name:	**Fluid Mechanics & Hydraulic Machinery Lab**	**Course Code:**	DME205
L P T Scheme:	**0-0-2**	**Credits:**	**1**
Prerequisites: Fluid Mechanics & Hydraulic Machinery ()			
Objective: This course is aimed at			
• To calibrate the given flow measuring device. • To apply the knowledge acquired in the theory subject. • To analyse the performance of turbines and pumps.			

Learning Outcomes:

Course Outcome	Description
CO1	Measure various properties such as pressure, velocity, flow rate using various instruments.
CO2	Calculate different parameters such as co-efficient of friction, power, efficiency etc. of various systems.
CO3	Understand the need and importance of calibration of pressure gauges.
CO4	Describe the construction and working of turbines and pumps.
CO5	Test the performance of turbines and pumps and Plot characteristics curves.

Course Content

S.No.	Topics for practice
I	Verification of Bernoulli's theorem.
II	Determination of Coefficient of Discharge of Venturi meter.
III	Determination of Coefficient of Discharge, coefficient of contraction and coefficient ofthe velocity of Orifice meter.
IV	Determination of coefficient of friction of flow through pipes.
V	Determination of force exerted by the jet of water on the given vane.
VI	Determination of minor losses of flow through pipes.

VII	Calibration of pressure gauge using dead weight pressure gauge tester.
VIII	Trial on centrifugal pump to determine overall efficiency.
IX	Trial on reciprocating pump to determine overall efficiency.
X	Trial on Pelton wheel to determine overall efficiency.
XI	Trial on Francis/Kaplan turbine to determine overall efficiency.

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	15	Full syllabus
DTDW	40	
Discipline and attendance	15	
Lab Record	15	
Total	100	

Book:

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

Semester-III			
Course Name:	**Thermal Engineering Lab-I**	**Course Code:**	DME206
L P T Scheme:	**0-0-2**	**Credits:**	**1**

Prerequisites: Thermal Engineering – I ()

Objective: This course is aimed at

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

Learning Outcomes:

Course Outcome	**Description**
CO1	Understand the determination of flash and fire point of a given sample of fuel using a given apparatus (Abel's, Cleveland &Pensky Martin)
CO2	Understand the determination of the Viscosity of a given sample of oil using a given apparatus.
CO3	Understand the determination of the Calorific value of a given sample of fuel using a given apparatus.

CO4	Understand the determination of the amount of carbon residue of a given sample of petroleum product.
CO5	Draw VTD /PTD of a given I.C. Engine and understand how the processes are controlled during its operation.
CO6	Understand the functions of various parts of IC engines and the working of IC engines.

Course Content

S.No.	Topics for practice
I	Verification of Bernoulli's theorem.
II	Determination of Coefficient of Discharge of Venturi meter.
III	Determination of Coefficient of Discharge, coefficient of contraction and coefficient of the velocity of Orifice meter.
IV	Determination of coefficient of friction of flow through pipes.
V	Determination of force exerted by the jet of water on the given vane.
VI	Determination of minor losses of flow through pipes.
VII	Calibration of pressure gauge using dead weight pressure gauge tester.
VIII	Trial on centrifugal pump to determine overall efficiency.
IX	Trial on reciprocating pump to determine overall efficiency.
X	Trial on Pelton wheel to determine overall efficiency.
XI	Trial on Francis/Kaplan turbine to determine overall efficiency.

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	15	Full syllabus
DTDW	40	
Discipline and attendance	15	
Lab Record	15	
Total	100	

Books:

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

Diploma: Mechanical Engineeing

Semester-IV			
Course Name:	**Measurements & Metrology**	**Course Code:**	DME108
L P T Scheme:	**2-1-0**	**Credits:**	**3**
Prerequisites: Nil			
Objective: This course is aimed at			
• To study advances in technology, measurement techniques, types of instrumentation devices, innovations, and refinements. • To study the principles of instrumentation, transducers & measurement of non-electrical parameters like temperature, pressure, flow, speed, force, and stress.			

Learning Outcomes:

Course Outcome	Description
CO1	Define accuracy, precision, calibration, sensitivity, repeatability and such relevant terms in metrology.
CO2	Distinguish between various types of errors.
CO3	Understand the principle of operation of an instrument and select suitable measuring device for a particular application.
CO4	Appreciate the concept of calibration of an instrument.
CO5	Analyze and interpret the data obtained from the different measurements processes and present it in the graphical form, statistical form.

Course Content

Unit 1:	**Introduction to measurements:** Definition of measurement; Significance of measurement; Methods of measurements: Direct & Indirect; Generalized measuring system; Standards of measurements: Primary & Secondary; Factors influencing selection of measuring instruments; Terms applicable to measuring instruments: Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, calibration; Errors in Measurements: Classification of errors, Systematic and Random error. **Measuring instruments:** Introduction; Thread measurements: Thread gauge micrometer; Angle measurements: Bevel protractor, Sine Bar; Gauges: plain plug gauge, ring Gauge, snap gauge, limit gauge; Comparators: Characteristics of comparators, Types of comparators; Surface finish: Definition, Terminology of surface finish, Talysurf surface roughness tester; Co-ordinating measuring machine.
Unit 2:	**Transducers and Strain gauges:** Introduction; Transducers: Characteristics, classification of transducers, two coil self-inductance transducer, Piezoelectric transducer; Strain Measurements: Strain gauge, Classification, mounting of strain gauges, Strain gauge rosettes-two and three elements. **Measurement of force, torque, and pressure:** Introduction; Force measurement: Spring Balance, Proving ring, Load cell; Torque measurement: Prony brake, Eddy current, Hydraulic dynamometer; Pressure measurement: Mcloed gauge.
Unit 3:	**Applied mechanical measurements:** Speed measurement: Classification of tachometers, Revolution counters, Eddy current tachometers; Displacement

	measurement: Linear variable Differential transformers (LVDT); Flow measurement: Rotameters, Turbine meter; Temperature measurement: Resistance thermometers, Optical Pyrometer. **Miscellaneous measurements:** Humidity measurement: hair hygrometer; Density measurement: hydrometer; Liquid level measurement: sight glass, Float gauge; Biomedical measurement: Sphygmo monometer.
Unit 4:	**Limits, Fits & Tolerances:** Concept of Limits, Fits, and Tolerances; Selective Assembly; Interchangeability; Hole and Shaft Basis System; Taylor's Principle; Design of Plug; Ring Gauges; IS 919-1993 (Limits, Fits & Tolerances, Gauges} IS 3477-1973; concept of multi gauging and inspection. Angular Measurement: Concept; Instruments for Angular Measurements; Working and Use of Universal Bevel Protractor, Sine Bar, Spirit Level; Principle of Working of Clinometers; Angle Gauges (With Numerical on Setting of Angle Gauges). **Screw thread Measurements:** ISO grade and fits of thread; Errors in threads; Pitch errors; Measurement of different elements such as major diameter, minor diameter, effective diameter, pitch; Two wire method; Thread gauge micrometer; Working principle of floating carriage dial micrometer.
Unit 5:	**Gear Measurement and Testing:** Analytical and functional inspection; Rolling test; Measurement of tooth thickness (constant chord method); Gear tooth Vernier; Errors in gears such as backlash, runout, composite. **Machine tool testing:** Parallelism; Straightness; Squareness; Coaxiallity; roundness; run out; alignment testing of machine tools as per IS standard procedure.

Evaluation Scheme:

Exam	**Marks**	**Course Coverage**
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

1. Mechanical measurements – Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. Metrology & Measurement – Anand K Bewoor,Vinaykulakarni, Tata McGraw Hill, New Delhi, 2009
3. Principles of Industrial instrumentation and control systems – Channakesava. R. Alavala, DELMAR cenage learning, 2009.
4. Principles of Engineering Metrology – Rega Rajendra, Jaico publishers, 2008
5. Dimensional Metrology – Connie Dotson, DELMAR, Cenage learning, 2007
6. Instrumentation measurement and analysis – B.C. Nakara, K.K. Chaudary, second edition, Tata cgraw Hill, 2005.
7. Engineering Metrology – R.K. Jain, Khanna Publishers, New Delhi, 2005.

8. A text book of Engineering Metrology – I.C. Gupta, Dhanpat Rai and Sons, New Delhi, 2005
9. Metrology for Engineers – J.F.W. Galyer and C. R. Shotbolt, ELBS
10. Engineering Metrology – K. J. Hume, Kalyani publishers

Semester-IV			
Course Name:	**Strength of Materials**	**Course Code:**	DME109
L P T Scheme:	**3-1-0**	**Credits:**	**4**
Prerequisites: Engineering Mechanics ()			
Objective: This course is aimed at			
• To understand the concept of Simple Stresses and Strains. • To understand the concept of Strain Energy. • To understand the concept of Shear Force and Bending Moment Diagrams. • To understand the concept of Theory of Simple Bending and Deflection of Beams. • To understand the concept of Torsion in Shafts and Springs. • To understand the concept of Thin Cylindrical Shells.			

Learning Outcomes:

Course Outcome	Description
CO1	Compute stress and strain values and find the changes in axial, lateral and volumetric dimensions of bodies of uniform section and of composite section under the influence of normal forces.
CO2	Calculate thermal stresses, in bodies of uniform section and composite sections.
CO3	Define resilience, proof-resilience, and modulus of resilience and obtain expressions for instantaneous stress developed in bodies subjected to different loads.
CO4	Compute shear force and bending moment at any section of the beam and draw the S.F. and B.M. diagrams for UDL and Point loads.
CO5	Calculate the safe load, safe span, and dimensions of the cross section.
CO6	Compare the strength and weight of solid and hollow shafts of the same length and material and compute the stress and deflection of the closed coil helical spring.

Course Content

Unit 1:	**Simple Stresses and Strains:** Types of forces; Stress, Strain and their nature; Mechanical properties of common engineering materials; Significance of various points on stress – strain diagram for M.S. and C.I. specimens; Significance of factor of safety; Relation between elastic constants; Stress and strain values in bodies of uniform section and of composite section under the influence of normal forces; Thermal stresses in bodies of uniform section and composite sections; Related numerical problems on the above topics. **Strain Energy:** Strain energy or resilience, proof resilience and modulus of resilience; Derivation of strain energy for the following cases: i) Gradually applied load, ii)

	Suddenly applied load, iii) Impact/shock load; Related numerical problems.
Unit 2:	**Shear Force and Bending Moment Diagrams:** Types of beams with examples: a) Cantilever beam, b) Simply supported beam, c) Over hanging beam, d) Continuous beam, e) Fixed beam; Types of Loads – Point load, UDL and UVL; Definition and explanation of shear force and bending moment; Calculation of shear force and bending moment and drawing the S.F and B.M. diagrams by the analytical method only for the following cases: a) Cantilever with point loads, b) Cantilever with uniformly distributed load, c) Simply supported beam with point loads, d) Simply supported beam with UDL, e) Over hanging beam with point loads, at the centre and at free ends, f) Over hanging beam with UDL throughout, g) Combination of point and UDL for the above; Related numerical problems.
Unit 3:	**Theory of Simple Bending and Deflection of Beams:** Explanation of terms: Neutral layer, Neutral Axis, Modulus of Section, Moment of Resistance, Bending stress, Radius of curvature; Assumptions in theory of simple bending; Bending Equation $M/I = \sigma/Y = E/R$ with derivation; Problems involving calculations of bending stress, modulus of section and moment of resistance; Calculation of safe loads and safe span and dimensions of cross- section; Definition and explanation of deflection as applied to beams; Deflection formulae without proof for cantilever and simply supported beams with point load and UDL only (Standard cases only); Related numerical problems.
Unit 4:	**Torsion in Shafts and Springs:** Definition and function of shaft; Calculation of polar M.I. for solid and hollow shafts; Assumptions in simple torsion; Derivation of the equation $T/J=f_s/R=G\theta/L$; Problems on design of shaft based on strength and rigidity; Numerical Problems related to comparison of strength and weight of solid and hollow shafts; Classification of springs; Nomenclature of closed coil helical spring; Deflection formula for closed coil helical spring (without derivation); stiffness of spring; Numerical problems on closed coil helical spring to find safe load, deflection, size of coil and number of coils.
Unit 5:	**Thin Cylindrical Shells:** Explanation of longitudinal and hoop stresses in the light of circumferential and longitudinal failure of shell; Derivation of expressions for the longitudinal and hoop stress for seamless and seam shells; Related numerical Problems for safe thickness and safe working pressure.

