# Metallurgical and Materials engineering

## Course Structure and Detailed Syllabus of Engineering I$^{st}$ Year Semester-II

| Subject Code | Subject Name | L-T | P | C |
|---|---|---|---|---|
| PH1001 | Physics | 4 | - | 4 |
| MA1201 | Mathematics-II | 4 | - | 4 |
| CS1201 | Scripting Languages | 4 | - | 3 |
| EE1001/2001 | Basic Electrical and Electronics Engineering | 4 | - | 4 |
| HS1201 | Communication Skills-II | 2 | - | 1 |
| CE1001 | Engineering Drawing | 4 | - | 4 |
| PH1601 | Physics Lab | - | 3 | 2 |
| EE1601/2601 | Basic Electrical and Electronics Engineering Lab | - | 3 | 2 |
| ME1601 | Workshop | - | 3 | 2 |
| **TOTAL** | | **22** | **9** | **26** |

**PH 1001** **ENGINEERING PHYSICS**

**Externals: 60Marks** **L-T-P-C***
**Internals: 40Marks** **4-0-0-4**

## Objectives:

1. To inculcate in the Students a sense of yearning to learn the basic Physics behind the applications that we look around in day to day life.

2. To deliver the basic Principles of Physics that forms the basis for the development of Technology.

3. The basic details of Solid state Physics, Optics and Electrodynamics and Quantum Physics provided in a subtle fashion dealt in finer details to have strong basics in these areas.

**UNIT – I**
**MATHEMATICAL PHYSICS (3)**

1.1 Gradient, Divergence, Curl and their physical significance
Scalar and Vector point Functions, Differential operator, Gradient , Physical significance, Divergence, Significance, Curl, Physical Significance, Vector Identities

1.2 Stokes theorem & Gauss theorem
Vector Integral Theorems, Line Integral, Surface and Volume Integrals, Stokes Theorem, Gauss-Divergence Theorem, Application

1.3 Curvilinear coordinates
Types of Coordinate systems, Polar coordinates, Cylindrical and Spherical coordinates, Equations Relating Cartesian, Spherical and Cylindrical coordinate

**UNIT – II**
**ELECTRODYNAMICS (6)**

2.1 Maxwell's Equations
Electrodynamics before Maxwell, Fixing of