Evaluation Scheme:

Exam	**Marks**	**Course Coverage**
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

1. Strength of Materials – D.S. Bedi, Khanna Book Publishing Co. (P) Ltd., Delhi, 2017

2. Strength of Materials – B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications,New Delhi, 2013
3. Strength of Materials – S. Ramamrutham, Dhanpat Rai & Publication New Delhi
4. Strength of Materials – R.S. Khurmi, S.Chand Company Ltd. Delhi
5. A Text Book strength of Material– R.K. Bansal, Laxmi Publication New Delhi

Semester-IV			
Course Name:	**Thermal Engineering - II**	**Course Code:**	DME110
L P T Scheme:	**2-1-0**	**Credits:**	**3**
Prerequisites: Thermal Engineering - I ()			
Objective: This course is aimed at			
• To understand the working and applications of Gas turbines & Jet Propulsion. • To understand the methods of computing various properties of steam. • To understand the working of various Steam Boilers, functions of various accessories and mountings of boilers. • To understand the Working of Steam Nozzles and Steam turbines. • To understand the necessity of compounding and governing of a turbine.			

Learning Outcomes:

Course Outcome	Description
CO1	Explain the working cycle of gas turbines and the workings of Jet and Rocket Engines, as well as identify the fuels used for Jet and Rocket propulsion.
CO2	Compute the work done, enthalpy, internal energy and entropy of steam at given conditions using steam tables and Mollier chart.
CO3	Distinguish between water-tube and fire-tube boilers and explain the function of all the mountings and accessories.
CO4	Calculate the Velocity of steam at the exit of the nozzle in terms of heat drop analytically and using a Mollier chart.
CO5	State the necessity of governing and compounding a turbine.
CO6	Explain the principle of working of a steam turbine and distinguish between the impulse turbines and reaction turbines.

Course Content

Unit 1:	**Gas Turbines:** Air-standard Brayton cycle; Description with p-v and T-S diagrams; Gas turbines Classification: open cycle gas turbines and closed cycle gas turbines; comparison of gas turbine with reciprocating I.C. engines and steam turbines. Applications and limitations of gas turbines; General lay-out of Open cycle constant pressure gas turbine; P-V and T-S diagrams and working; General lay-out of Closed cycle gas turbine; P-V and T-S diagrams and working. **Jet Propulsion:** Principle of jet propulsion; Fuels used for jet propulsion; Applications of jet propulsion; Working of a turbojet engine; Principle of Ram effect; Working of a Ram jet engine; Principle of Rocket propulsion; Working principle of a

	rocket engine; Applications of rocket propulsion; Comparison of jet and rocket propulsions.
Unit 2:	**Properties of Steam:** Formation of steam under constant pressure; Industrial uses of steam; Basic definitions: saturated liquid line, saturated vapour line, liquid region, vapour region, wet region, superheat region, critical point, saturated liquid, saturated vapour, saturation temperature, sensible heat, latent heat, wet steam, dryness fraction, wetness fraction, saturated steam, superheated steam, degree of superheat; Determination of enthalpy, internal energy, internal latent heat, the entropy of wet, dry and superheated steam at a given pressure using steam tables and Mollier chart for the following processes: Isochoric process, Isobaric process, Hyperbolic process, Isothermal process, Isentropic process, Throttling process, Polytropic process; Simple direct problems on the above using tables and charts; Steam calorimeters: Separating, throttling, Combined Separating and throttling calorimeters – problems.
Unit 3:	**Steam Generators:** Function and use of steam boilers; Classification of steam boilers with examples; Brief explanation with line sketches of Cochran, Babcock and Wilcox Boilers; Comparison of water tube and fire tube boilers; Description with line sketches and working of modern high pressure boilers Lamont and Benson boilers; Boiler mountings: Pressure gauge, water level indicator, fusible plug, blow down cock, stop valve, safety valve, (dead weight type, spring loaded type, high pressure and low water safety alarm); Boiler accessories: feed pump, economiser, super heater and air pre-heater; Study of steam traps & separators; Explanation of the terms: Actual evaporation, equivalent evaporation, factor of evaporation, boiler horse power and boiler efficiency; Formula for the above terms without proof; Simple direct problems on the above; Draught systems (Natural, forced & induced).
Unit 4:	**Steam Nozzles:** Flow of steam through nozzle; Velocity of steam at the exit of nozzle in terms of heat drop using analytical method and Mollier chart; Discharge of steam through nozzles; Critical pressure ratio; Methods of calculation of cross-sectional areas at throat and exit for maximum discharge; Effect of friction in nozzles and Super saturated flow in nozzles; Working steam jet injector; Simple numerical problems.
Unit 5:	**Steam Turbines:** Classification of steam turbines with examples; Difference between impulse & reaction turbines; Principle of working of a simple De-lavel turbine with line diagrams- Velocity diagrams; Expression for work done, axial thrust, tangential thrust, blade and diagram efficiency, stage efficiency, nozzle efficiency; Methods of reducing rotor speed; compounding for velocity, for pressure or both pressure and velocity; Working principle with line diagram of a Parson's Reaction turbine–velocity diagrams; Simple problems on single stage impulse turbines (without blade friction) and reaction turbine including data on blade height. Bleeding, re-heating and re-heating factors (Problems omitted); Governing of steam turbines: Throttle, By-pass & Nozzle control governing.

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	

Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

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

Semester-IV			
Course Name:	**Material Testing Lab**	**Course Code:**	DME207
L P T Scheme:	**0-0-2**	**Credits:**	**1**
Prerequisites: Material Science & Engineering () Strength of Materials ()			
Objective: This course is aimed at			
• To identify the type of material based on its grain structure • To learn the procedure for identifying the cracks in the material • To understand various material testing methods to determine mechanical properties such as yield stress, Ultimate stress, percentage elongation, Young's Modulus etc.			

Learning Outcomes:

Course Outcome	Description
CO1	Identify the given specimen by viewing the micro structure using metallurgical microscope
CO2	Identify the cracks in the specimen using different techniques
CO3	Determine the various types of stress and plot the stress strain diagram for mild steel.
CO4	Determine the torsion, bending, impact and shear values of given materials
CO5	Determine the modulus of rigidity, strain energy, shear stress and stiffness of coil spring

Course Content

S.No.	Topics for practice
I	Prepare a specimen and examine the microstructure of the Ferrous and Non-ferrous metals using the Metallurgical Microscope.
II	Detect the cracks in the specimen using (i) Visual inspection and ring test, (ii) Die penetration test, and (iii) Magnetic particle test.
III	Determination of Rockwell's Hardness Number for various materials like mild steel, high carbon steel, brass, copper, and aluminum.
IV	Finding the resistance of materials to impact loads by Izod test and Charpy test.

V	Torsion test on mild steel – relation between torque and angle of twist determination of shear modulus and shear stress.
VI	Finding Young's Modulus of Elasticity, yield points, percentage elongation and percentage reduction in area, stress strain diagram plotting, tests on mild steel.
VII	Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open & Closed coil spring)
VIII	Single or double Shear test on M.S. bar to finding the resistance of material to shear load.

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	15	Full syllabus
DTDW	40	
Discipline and attendance	15	
Lab Record	15	
Total	100	

Books:

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

Semester-IV			
Course Name:	**Measurements & Metrology Lab**	**Course Code:**	DME208
L P T Scheme:	**0-0-2**	**Credits:**	**1**
Prerequisites: Measurements and Metrology (MEPC202)			
Objective: This course is aimed at			
• To understand techniques for precise measurement of the dimensions of various objects and shapes.			

Learning Outcomes:

Course Outcome	**Description**
CO1	Measure various component of linear measurement using Vernier calipers and Micrometer.
CO2	Measure various component of angle measurement using sine bar and bevel Protractor
CO3	Measure the geometrical dimensions of V-thread and spur gear

Course Content

S.No.	**Topics for practice**
I	Measure the diameter of a wire using a micrometer and compare the result with a digital micrometer.
II	Measure the angle of the machined surface using sine bar with slip gauges.

III	Measure the angle of a V-block / Taper Shank of Drill / Dovetail using a universal bevel protractor.
IV	Measure the dimensions of ground MS flat/cylindrical bush using Vernier Caliper compared with Digital/Dial Vernier Caliper.
V	Measure the geometrical dimensions of V-Thread using a thread Vernier gauge.
VI	Measure the thickness of ground MS plates using slip gauges

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	15	Full syllabus
DTDW	40	
Discipline and attendance	15	
Lab Record	15	
Total	100	

Books:

1. Engineering Metrology – R. K. Jain
2. Engineering precision metrology – R. C. Gupta
3. A Hand book of Industrial Metrology – ASME

Semester-IV			
Course Name:	**Thermal Engineering Lab - II**	**Course Code:**	DME209
L P T Scheme:	**0-0-2**	**Credits:**	**1**
Prerequisites: Thermal Engineering - I () Thermal Engineering - II ()			
Objective: This course is aimed at			
• To understand the working of boilers, compressors and IC engines. • To observe various parts of engines and understand their functions. • To perform various tests on IC engines and calculate performance parameters. • To understand economical and optimum running conditions of the engines.			

Learning Outcomes:

Course Outcome	Description
CO1	Evaluate the performance characteristics of single cylinder diesel/petrol engine at different loads and draw the heat balance sheet.
CO2	Find the indicated power of individual cylinders of an engine by using morse test.
CO3	Evaluate the performance characteristics Multi stage air compressor
CO4	Evaluate the co efficient of performance of refrigerator
CO5	Find the thermal conductivity of material

Course Content

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S.No.	Topics for practice
I	Study of high pressure boiler with model
II	Study of boiler mountings and accessories
III	Conduct performance test on VCR test rig to determine COP of the refrigerator
IV	Conduct performance test on multi stage reciprocating compressor
V	Conduct Morse test to determine the indicated power of individual cylinders
VI	Conduct Performance test on 2-S CI/SI engine.
VII	Conduct Performance test on 4-S CI/SI engine.
VIII	Conduct Heat balance test on CI/SI engine.
IX	Conduct Economical speed test on 4-S CI/SI engine.
X	Thermal conductivity test on 1) Thick slab 2) Composite wall 3) Thick cylinder
XI	Leak detection of refrigeration equipment
XII	Conduct performance test on A/C test rig to determine COP of the refrigerator

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	15	Full syllabus
DTDW	40	
Discipline and attendance	15	
Lab Record	15	
Total	100	

Books:

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

Title: Indian Knowledge and Tradition Credit: 0

Unit 1: Historical Background and Making of the Constitution

The Company Rule (1773–1858), The Crown Rule (1858–1947), Composition of the Constituent Assembly, Working of the Constituent Assembly, Committees of the Constituent Assembly,Enactment of the Constitution, Enforcement of the Constitution, Criticism of the Constituent Assembly, Salient Features of the Constitution.

Unit 2: Preamble, Fundamental Rights, Directive Principles of State Policies

Text of the Preamble, Ingredients of the Preamble, Key Words in the Preamble, Significance of the Preamble, Preamble as Part of the Constitution, Amendability of the Preamble, Features of Fundamental Rights, Definition of State, Laws Inconsistent with Fundamental Rights, Writs—Types and Scope, Armed Forces and Fundamental Rights, Martial Law and Fundamental Rights, Effecting Certain Fundamental Rights, Present Position of Right to Property, Exceptions to Fundamental Right, Criticism of Fundamental Rights, Significance of Fundamental Rights. Features of the Directive Principles, Classification of the Directive Principles, New Directive Principles, Sanction Behind Directive Principles, Criticism of the Directive Principles, Utility of Directive Principles, Conflict Between Fundamental Rights and Directive Principles, Implementation of Directive Principles.

Unit 3: Fundamental Duties, Amendment of Constitution, Basic Structure of Constitution

List of Fundamental Duties, Features of the Fundamental Duties, Criticism of Fundamental, Duties, Significance of Fundamental Duties, Procedure for Amendment, Types of Amendments

Criticism of the Amendment Procedure, Emergence of the Basic Structure, Elements of the Basic Structure, Features of Parliamentary Government, Features of Presidential Government, Merits of the Parliamentary System, Demerits of the Parliamentary System, Reasons for Adopting Parliamentary System, Distinction between Indian and British Models

Unit 4: Emergency Provisions, Various posts in Indian Constitution, Parliament, Judiciary

Emergency Provisions, President, Vice-President, Prime Minister, Central Council of Ministers, Parliament, Supreme Court, High Court

Unit5: Ancient India,Medieval India, Modern India: Culture, Education, S&T

Different Aspects of Ancient, Medieval and Modern India: Background, Administration, Economy, Society, Culture, Religion, Education, Impact of western Renaissance and Reformation Movements on India.

Semester-V			
Course Name:	**Advanced Manufacturing Processes**	**Course Code:**	DME111
L P T Scheme:	**3-0-0**	**Credits:**	**3**
Prerequisites: Basic Mechanical Engineering, Manufacturing Engineering			
Objective: This course is aimed at			
• To Know the functions of Jigs and Fixtures. • To know the applications of jig-boring machines. • To identify different fabrication methods of plastic processing viz., sheet forming, blow molding,laminating and reinforcing of plastics. • To distinguish between non-conventional machining and traditional machining			

processes.

- To know about the advancements in the area of manufacturing and production processes.
- To impart knowledge & skills necessary for working in modern manufacturing environment.
- To get familiarized with working principles and operations performed on non-traditional machines,machining center, SPM, automated machines, and maintenance of machine tools.

Learning Outcomes:

Course Outcome	Description
CO1	Know the Operation and control of different advanced machine tools and equipments.
CO2	Produce jobs as per specified requirements by selecting the specific machining process.
CO3	Develop the mind set for modern trends in manufacturing and automation.
CO4	Identify the different fabrication methods viz., sheet forming, blow moulding, laminating and reinforcing of plastics.
CO5	Know different non-traditional machining processes, CNC milling machines, special purpose machines.
CO6	Work as maintenance engineer.

Course Content

Unit 1:	**Jigs & Fixtures:** Definition of jig; Types of jigs: Leaf jig, Box and Handle jig, Template jig, Plate jig, Indexing jig, Universal jig, Vice jigs - constructional details of the above jigs; General consideration in the design of drill jigs; Drill bush; Types of fixtures: Vice fixtures, Milling fixtures, Boring fixtures, Grinding fixtures - constructional details of the above fixtures; Basic principles of location; Locating methods and devices; Basic principles of the clamping; Types of clamps: Strap clamps, Cam clamps, Screw clamps, Toggle clamps, Hydraulic and Pneumatic clamps.
Unit 2:	**Jig Boring:** Introduction; Jig boring on vertical milling machine; Types jig boring machines: Open front machine, Cross rail type machine - constructional details & their working; System of location of holes. **Plastic Processing:** Processing of plastics; Moulding processes: Injection moulding, Compression moulding, Transfer moulding; Extruding; Casting; Calendering; Fabrication methods-Sheet forming, Blow moulding, Laminating plastics (sheets, rods & tubes), Reinforcing; Applications of Plastics.
Unit 3:	**Modern Machining Processes:** Introduction – comparison with traditional machining; Ultrasonic Machining: principle, Description of equipment, applications; Electric Discharge Machining: Principle, Description of equipment, Dielectric fluid, tools (electrodes), Process parameters, Output characteristics, applications; Wire cut EDM: Principle, Description of equipment, Controlling parameters; applications; Abrasive Jet Machining: principle, description of equipment, application; Laser Beam Machining: principle, description of equipment, application; Electro Chemical

	Machining: description of equipment, application.
Unit 4:	**CNC Milling Machines:** Vertical and horizontal machining center: Constructional features, Axis identification, electronic control system. Automatic tool changer and tool magazine. CNC programming: Preparatory functions (G code), miscellaneous functions (M code), Part programming including subroutines and canned cycles. Principles of computer aided part programming. **Machine Tool Automation:** Introduction and Need; (A) Single spindle automates, transfer lines. (B) Elements of control system, Limit switches, Proximity switches, Block diagram for feedback andservo control system, Introduction to PLC, Block diagram of PLC.
Unit 5:	**Special Purpose Machines (SPM):** Concept, General elements of SPM, Productivity improvement by SPM, Principles of SPM design. **Maintenance of Machine Tools:** Types of maintenance, Repair cycle analysis, Repair complexity, Maintenance manual, Maintenance records, Housekeeping. Introduction to Total Productive Maintenance (TPM).

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

1. Production Technology – HMT, Banglore, Tata Mc-Graw Hill
2. CNC machines – Pabla B. S. & M. Adithan, New Age international limited.
3. Non conventional Machining – P. K. Mistra, NarvasaPublishining House
4. Manufacturing Processes – Begman& Amsted, John Willey and Sons.
5. Advanced manufacturing technology – David L. Goetsch
6. Exploring Advanced Manufacturing Technologies – Stephen F. Krar& Arthur Gil, IndustrialPress

Semester-V			
Course Name:	**Theory of Machines & Mechanisms**	**Course Code:**	DME112
L P T Scheme:	**2-1-0**	**Credits:**	**3**
Prerequisites: Engineering Mechanics			

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Objective: This course is aimed at
• To understand different types of cams and their motions and also to draw cam profiles for variousmotions. • To understand the mechanism of various types of drives available for transmission of power. • To understand the design of Brakes, Dynamometers, Bearings and Clutches and their functionand working. • To understand the need for balancing of masses in the same plane • To Know different types of governors.

Learning Outcomes:

Course Outcome	Description
CO1	Know different machine elements and mechanisms.
CO2	Understand Kinematics and Dynamics of different machines and mechanisms.
CO3	Select Suitable Drives and Mechanisms for a particular application.
CO4	Appreciate concept of balancing and Vibration.
CO5	Develop ability to come up with innovative ideas.
CO6	Understand different types of cams and their motions and also draw cam profiles for variousmotions

Course Content

Unit 1:	**Cams and Followers:** Concept; Definition and application of Cams and Followers; Classification of Cams and Followers; Different follower motions and their displacement diagrams like uniform velocity, SHM, uniform acceleration and Retardation; Drawing of profile of radial cam with knife-edge and roller follower with and without offset with reciprocating motion (graphical method).
Unit 2:	**Power Transmission:** Types of Drives – Belt, Chain, Rope, Gear drives & their comparison; Belt Drives - flat belt, V– belt & its applications; Material for flat and V-belt; Angle of lap, Belt length. Slip and Creep; Determination of Velocity Ratio, Ratio of tight side and slack side tension; Centrifugal tension and Initial tension; Condition for maximum power transmission (Simple numericals); Chain Drives – Advantages & Disadvantages; Selection of Chain & Sprocket wheels; Methods of lubrication; Gear Drives – Spur gear terminology; Types of gears and gear trains, their selection for different applications; Train value & Velocity ratio for compound, reverted and simple epicyclic gear train; Methods of lubrication; Law of gearing; Rope Drives – Types, applications, advantages & limitations of Steel ropes.
Unit 3:	**Flywheel and Governors: Flywheel -** Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C. Engine (no Numericals); Coefficient of fluctuation of energy, Coefficient of fluctuation of speed and its significance; Governors - Types and explanation with neat sketches (Centrifugal, Watt and Porter);

	Concept, function and applications & Terminology of Governors; Comparison between Flywheel and Governor.
Unit 4:	**Brakes, Dynamometers, Clutches & Bearings:** Function of brakes and dynamometers; Types of brakes and Dynamometers; Comparison between brakes and dynamometers; Construction and working of i) shoe brake, ii) Band Brake, iii) Internal expanding shoe brake iv) Disc Brake; Concept of Self Locking & Self energizing brakes; Numerical problems to find braking force and braking torque for shoe & band brakes; Construction and working of i) Rope Brake Dynamometer, ii) Hydraulic Dynamometer, iii) Eddy current Dynamometers; Clutches- Uniform pressure and Uniform Wear theories; Function of Clutch and its application; Construction and working of i) Single plate clutch, ii) Multiplate clutch, iii) Centrifugal Clutch iv) Cone clutch and v) Diaphragm clutch. (Simple numerical on single and Multiplate clutch); Bearings – i) Simple Pivot, ii) Collar Bearing, iii) Conical pivot. Torque & power lost in friction (no derivation). Simple numerical.
Unit 5:	**Balancing & Vibrations:** Concept of balancing; Balancing of single rotating mass; Graphical method for balancing of several masses revolving in same plane; Concept and terminology used in vibrations, Causes of vibrations in machines; their harmful effects and remedies.

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

1. Theory of machines – S.S .Rattan ,Tata McGraw-Hill publications.
2. Theory of machines – R.K.Bansal ,Laxmi publications
3. Theory of machines – R.S. Khurmi&J.K.Gupta , S.Chand publications.
4. Dynamics of Machines – J B K Das, Sapna Publications.
5. Theory of machines – Jagdishlal, Bombay Metro – Politan book Ltd.

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Semester-V			
Course Name:	**Industrial Engineering & Management**	**Course Code:**	DME113
L P T Scheme:	**3-0-0**	**Credits:**	**3**
Prerequisites: Nil			
Objective: This course is aimed at			
• To take the right decisions to optimize resources utilization by improving productivity of theLands, Buildings, People, Materials, Machines, Money, Methods and Management effectively. • To eliminate unproductive activities under the control of the Management, Supervisor, workerand the Design of Products and Processes. • To use the Charts to record the Activities of the people, materials and Equipment to find alternative methods which minimize waste and to implement the best method.			

Learning Outcomes:

Course Outcome	Description
CO1	Explain the different types of layouts and plant maintenance with safety
CO2	List and explain the need of method study and work measurements
CO3	Explain the production planning and quality control, and its functions
CO4	Understand the basic principles, approaches and functions of management and identify concepts to specific situations
CO5	List and explain the different financial sources and methods of inventory management

Course Content:

Unit 1:	**Plant Engineering:** Plant; Selection of site of industry; Plant layout; Principles of a good layout; Types; Process; Product and Fixed position; Techniques to improve Layout; Principles of Material handling equipment; Plant maintenance; Importance; Break down maintenance; Preventive maintenance and Scheduled maintenance. **Plant Safety**: Importance; Accident: Causes and Cost of an Accident, Accident Proneness, Prevention of Accidents; Industrial disputes; Settlement of Industrial disputes; Collective bargaining; Conciliation; Mediation; Arbitration; Indian Factories Act 1948 and its provisions related to health, welfare and safety.
Unit 2:	**Work Study:** Productivity; Standard of living; Method of improving Productivity; Objectives; Importance of good working conditions. **Method Study:** Definition; Objectives; Selection of a job for method study; Basic procedure for conduct of Method study; Tools used; Operation process chart; Flow process chart; Two handed process chart; Man

	Machine chart; String diagram and flow diagram. **Work Measurement:** Definition; Basic procedure in making a time study; Employees rating factor; Application of time allowances: Rest, Personal, Process, Special and Policy allowances; Calculation of standard time; Numerical Problems; Basic concept of production study; Techniques of Work Measurement; Ratio delay study; Synthesis from standard data; Analytical estimating and Pre-determined Motion Time System (PMTS).
Unit 3:	**Production Planning and Control:** Introduction; Major functions of Production Planning and Control; Pre planning; Methods of forecasting; Routing and Scheduling; Dispatching and Controlling; Concept of Critical Path Method (CPM); Types of Production: Mass Production, Batch Production and Job Order Production; Characteristics; Economic Batch Quantity (EBQ); Principles of Product and Process Planning; Make or Buy decision; Numerical problems. **Quality Control:** Definition; Objectives; Types of Inspection: First piece, Floor and Centralized Inspection; Advantages and Disadvantages; Statistical Quality Control; Types of Measurements; Method of Variables; Method of Attributes; Uses of X, R, p and c charts; Operating Characteristics curve (O.C curve); Sampling Inspection; Single and Double Sampling plan; Concept of ISO 9001:2008 Quality Management System Registration/Certification procedure; Benefits of ISO to the organization.
Unit 4:	**Principles of Management:** Definition of Management; Administration; Organization; F.W. Taylor's and Henry Fayol's Principles of Management; Functions of Manager; Types of Organization: Line, Staff, Taylor's Pure functional types; Line and staff and committee type; Directing; Leadership; Styles of Leadership; Qualities of a good leader; Motivation; Positive and Negative Motivation; Modern Management Techniques; Just In Time; Total Quality Management (TQM); Quality circle; Zero defect concept; 5S Concept; Management Information Systems. Personnel Management: Responsibility of Human Resource Management; Selection Procedure; Training of Workers; Apprentice Training; On the Job training and Vestibule School Training; Job Evaluation and Merit Rating; Objectives and Importance; Wages and Salary Administration; Components of Wages; Wage Fixation; Type of Wage Payment: Halsey's 50% Plan, Rowan's Plan and Emerson's efficiency plan; Numerical Problems.
Unit 5:	**Financial Management:** Fixed and Working Capital; Resources of Capital; Shares Preference and Equity Shares; Debentures; Type of debentures; Public Deposits; Factory Costing: Direct Cost; Indirect Cost; Factory Overhead; Selling Price of a product; Profit. **Numerical Problems**; Depreciation; Causes; Methods: Straight line, sinking fund and percentage on Diminishing Value Method; Numerical Problems. Material Management: Objectives of good stock control system; ABC analysis of Inventory; Procurement and Consumption cycle; Minimum Stock, Lead Time, Reorder Level-Economic Order Quantity problems; Supply Chain.

Evaluation Scheme:

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Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

1. Industrial Engineering & Management, S.C. Sharma, Khanna Book Publishing Co. (P) Ltd., Delhi
2. Industrial Engineering and Management, O.P. Khanna, Revised Edition, Dhanpat Rai Publications(P) Ltd., New Delhi – 110002.
3. Management, A global perspective, Heinz Weihrich, Harold Koontz, 10th Edition, McGraw Hill InternationalEdition 1994.
4. Essentials of Management, 4th Edition, Joseph L.Massie, Prentice-Hall of India, New Delhi 2004.
5. Principles and Practices of Management, Premvir Kapoor, Khanna Publishing House, N. Delhi

Semester-V			
Course Name:	**CAD/CAM Lab**	**Course Code:**	DME211
L P T Scheme:	**0-0-2**	**Credits:**	**1**
Prerequisites: Computer Aided Machine Drawing			
Objective: This course is aimed at			
• To understand the fundamentals and use CAD. • To conceptualize drafting and modeling in CAD. • To interpret the various features in the menu of solid modeling package. • To synthesize various parts or components in an assembly. • To prepare CNC programmes for various jobs.			

Learning Outcomes:

Course Outcome	Description
CO1	Explain the 3D commands and features of a CAD software
CO2	Create 3D solid model and find the mass properties of simples solids
CO3	Demonstrate the working of CNC turning and milling machine
CO4	Develop the part program using simulation software for Lathe and Milling

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CO5	Assess the part program, edit and execute in CNC turning and machining centre

Course Content:

S.No.	Topics for practice
1	**Introduction:** Part modelling; Datum Plane; constraint; sketch; dimensioning; extrude; revolve; sweep; blend; protrusion; extrusion; rib; shell; hole; round; chamfer; copy; mirror; assembly; align; orient.
2	**Exercises:** 3D Drawings of 1). Geneva Wheel; 2). Bearing Block; 3). Bushed bearing: 4). Gib and Cotter joint; 5). Screw Jack; 6). Connecting Rod: Note: Print the orthographic view and sectional view from the above assembled 3D drawing.
3	**CNC Programming and Machining:** Introduction; 1). Study of CNC lathe, milling; 2). Study of international standard codes: G-Codes and M-Codes; 3). Format – Dimensioning methods; 4). Program writing – Turning simulator – Milling simulator, IS practice – commands menus; 5). Editing the program in the CNC machines; 6). Execute the program in the CNC machines; Exercises: Note: Print the Program from the Simulation Software and make the Component in the CNC Machine.
4	**CNC Turning Machine:** (Material: Aluminium/Acrylic/Plastic rod) 1. Using Linear and Circular interpolation - Create a part program and produce component in the Machine. 2. Using Stock removal cycle – Create a part program for multiple turning operations and produce component in the Machine. 3. Using canned cycle - Create a part program for thread cutting, grooving and produce component in the Machine.
5	**CNC Milling Machine (Material: Aluminium/ Acrylic/ Plastic)** 1. Using Linear interpolation and Circular interpolation – Create a part program for grooving and produce component in the Machine. 2. Using canned cycle - Create a part program for drilling, tapping, counter sinking and produce component in the Machine. 3. Using subprogram - Create a part program for mirroring and produce component in the Machine.

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	15	Full syllabus
DTDW	40	
Discipline and attendance	15	
Lab Record	15	
Total	100	

Books:

1. Machine Drawing – P.S. Gill S. K. Kataria& Sons, Delhi., 17th Revised edition, 2001
2. Mechanical Draughtsmanship - G.L. TamtaDhanpat Rai & Sons, Delhi, 1992
3. Inside AutoCAD – D. Raker and H. Rice, BPB Publications, New Delhi, 1985
4. CAD/CAM/CIM – P. Radhakrishnan, S. Subramaniyan& V. Raju, New Age International Pvt.Ltd., New Delhi, 3rd Edition,
5. Engineering AutoCAD, A.P. Gautam & Pradeep Jain, Khanna Book Publishing Co., Delhi

Semester-V			
Course Name:	**Manufacturing Engineering Lab-II**	**Course Code:**	DME212
L P T Scheme:	**0-0-2**	**Credits:**	**1**
Prerequisites: Manufacturing Engineering			
Objective: This course is aimed at			
• To Know the working of Drilling machine, shaper, slotter, planer, milling and grinding machines and be in a position to operate the same. • To make use of various measuring instruments for taking dimensions. • To Practice different operations on drilling shaper, slotter, planer, milling and grinding machines.			

Learning Outcomes:

Course Outcome	Description
CO1	Dismantle and assemble the components on drilling, shaping, milling and grinding machines.
CO2	Perform operations on drilling, shaping, milling and grinding machines.
CO3	Produce articles of industrial application such as Spur gear, square headed bolt, V-block
CO4	Make use of various measuring instruments for taking dimensions

List of Experiment:

1	Drilling Exercise (Three different sized holes for different materials maintaining uniform distance between them)
2	Milling-square-hexagon from round bars with indexing and without indexing
3	Generation of spur gear teeth on a round bar
4	Simple planning exercise cutting 'T' slots (one model)
5	Shaping a Hexagon on a round bar, keyways, grooves splines
6	Shaping step block cut dovetail to angles 60, 90, 120 degrees
7	Cylindrical grinding of external surface and internal surface using universal grinding machines
8	Grinding Cutting tools to the required angles

9	Grinding of milling cutters etc, on a tool and cutter grinder
10	Grinding flat surface on a surface grinder using magnetic chuck and clamping devices
11	Dismantling some of the components of drilling machine and service, assemble the same
12	Dismantling some of the components of shaper head and then assemble the same
13	Dismantling some of the components of Milling machines and service, assemble the same
14	Servicing of universal grinding machine

Evaluation Scheme:

Exam	Marks	Course Coverage
P-1	15	Syllabus covered up to P-1
P-2	15	Full syllabus
DTDW	40	
Discipline and attendance	15	
Lab Record	15	
Total	100	

Books:

1. Elements of Workshop Technology (Volume I & II) – Hajra Choudhary&Bhattacharaya, Media Promoters, 11th Edition, 2007
2. Introduction of Basic Manufacturing Processes and Workshop Technology – Rajender Singh, New Age International (P) Ltd. NewDelhi, 2006
3. Production Technology – HMT, 18th edition, Tata McGraw Hill, New Delhi
4. Manufacturing process – Myron N Begman, 5 th edition, Tata McGraw Hill, New Delhi

Semester-VI			
Course Name:	**Design of Machine Elements**	**Course Code:**	DME114
L P T Scheme:	**2-1-0**	**Credits:**	**3**

Prerequisites: Engineering Mechanics, Strength of Materials and Theory of Machines & Mechanisms

Objective: This course is aimed at

- To enable the student to design and draw simple machine components used in small andmedium scale industries.
- To understand the basic philosophy and fundamentals of Machine Design.
- To understand the modes of failures of m/c components and decide the design criteria andequations.
- To analyze and evaluate the loads, forces, stresses involved in components and subassembliesand decide the dimensions.

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- To develop analytical abilities to give solutions to engineering design problems.

Learning Outcomes:

Course Outcome	Description
CO1	Analyze the various modes of failure of machine components under different load patterns.
CO2	Design and prepare part and assembly drawings.
CO3	Use design data books and different codes of design.
CO4	Select standard components with their specifications from manufacturer's catalogue.
CO5	Develop drawings on CAD software.

Course Content

Unit 1:	**Introduction to Design**: Machine Design philosophy and Procedures; General Considerationsin Machine Design; Fundamentals: Types of loads, concepts of stress, Strain, Stress – StrainDiagram for Ductile and Brittle Materials, Types of Stresses; Bearing pressure Intensity; Crushing; Bending and Torsion; Principal Stresses; Simple Numericals; Creep strain and Creep Curve; Fatigue; S-N curve; Endurance Limit; Factor of Safety and Factors governing selection of factor of Safety; Stress Concentration: Causes & Remedies; Converting actual load or torque into design load or torque using design factors like velocity factor, factor of safety & service factor; Properties of Engineering materials; Designation of materials as per IS and introduction to International standards & advantages of standardization; Use of design data book; Use of standards in design and preferred numbers series; Theories of Elastic Failures; Principal normal stress theory; Maximum shear stress theory & Maximum distortion energy theory.
Unit 2:	**Design of simple machine parts:** Cotter Joint; Knuckle Joint; Turnbuckle; Design of Levers: Hand/Foot Lever & Bell Crank Lever; Design of C–Clamp; Off-set links; Overhang Crank; Arm of Pulley. **Antifriction Bearings:** Classification of Bearings; Sliding contact & Rolling contact; Terminology of Ball bearings: Life Load relationship, Basic static load rating and Basic dynamic load rating, limiting speed; Selection of ball bearings using manufacturer's catalogue.
Unit 3:	**Design of Shafts, Keys, Couplings and Spur Gears:** Types of Shafts; Shaft materials; Standard Sizes; Design of Shafts (Hollow and Solid) using strength and rigidity criteria; ASME code of design for line shafts supported between bearings with one or two pulleys in between or one overhung pulley; Design of Sunk Keys; Effect of Keyways on strength of shaft; Design of Couplings – Muff Coupling, Protected type Flange Coupling, Bush-pin type flexible coupling; Spur gear design considerations; Lewis equation for static beam strength of spur gear teeth; Power transmission capacity of spur gears in bending.
Unit 4:	**Design of Power Screws:** Thread Profiles used for power Screws - Relative merits and demerits of each; Torque required to overcome thread friction; Self-locking and overhauling property; Efficiency of power screws; Types of stresses induced; Design of Screw Jack; Toggle Jack. **Design of springs**: Classification and Applications of Springs; Spring terminology;

	Materials and Specifications; Stresses in springs; Wahl's correction factor; Deflection of springs; Energy stored in springs; Design of Helical, Tension and Compression springs subjected to uniform applied loads like I.C. engine valves, Weighing balance, Railway buffers and Governor springs; Leaf springs: Construction and Application.
Unit 5:	**Design of Fasteners:** Stresses in Screwed fasteners; Bolts of Uniform Strength; Design of Bolted Joints subjected to eccentric loading; Design of Parallel and Transverse fillet welds; Axially loaded symmetrical section; Merits and demerits of screwed and welded joints. **Ergonomics & Aesthetic consideration in design:** Ergonomics of Design: Man–Machine relationship; Design of Equipment for control, environment & safety; Aesthetic considerations regarding shape, size, color & surface finish.

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

1. Machine Design – Sadhu Singh, Khanna Book Publishing Co., Delhi (ISBN: 978-9382609-575)
2. Machine Design Data Book – Sadhu Singh, Revised Edition, Khanna Book Publishing Co., Delhi(ISBN: 978-9382609-513)
3. Introduction to Machine Design – V.B.Bhandari, Tata Mc- Graw Hill, New Delhi.
4. Mechanical Engineering Design – Joseph Edward Shigley, Tata Mc- Graw Hill, New Delhi.
5. Machine design – Pandya & Shah, Dhanpat Rai & Son, New Delhi.
6. Machine design – R.K.Jain, Khanna Publication, New Delhi.
7. Design Data Book – PSG Coimbtore, PSG Coimbtore.
8. Hand Book of Properties of Engineering Materials & Design Data for Machine Elements – AbdullaShariff, Dhanpat Rai & Sons, New Delhi.

Semester-VI			
Course Name:	**Production & Operations Management**	**Course Code:**	DME115
L P T Scheme:	**3-0-0**	**Credits:**	**3**
Prerequisites: NIL			

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Objective: This course is aimed at
• One of the most critical areas for success in any business enterprise is how Production and Operationsare managed. • To study the statistics, economics, finance, organizational behaviour and strategy into a consolidatedproduction and operation related decisions. • To discuss the role of location strategy and the criteria for location decisions. • To define quality and explain quality management, including TQM and its tools.

Learning Outcomes:

Course Outcome	Description
CO1	Define operations management and explain its relationship to productivity. And also understand tools and techniques.
CO2	Describe the importance of forecasting and explain the effective application of the differentforecasting approaches and methods.
CO3	Explain layout strategy and how operations managers determine facility arrangements andsize.
CO4	Describe how operations managers achieve a reasonable work environment and set expectations related to employee productivity.
CO5	Understand make-or-buy decisions, and the selection and integration of suppliers. Andhow much to order and when to order.

Course Content

Unit 1:	**Process Planning and Process Engineering:** Process Planning: Introduction, Function, Pre-requisites and steps in process planning, Factors affecting process planning, Make or buy decision, plant capacity and machine capacity. Process Engineering: Preliminary Part Print Analysis: Introduction, Establishing the General Characteristics of work piece, determining the principal Process, Functional surfaces of the work piece, Nature of the work to be Performed, Finishing and identifying operations. Dimensional Analysis: Introduction, types of dimensions, measuring the Geometry of form, Baselines, Direction of specific dimensions. Tolerance Analysis: Causes of work piece variation, Terms used in work piece dimensions, Tolerance stacks. Work piece Control: Introduction, Equilibrium Theories, Concept of location, Geometric Control, Dimensional control, Mechanical control.
Unit 2:	**Production Forecasting:** Introduction of production forecasting, The strategic role of forecasting in supply chain, Time frame, Demand behavior, Forecasting methods-Qualitative and Quantitative, Forecast accuracy. **Scheduling:** Introduction, Objectives in scheduling, Loading, Sequencing, Monitoring, Advanced Planning and Scheduling Systems, Theory of Constraints, Employee scheduling.
Unit 3:	**Break-Even Analysis:** Introduction, Break-even analysis charts, Breakeven analysis for process, plant and equipment selection. **Aggregate Operations Planning:** Aggregate production planning, Adjusting capacity to meet the demand, Demand management, Hierarchical and collaborative planning, Aggregate planning for services.

Unit 4:	**Assembly Line Balancing:** Assembly lines, Assembly line balancing, Splitting tasks, Flexible and U-shaped line layouts, Mixed model line balancing, Current thoughts on assembly lines, Computerized assembly line balancing.
Unit 5:	**Material Management:** Introduction, Importance and objectives, Purchasing and Stores: policies and procedures, Vendor development, selection, analysis and rating.

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

1. Production and Operations Management – K.Aswathappa, K.Shridhara Bhat, HimalayaPublishing House, 2014.
2. Production and Operations Management – Shailendra Kale, McGraw Hill Educations (India) Private Limited,2013.
3. Production and Operations Management – R.Paneerselvam, PHI Learning Private Limited, 2013.
4. Operations Management – Joseph Monk, TMH Publishers, New Delhi, 2004.
5. Modern Production /Operations Management – Buffa Elwood S, John Wiley Publishers, Singapore, 2002.

Course Description Electives

Course Name:	**Tool Engineering**	**Course Code:**	DME301
L P T Scheme:	**3-0-0**	**Credits:**	**3**
Prerequisites: Nil			
Objective: This course is aimed at			
• To understand metal cutting and forming process and factors affecting machinability. • To develop knowledge of tools, dies and tool materials. • To understand processes for increased productivity and quality.			

Learning Outcomes:

Course Outcome	Description
CO1	Understand concepts, principles and procedures of tool engineering
CO2	Classify and explain various tools and tool operations
CO3	Select proper tool and a die for a given manufacturing operation to achieve highest

	productivity
CO4	Estimate tool wear and tool life

Course Content

Unit 1:	**Metal Cutting:** Mechanics of Metal cutting;requirements of tools; cutting forces; types of chips; chip thickness ratio; shear angle ; simple numericals only; types of metal cutting process; orthogonal; oblique and form cutting; **Cutting fluids:** types; characteristics and applications. **Tool wear:** Types of wear; Tool life; Tool life equations
Unit 2:	**Machinability:** definition; factors affecting machinability; machinability index. **Tool materials:** Types; characteristics; applications; Heat treatment of tool steels; Specification of carbide tips; Types of ceramic coatings. **Cutting Tool Geometry:** Single point cutting tool; drills; reamers; milling; cutters.
Unit 3:	**Types of dies and construction:** Simple Die; Compound Die; Progressive Die; Combination Die. **Punch & Die mountings:** pilots; strippers; misfeed detectors; Pressure Pads; Knock outs; stock guide; Feed-Stop; guide bush; guide pins.
Unit 4:	**Die Design Fundamentals:** Die Operations; blanking; piercing; shearing; cropping; notching; lancing; coining; embossing; stamping; curling; drawing; bending; forming; Die set; Die shoe; Die area; Calculation of clearances on die and punch for blanking and piercing dies; Strip layout; Calculation of material utilization factor.
Unit 5:	**Forming Dies:** Bending methods; Bending Dies; bend allowance; spring back; spanking; bending pressure; pressure pads; development of blank length. **Drawing:** operations; Metal flow during drawing; Calculation of Drawing blank size; variables affecting metal flow during drawing; single action and double action dies; combination dies. **Fundamentals of other Tools:** Constructional features of - Pressure Die casting dies; metal extrusion dies; injection molding dies; Forging dies; Plastic Extrusion Dies.

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	

Total	100	

Learning Resource:
Tutorials, lecture slides and books on Tool Engineering will be available on the JUET server.

Books
1. Tool Design - Donaldson Anglin, Tata McGraw Hill.
2. Production Technology- H.M.T.Jain, Tata McGraw Hill.
3. A Text Book of Production engineering – P.C. Sharma, S.Chand& Co.
4. Production Technology, R.K.Jain, Khanna Publishers

Course Name:	**Computer Integrated Manufacturing**	**Course Code:**	DME302
L P T Scheme:	**3-0-0**	**Credits:**	**3**
Prerequisites: Nil			
Objective: This course is aimed at			
• To understand General Principles of Mechanical Engineering. • To understand laws of thermodynamics, thermal and thermodynamic Processes • To understand working principles of power developing and power absorbing devices • To understand basic materials and manufacturing processes			

Learning Outcomes:

Course Outcome	**Description**
CO1	Understand the formulation of Liner Programming
CO2	Analyze and Convert the problem into a mathematical model.
CO3	Understand the dual LP and Primal Dual relation problems
CO4	Understand and implement the transportation problems at workplace
CO5	Solve the assignment problems, solving linear programming approach using software

Course Content

Unit 1:	**Concept of Computer Integrated Manufacturing (CIM):** Basic components of CIM; Distributed database system; distributed communication system, computer networks for manufacturing; future automated factory; social and economic factors
Unit 2:	**Computer Aided Design (CAD):** CAD hardware and software; product modelling, automatic drafting; engineering analysis; FEM design review and evaluation; Group Technology Centre.
Unit 3:	**Computer Aided Manufacturing (CAM):** Computer assisted NC part programming; Computer assisted robot programming; computer aided process planning (CAPP); computer aided material requirements planning (MRP)

Unit 4:	**Computer aided production scheduling:** computer aided inspection planning; computer aided inventory planning, Flexible manufacturing system (FMS); concept of flexible manufacturing.
Unit 5:	Integrating NC machines, robots, AGVs, and other NC equipment; Computer aided quality control; business functions, computer aided forecasting; office automation

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Learning Resource:
Tutorials, lecture slides and books on Computer Integrated Manufacturing will be available on the JUET server.

Books

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

Course Name:	**Computer Aided Design and Manufacturing**	**Course Code:**	DME303
L P T Scheme:	**3-0-0**	**Credits:**	**3**

Prerequisites: Computer Aided Machine Drawing Practice ( )

Objective: This course is aimed at

- To provide an overview of how computers are being used in design, development of manufacturing plans and manufacture.
- To understand concepts of drafting and modelling using CAD.
- To understand the need for integration of CAD and CAM.
- To understand the concepts of flexible manufacturing system.

Learning Outcomes:

Course Outcome	Description
CO1	Develop mathematical models to represent curves and surfaces and Model engineering components using solid modeling techniques.
CO2	Understand geometric transformation techniques in CAD.

CO3	Develop programs for CNC to manufacture industrial components.
CO4	Understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.
CO5	Utilize Flexible manufacturing system tools

Course Content

Unit 1:	**Fundamentals of CAD/CAM:** Automation; Design process; Application of computers for design; Benefits of CAD; Computer configuration for CAD applications; Design workstation; Graphic terminal; CAD Software: Definition of system software and application software; CAD database and structure. **Geometric Modeling:** 3D-Wire frame modeling; Wire frame entities and their definitions; Interpolation and Approximation of curves; Concept of Parametric and Non-parametric representation of curves; Curve fitting techniques.
Unit 2:	**Surface Modeling:** Algebraic and Geometric form; Parametric space of surface; Blending functions; Parametrization of surface patch; Subdividing; Cylindrical surface; Ruled surface; Surface of revolution; Spherical surface; Composite surface; Bezier surface; Solid Modelling: Definition of cell composition and spatial occupancy enumeration; Sweep representation; Constructive solid geometry; Boundary representations
Unit 3:	**NC Control Production Systems:** Numerical control; Elements of NC system; NC part programming; Methods of NC part programming; Manual part programming, Computer assisted part programming; Post processor; Computerized part program.
Unit 4:	**Group Technology:** Part families; Parts classification and coding; Production analysis; Machine cell design; Computer aided process planning: Retrieval type and Generative type; Machinability data systems; MRP and its Benefits.
Unit 5:	**Flexible manufacturing system:** F.M.S equipment; Layouts; Analysis methods and benefits; Computer aided quality control; Automated inspection: Off-line, On-line, Contact, Non-contact; Coordinate measuring machines; Machine vision; CIM system and Benefits.

Evaluation Scheme:

Exam	**Marks**	**Course Coverage**
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Learning Resource:

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Tutorials, lecture slides and books on Computer Aided Design and Manufacturing will be available on the JUET server.

Books:

1. CAD/CAM Principles and Applications, P.N. Rao, Tata McGraw-Hill
2. Computer Aided Design and Manufacturing, Groover M.P. &Zimmers Jr, Prentice hall of India
3. CAD/CAM/CIM, Radha Krishna P. & Subramanyam, Wiley Eastern Ltd.

Course Name:	**Industrial Robotics & Automation**	**Course Code:**	DME304
L P T Scheme:	**3-0-0**	**Credits:**	**3**

Prerequisites:

Objective: This course is aimed at

- To introduce the basic concepts, parts of robots and types of robots.
- To make the student familiar with the various drive systems for robot, sensors and their applications in robots and programming of robots.
- To select the robots according to its usage.
- To discuss about the various applications of robots, justification and implementation of robot.
- To Conceptualize automation and understand applications of robots in various industries

Learning Outcomes:

Course Outcome	Description
CO1	Explain the robot anatomy, classification, characteristics of robot, advantages and disadvantages.
CO2	Explain the various robotic actuators on hydraulic, pneumatic and electrical drives.
CO3	Explain about various types of sensors and concepts on robot vision system.
CO4	Explain the concepts of robot programming languages and various methods of robot programming.
CO5	Explain the various applications of robots

Course Content

Unit 1:	**Fundamentals of Robotics:** Introduction; Definition; Robot anatomy (parts) and its working; Robot Components: Manipulator, End effectors; Construction of links, Types of joints; Classification of robots; Cartesian, Cylindrical, Spherical, Scara, Vertical articulated; Structural Characteristics of robots; Mechanical rigidity; Effects of structure on control work envelope and work Volume; Robot work Volumes, comparison; Advantages and disadvantages of robots.
Unit 2:	**Robotic Drive System and Controller:** Actuators; Hydraulic, Pneumatic and Electrical drives; Linear actuator; Rotary drives; AC servo motor; DC servo motors and Stepper motors; Conversion between linear and rotary motion; Feedback devices; Potentiometers; Optical encoders; DC tachometers; Robot controller; Level of Controller; Open loop and Closed

	loop controller; Microprocessor based control system; Robot path control: Point to point, Continuous path control and Sensor based path control; Controller programming.
Unit 3:	**Sensors: Requirements of a sensor:** Principles and Applications of the following types of sensors: Position sensors (Encoders, Resolvers, Piezo Electric); Range sensors (Triangulation Principle, Structured lighting approach); Proximity sensing; Force and torque sensing. **Introduction to Machine Vision:** Robot vision system (scanning and digitizing image data); Image processing and analysis; Cameras (Acquisition of images); Videocon camera (Working principle & construction); Applications of Robot vision system: Inspection, Identification, Navigation & serving.
Unit 4:	**Robot kinematics and Robot Programming:** Forward Kinematics; Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two Degrees of Freedom (In 2 Dimensional); Deviations and Problems. Teach Pendant Programming; Lead through programming; Robot programming Languages; VAL Programming; Motion Commands; Sensor Commands; End effecter commands; and Simple program.
Unit 5:	**Automation:** Basic elements of automated system, advanced automation functions, levels of automation. **Industrial Applications:** Application of robots in machining; welding; assembly and material handling.

Evaluation Scheme:

Exam	**Marks**	**Course Coverage**
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Learning Resource:

Tutorials, lecture slides and books on Industrial Robotics & Automation will be available on the JUET server.

Books:

1. Introduction to Robotics: Analysis, Systems, Applications – Saeed B. Niku, Pearson Education Inc. New Delhi 2006.
2. Industrial Robotics: Technology, Programming and Applications – M.P. Groover, Tata McGraw Hill Co, 2001.
3. Robotics Control, Sensing, Vision and Intelligence – Fu.K.S. Gonzalz.R.C and Lee C.S.G, McGraw Hill Book Co, 1987.
4. Robotics for Engineers – Yoram Koren, McGraw Hill Book Co, 1992.
5. A Text book on Industrial Robotics – Ganesh S. Hedge, Laxmi Publications Pvt. Ltd., New Delhi, 2008.

6. Robotics Technology and Flexible Automation – S.R. Deb & Sankha Deb, Tata McGraw-Hill, 2010.
7. Elements of Robotics Process Automation, Mukherjee, Khanna Publishing House, Delhi, 2018

Course Description

Course Name:	HEAT TRANSFER	**Course Code:**	DME305
L P T Scheme:	**3-0-0**	**Credits:**	**3**

Prerequisites: Basic Mechanical Engineering

Objective: This course is aimed at

- To understand the concepts of conduction.
- To understand the concepts of Fins heat transfer.
- To understand the concepts of radiation.
- To understand the concepts of convection.
- To understand the basics of heat exchangers.

Learning Outcomes:

Course Outcome	Description
CO1	Understand the concepts of conduction
CO2	understand the concepts of fins
CO3	Understand the concepts of radiation.
CO4	Understand the concepts of convection
CO5	Understand the basic concepts of heat exchangers.

Course Content:

Unit 1:	**Conduction**: Fourier law of heat conduction for isotropic material; Thermal conductivity; Derivation of the energy equation in three dimensions including transient effect; Nondimensional - thermal diffusivity and Fourier number; Types of boundary conditions (Dirchlet, Neumann, mixed type); One dimensional solution with and without heat generation; Analogy with electrical circuits.
Unit 2:	**Fins**: rectangular and pin fins. Fin effectiveness and efficiency. Critical thickness of insulation.Lumped parameter approach and physical significance of time constant, Biot number, Validity of lumped parameter approach. Introduction to Heissler Chart.
Unit 3:	**Convection:** Introduction, Newton's law of cooling; Momentum and energy equations in two dimensions; nondiemnsionalisation, importance of nondimensional quantities and their physical significance. Velocity and thermal boundary layer thickness by integral method. Analogies between momentum, heat and mass transfer. Natural convection, effect of coupling on the conservation equations.
Unit 4:	**Radiation** : Physical mechanism of thermal radiation, laws of radiation, dfeinition of black body, emissive power, intensity of radiation, emissivity, reflectivity, transmittivity, irradiation, radiosity. Radiation

	exchange between black bodies, concept of Gray-Diffuse Isotropic (GDI) surface. Radiation exchange between GDI surfaces by radiation network and radiosity matrix method. Radiation shielding.
Unit 5:	**Heat exchangers:** Types of heat exchangers, parallel and counterflow types, Introduction to LMTD. Correction factors, fouling factor. NTU method for heat exchangers

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

1. Fundamentals of Heat and Mass Transfer by F.P.Incropera and D.P.Dewitt, 4th ed., John Wiley &Sons.
2. Heat Transfer - A Basic Approach by M.N.Ozisik, McGrawhill.
3. Heat Transfer by J.P.Holman, 8th ed., McGrawhill.
4. Elements of Heat & Mass Transfer by Vijay Gupta, 2nd ed., New Age International Publishers.

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Course Name:	REFRIGERATION AND AIR-CONDITIONING	**Course Code:**	DME306
L P T Scheme:	**3-0-0**	**Credits:**	**3**

Prerequisites: Basic Mechanical Engineering

Objective: This course is aimed at

- To understand the basics of Refrigeration cycles.
- To understand basics of vapour compression and vapour absorbtion systems.
- To identify components and refrigerants and lubricants of a refrigeration system.
- To understand control strategies for refrigeration system.
- To understand the basics about air conditioning systems.

Learning Outcomes:

Course Outcome	Description
CO1	Define refrigeration and types of Refrigeration cycles.
CO2	Explain Vapour Compression and Vapour Absorbtion System working principles
CO3	Identify the components required for refrigeration system.
CO4	Identify the controlling components for a refrigeration system.
CO5	Explain the working principles of Air-conditioning

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Course Content:

Unit 1:	**Introduction to Refrigeration:** Definition of Refrigeration; Refrigerating effect-unit of refrigeration-Coefficient of performance; Types of Refrigeration-Ice, dry ice, Steam jet, Throttling, Liquid nitrogen refrigeration; Carnot refrigeration Cycle; Air refrigeration- Bell - Coleman cycle, PV& TS diagram; Advantage and disadvantages in air refrigeration; Simple problems.
Unit 2:	**Refrigeration systems:** Basic Components, Flow diagram of working of Vapour compression cycle; Representation of the vapour compression cycle on P-H, T-S & P-V Diagram; Expression for Refrigerating effect, work done and power required; Types of Vapour Compression cycle; Effects of super heating and under cooling, its advantages and disadvantages; Simple Vapour absorptions cycle and its flow diagram; Simple Electrolux system for domestic units; Comparison of Vapour absorption and vapour compression system; Simple problems on vapour compression cycle.
Unit 3:	**Refrigeration equipments:** Compressor - types of compressors; Hermetically sealed and Semi hermetically sealed compressor; Condensers - Air Cooled, water cooled, natural and forced draught cooling system; Advantages and disadvantages of air cooled and water cooled condensers; Evaporators -natural, convection, forced convection types. **Refrigerants and lubricants:** Introduction to refrigerants; Properties of good refrigerants; Classification of refrigerants by group number and commonly used refrigerants in practice; Detection of refrigerants leakage; Charging the system with refrigerant; Lubricants used in refrigeration and their properties.
Unit 4:	**Refrigerant flow controls:** Capillary tube; Automatic Expansion valve; Thermo static expansion valve; High side and low side float valve; Solenoid valve; Evaporator pressure regulator. **Application of refrigeration:** Slow and quick freezing; Cold storage and Frozen storage; Dairy refrigeration; Ice making industry; Water coolers. **Unit-V: Air conditioning:** Introduction to Air conditioning; Factors affecting Air conditioning; Psychometric chart and its use; Psychometric process-sensible heating and cooling, Humidifying and dehumidifying; Adiabatic saturation process; Equipments used in air conditioning cycle; Air conditioning units and plants. **Refrigeration and Air-conditioning tools: T**ools used in refrigeration and Air conditioner installation; Installation procedure; Faults in refrigeration and air conditioning system; Servicing procedure.

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	

Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

1. Refrigeration and Air Conditioning – Sadhu Singh, Khanna Book Publishing Co., New Delhi
2. Refrigeration and Air Conditioning – S. Domakundawar, Dhanpat Rai publications.
3. Refrigeration and Air Conditioning – A.S.Sarao& G.S. Gabi, 6th edition, Satya Prakashan publications, New Delhi, 2004.
4. Principles of Refrigeration – Roy J.Dossat, 5th edition, Pearson Publications, 2001.
5. Refrigeration and Air Conditioning – M.ZakriaBaig, Premier/ Radiant Publishing House.
6. Refrigeration and Air Conditioning – C.P Arora, Tata McGraw Hill Education, 2000.

Course Name:	AUTOMOBILE ENGINEERING	**Course Code:**	DME307
L P T Scheme:	**3-0-0**	**Credits:**	**3**
Prerequisites: NIL			
Objective: This course is aimed at			
• To understand the basic structure and components of an automobile. • To understand the concepts of cooling and lubricating systems. • To understand the concepts of Ignition and transmission and steering systems. • To understand the classification and necessity of suspension system. • To identify different special vehicles.			

Learning Outcomes:

Course Outcome	Description
CO1	Identify the components of an automobile with their working
CO2	Explain the concepts of cooling and lubricating systems.
CO3	Explain the concepts of Ignition and Transmission and steering systems.
CO4	Identify different suspension systems and their applications..
CO5	Differentiate the special vehicles according to the usage

Course Content:

Unit 1:	**Introduction to basic structure of an automobile:** Basic engine components; Cylinder block; Cylinder head; Gaskets; cylinder liners, types of cylinder liners; Piston and piston pin; pistonrings, types of piston rings; Connecting rod; Crank shaft; Cam shaft; Crankcase; Engine valves; Flywheel and Governer.

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Unit 2:	**Cooling and lubrication system:** The necessity of cooling system; Types of cooling system- air cooling and water cooling; Air cooling system; Types of water cooling system –Thermosyphon system and pump circulation system; Advantages and disadvantages of air cooling and water cooling systems; The components of water cooling system – fan, radiator, pump and thermostat; The necessity of lubrication system; S.A.E rating of lubrication system; Types of lubrication system; Petrol lubrication and high pressure lubrication system. **Fuel feed system:** Conventional fuels and alternative fuels: Cetane and octane numbers; Types of carburettors; Working of simple carburettor; Multi point and single point fuel injection systems; Different fuel transfer pumps; Working of S.U electrical and A.C mechanical pump; Fuel filters; Fuel injection pump; Fuel injectors.
Unit 3:	**Ignition system:** Introduction to ignition system; Battery Ignition systems and magneto Ignition system; Electronic Ignition system; Construction and working of lead acid battery; Elements of charging system; Elements of starting system; Types of lights used in the automobile: **Transmission and steering system:** General arrangement of clutch; Principle of friction clutches; Constructional details of Single plate clutch; Constructional details of multi-plate clutch; Constructional details of centrifugal clutch; Necessity for gear ratios in transmission; Types of gear boxes; Working of sliding mesh gear box; Working of constant mesh gear box; Working of propeller shaft Working of propeller shaft; Working of universal joint; Working of differential; Types of rear axle; Purpose of front axle; Necessity of steering system; Caster, camber and king pin inclination; Rack and pinion steering system; Power steering.
Unit 4:	**Suspension system:** Necessity of suspension system; Torsion bar suspension systems; Leaf spring and coil spring suspension system; Independent suspension for front wheel and rear wheel; Working of telescopic shock absorber; Functions of brakes; Types of brakes; Working of internal expanding brake; Working of disc brake
Unit 5:	**Special vehicles:** Introduction to Special vehicles; Tractor; Motor grader; Scrappers; Excavators;Duper trucks.

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

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

Course Name:	POWER PLANT ENGINEERING	**Course Code:**	DME308
L P T Scheme:	**3-0-0**	**Credits:**	**3**
Prerequisites: Thermal Engineering - I			
Objective: This course is aimed at			
• To understand the present scenario of power in India. • To recognize various load terminologies used in power plants. • To understand hydro working principles • To understand working of Diesel, Gas and Nuclear power plants. • To understand the issues and safety precautions in power plants.			

Learning Outcomes:

Course Outcome	Description
CO1	Familiarised with the present and future power scenario of India.
CO2	Enlist various load terminologies in power plants
CO3	Working and classifications in hydro power plant
CO4	Working principles of Diesel, Gas and Nuclear power plants..
CO5	Understand the issues and necessity of safety concepts of power plants

Course Content:

Unit 1:	**Introduction to Power plant:** Introduction to power plant; Indian Energy scenario in India; Location of power plant; Choice of Power plant; Classification of power plants.
Unit 2:	**Economics of power plant:** Terminology used in power plant: Peak load, Base load, Load factor, Load curve; Various factor affecting the operation of power plant; Methods of meeting the fluctuating load in power plant; Load sharing- cost of power-tariff methods; Performance and operating characteristics of power plant.
Unit 3:	**Hydro power plant:** Introduction to Hydro electric power plant; Rainfall, Runoff and its measurement, Hydrograph, flow duration curve; Selection of sites for hydro electric power plant; General layout of Hydro electric power plant and its working; Classification of the Plant- Run off river plant, storage river plant, pumped storage plant; Advantages and disadvantages of hydro electric power plant.
Unit 4:	**Diesel and Gas turbine plant:** The layout of diesel power plant; Components and the working of diesel power plant; Advantages and

	disadvantages of diesel power plant; Gas turbine power Plant-Schematic diagram, components and its working; Combined cycle power generation- Combined gas and steam turbine power plant operation (only flow diagram). **Nuclear power plant:** Introduction; Nuclear Power-Radio activity-Radioactive charge-types of reactions; Working of a nuclear power plant; Thermal fission Reactors- PWR, BWR and gas cooled reactors; Advantages and Disadvantages of Nuclear power plant.
Unit 5:	**Environmental impact of Power plant:** Social and Economical issues of power plant; Green house effect; Acid precipitation-Acid rain, Acid snow, Dry deposition, Acid fog; Air, water, Thermal pollution from power plants; Radiations from nuclear power plant effluents. **Power plant safety:** Plant safety concept; Safety policy to be observed in power plants; Safety practices to be observed in boiler operation; Safety in oil handling system; Safety in Chemical handling system; Statutory provision related to boiler operation.

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Books:

1. Power plant Engineering-P.K. Nag 4th edition, Tata McGraw Hill Education, 2014.
2. Power plant Engineering – Frederick T. Morse, Litton Educational Publishing Inc. 1953.
3. A Course in Power Plant Engineering – Subhash C. Arora, S. Domakundwar, Dhanpat Rai,
   1984.
4. Power Plant Engineering – P.C. Sharma, S.K.Kataria& sons, 2009.
5. Power System Engineering – R.K. Rajput, Firewell Media,2006.

Course Description

Semester			
Course Name:	FARM EQUIPMENT AND FARM MACHINERY	**Course Code:**	DME309
L P T Scheme:	**3-0-0**	**Credits:**	**3**
Prerequisiteses: NIL			

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Objective: This course is aimed at
• To find and characterize the machinery based on crop production. • To find the field efficiency and capacities to calculate the economics of machinery. • To find the machines usages for different tillage, and its power requirement calculations. • To understand sowing, planting & transplanting equipment based on crop. • To understand machinery materials and heat effects for different farm machinery equipment.

Learning Outcomes:

Course Outcome	Description
CO1	Classify the Farm Machineries, equipment and materials
CO2	Describe the objectives of Farm mechanization.
CO3	Explain selection of the machineries
CO4	Discuss the forces acting on tillage tools and hitching systems
CO5	Understand the calibration, constructional features and working of various farm equipment.

Course Content

Unit 1:	Introduction to farm mechanization. Classification of farm machines. Unit operations in crop production. Identification and selection of machines for various operations on the farm. Hitching systems and controls of farm machinery.
Unit 2:	Calculation of field capacities and field efficiency. Calculations for economics of machinery usage, comparison of ownership with hiring of machines. Introduction to seed-bed preparation and its classification. Familiarization with land reclamation and earth moving equipment
Unit 3:	Introduction to machines used for primary tillage, secondary tillage, rotary tillage, deep tillage and minimum tillage. Measurement of draft of tillage tools and calculations for power requirement for the tillage machines. Introduction to tillage machines like mould-board plough, disc plough, chisel plough, sub-soiler, harrows, puddler, cultivators, identification of major functional components. Attachments with tillage machinery
Unit 4:	Introduction to sowing, planting & transplanting equipment. Introduction to seed drills, no-till drills, and strip-till drills. Introduction to planters, bed planters and other planting equipment like sugarcane, potato. Study of types of furrow openers and metering systems in drills and planters. Calibration of seed-drills/ planters. Adjustments during operation.
Unit 5:	Introduction to materials used in construction of farm machines. Heat treatment processes and their requirement in farm machines. Properties of materials used for critical and functional components of agricultural machines. Introduction to steels and alloys for agricultural application. Identification of heat treatment processes specially for the agricultural machinery components.

Evaluation Scheme:

Exam	Marks	Course Coverage

Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Learning Resource:
Tutorials, lecture slides and books will be available on the JUET server.

Books:

1. Principles of Farm Machinery - R.A. Kepner, Roy Bainer, and E. L. Berger
2. Farm Machinery and Equipment - H. P. Smith
3. Farm Machinery and equipment - C. P. Nakra
4. Engineering principles of Agril. Machines - Dr. Ajit K. Srivastav, Caroll E. Goering and Roger P. Rohrbach.
5. Farm Machinery – an Approach - S. C Jain & Grace Phillips
6. Agril. Engineering through worked out examples - Dr. R. Lal and Dr. A.C. Dutta
7. Farm Power and Machinery Engineering - Dr.R. Suresh and Sanjay Kumar

Course Description

Semester			
Course Name:	MATERIAL HANDLING SYSTEM	**Course Code:**	DME310
L P T Scheme:	**3-0-0**	**Credits:**	**3**

Prerequisiteses: NIL

Objective: This course is aimed at

• To know the operational features of the material handling equipment & its practical applications.
• To understand, select, operate and maintain the material handling equipments.
• To understand different material handling processes used in industries.
• To understand & appreciate safety instrumentation for equipment.

Learning Outcomes:

Course Outcome	Description
CO1	Understand constructional & operational features of various materials handling systems.
CO2	Identify, compare & select proper material handling equipment for specified applications.
CO3	Know the controls & safety measures incorporated on material handling equipment.
CO4	Appreciate the role of material handling devices in mechanization & automation of industrial process..
CO5	Understand & appreciate safety instrumentation for equipment

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Course Content

Unit 1:	**Introduction to Material Handling System:** Main types of Material handling equipments & their applications; Types of load to be handled; Types of Movements; Methods of stacking, loading & unloading systems; Principles of Material Handling Systems; Modern trends in Materials handling.
Unit 2:	**Hoisting Machinery & Equipments:** Construction, Working & Maintenance of different types of hoists such as Lever operated hoist, Portable hand chain hoist, Differential hoists, Worm geared and Spur geared hoists, Electric & Pneumatic hoists, Jumper; Construction, Working & Maintenance of different types of cranes such as Rotary cranes, Trackless cranes, Mobile cranes, Bridge cranes, Cable cranes, Floating cranes & Cranes traveling on guide rails; Construction, Working & Maintenance of Elevating equipments such as Stackers, Industrial lifts, Freight elevators, Passenger lifts, and Mast type's elevators, Vertical skip hoist elevators.
Unit 3:	**Conveying Machinery: Construction,** Working & Maintenance of Traction type conveyors such as Belt conveyors, Chain conveyors, Bucket elevators, Escalators; Construction, Working & Maintenance of Traction less type conveyors such as Gravity type conveyors, Vibrating & Oscillating conveyors, Screw conveyors, Pneumatic & Hydraulic conveyors, Hoppers gates & Feeders. **Surface Transportation Equipment**: Construction, Function, Working of Trackless equipment such as Hand operated trucks, Powered trucks, Tractors, Automatic Guided vehicle, Industrial Trailers; Construction, Function, Working of Cross handling equipment such as Winches, Capstans, Turntables, Transfer tables, Monorail conveyors.
Unit 4:	**Components of Material Handling Systems:** Flexible hoisting appliances such as Welded load chains, Roller chains, Hemp ropes, Steel wire ropes, Fastening methods of wire & chains, Eye bolts, Lifting tackles, Lifting & Rigging practices; Load handling attachments: a) Various types of hooks- Forged, Triangular eye hooks, Appliances for suspending hooks b) Crane grab for unit & piece loads c) Electric lifting magnet, vacuum lifter. d) Grabbing attachment for loose materials e) Crane attachment for handling liquids/molten metals; Construction & Working of Arresting gear & Brakes; Construction & use of electromagnetic shoe brakes, Thruster operated shoe brakes, Control brakes**.**
Unit 5:	**Mechanism used in Material Handling Equipment:** Steady state motion; Starting & stopping of motion in following mechanisms: Hoisting mechanism, Lifting Mechanism, Traveling Mechanism, Slewing Mechanism, Rope & chain operated Cross- Traverse Mechanism. **Selection of Material Handling Equipment:** Factors affecting choice of material handling equipment such as Type of loads, Hourly capacity of the unit, Direction & length of travel, Methods of stocking at initial, final & intermediate points, Nature of production process involved, Specific load conditions & Economics of material handling system.

Evaluation Scheme:

Exam	Marks	Course Coverage

Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Learning Resource:
Tutorials, lecture slides and books on mathematics-1 will be available on the JUET server.

Books:

1. Material handling (Principles & Practice) – Allegri T. H., CBS Publisher, New Delhi.
2. Plant Layout & Materials Handling – Apple J. M., JohnWiley Publishers.
3. Material Handling Equipment – N. Rundenko, Peace Publisher, Moscow.
4. Material Handling Equipment – M. P. Alexandrov, MIR Publisher, Moscow.
5. Material Handling Equipment – Y. I. Oberman, MIR Publisher, Moscow.

Course Description

Semester			
Course Name:	HYBRID VEHICLES	**Course Code:**	DME311
L P T Scheme:	**3-0-0**	**Credits:**	**3**
Prerequisiteses: Nil			
Objective: This course is aimed at			
• To understand the basics of electric vehicle history and components. • To understand properties of batteries. • To understand the electrical machine properties and classifications. • To understand the properties of electric vehicle drive systems • To understand the concepts of hybrid electric vehicles.			

Learning Outcomes:

Course Outcome	**Description**
CO1	Understand the basics of electrical vehicle history and components.
CO2	Understand the properties of batteries.
CO3	Understand the electrical machine properties and classifications.
CO4	Understand the properties of electrical vehicle drive systems.
CO5	Understand the concepts of hybrid electric vehicles.

Course Content:

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Unit 1:	**Electric Vehicles:** Introduction; History of Hybrid and Electric Vehicles; Social and Environmental importance of Hybrid and Electric Vehicles; Components, Vehicle mechanics: Roadway fundamentals, Vehicle kinetics, Dynamics of vehicle motion; Propulsion System Design.
Unit 2:	**Battery: Basics;** Types; Parameters: Capacity, Discharge rate, State of charge, State of Discharge, Depth of Discharge; Technical characteristics, Battery pack Design, Properties of Batteries.
Unit 3:	**DC & AC Electrical Machines:** Motor and Engine rating; Requirements; DC machines; Three phase A/c machines; Induction machines; Permanent magnet machines; Switched reluctance machines.
Unit 4:	**Electric Vehicle Drive Train:** Transmission configuration; Components: Gears, Differential, Clutch, Brakes; Regenerative braking, Motor sizing; Fuel efficiency analysis.
Unit 5:	**Hybrid Electric Vehicles:** Types: Parallel, Series, Parallel and Series configurations; Drive train; Sizing of components; Basics of Micro, Mild, Mini, Plug-in and Fully hybrid.

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Learning Resource:
Tutorials, lecture slides and books on mathematics-1 will be available on the JUET server.

Books:

1. Electric & Hybrid Vehicles – A.K. Babu, Khanna Publishing House, New Delhi, 2018
2. Electric & Hybrid Vehicles – Design Fundamentals - Iqbal Hussain, Second Edition, CRC Press,
2011.
3. Electric Vehicle Technology Explained - James Larminie, John Wiley & Sons, 2003.
4. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals - Mehrdad Ehsani, Yimin
Gao, Ali Emadi, CRC Press, 2010.
5. Electric Vehicle Battery Systems - Sandeep Dhameja, Newnes, 2000.

Course Description

Semester			
Course	MECHATRONICS	**Course Code:**	DME312

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Name:			
L P T Scheme:	**3-0-0**	**Credits:**	**3**
Prerequisiteses: NIL			
Objective: This course is aimed at			
• To understand the basic concepts and characteristics of measurement systems. • To learn various types of sensors and transducers various mechanical, electrical and pneumatic actuation systems. • To learn various mechanical, electrical and pneumatic actuation systems. • To learn the concepts of digital communications and develop PLC programs. • To evaluate the performance of mechatronic systems.			

Learning Outcomes:

Course Outcome	Description
CO1	Describe about various types of sensors and transducers.
CO2	Explain the various mechanical, electrical and pneumatic actuation systems.
CO3	Explain the basic mathematical building blocks for mechanical, electrical, thermal and fluid actuation system and its interfacing of input/output requirements.
CO4	Explain the basic PLC architecture and PLC programming concepts.
CO5	Describe the design examples of mechatronics system. Explain the condition monitoring of production systems using sensors.

Course Content:

Unit 1:	**Introduction to Mechatronics:** Mechatronics; Importance of Mechatronics; Systems: Measurement systems; Control systems and their types; Closed-loop control System; Automatic water level controller; Sequential controllers-washing machine Measurement System terminology: Displacement, Position & Proximity Sensors; Velocity and Motion Sensors; Force Sensors; Fluid Pressure Sensors; Flow Sensors; Liquid Level Sensors; Temperature Sensors; Light Sensors; Selection of Sensors.
Unit 2:	**Mechanical Actuation Systems:** Types of motion; Freedom and constraints; loading; Gear Trains; Pawl & Ratchet; Belt & Chain drives; Bearings: Selection, Ball & Roller bearings; Mechanical aspects of motor selection. **Electrical Actuation Systems:** Switches & Relays; Solenoids; D.C Motors; A.C.Motors; Stepper Motors: Specifications and Control of stepper motors; Servomotors: D.C Servomotor and A.C Servomotor**.** **Pneumatic & Hydraulic Systems:** Power supplies; DCV; PCV; Cylinders; Rotary actuators.
Unit 3:	**Mathematical Model:** Introduction to Mathematical model; Mechanical System building blocks; Electrical System building blocks; Fluid System building blocks; Thermal System building blocks. **System Model:** Engineering Systems: Rotational, Translational Systems;

	Electro-Mechanical System; Hydro-Mechanical System. **Input/Output Systems**: Interfacing; Input/output ports; Interface requirements: Buffers, Handshaking, Polling and interrupts, Serial interfacing; Introduction to PIA; Serial communications interface; Example of interfacing of a seven-segment display with a decoder.
Unit 4:	**Programmable Logic Controller (PLC):** Definition; Basic block diagram and structure of PLC; Input/Output processing; PLC Programming: Ladder diagram, its logic functions, Latching and Sequencing; PLC mnemonics; Timers; Internal relays and Counters; Shift registers; Master and Jump Controls; Data handling; Analog input/output; Selection of PLC.
Unit 5:	**Design Examples & Advanced Applications in Mechatronics:** Design process stages; Traditional Vs Mechatronics designs; Possible design solutions: Timed switch, Wind-screen wiper motion, Bathroom scale; Case studies of Mechatronics systems: A pick-and-place robot, Car park barrier, Car engine management system, Automatic Camera and Automatic Washing Machine only. **Sensors for Condition Monitoring Systems of Production Systems**: Examples of Monitoring methods: Vibration monitoring, Temperature monitoring, Wear behavior monitoring; Mechatronics control in automated manufacturing: Monitoring of Manufacturing processes, On-line quality monitoring, Model based systems, Hardware in-the-loop simulation, Supervisory control in manufacturing inspection, Integration of heterogeneous systems.

Evaluation Scheme:

Exam	Marks	Course Coverage
Test-1	15	Syllabus covered up to Test-1
Test-2	25	Syllabus covered up to Test-2
Test-3	35	Full syllabus
Assignment	10	
Tutorial	5	
Quiz	5	
Attendance	5	
Total	100	

Learning Resource:
Tutorials, lecture slides and books on mathematics-1 will be available on the JUET server.

Books:

1. Mechatronics – W. Bolton, Pearson Education India.
2. A Text Book on Mechatronics – R.K.Rajput, S.Chand& Co, New Delhi.
3. Mechatronics – M.D.Singh& Joshi, Prentice Hall of India.
4. Mechatronics – HMT, Tata McGraw Hill, New Delhi.
5. Mechatronics System – Devadas Shetty, PWS Publishing
6. Exploring Programmable Logic Controllers with applications – Pradeep Kumar Srivatsava, BPB
Publications.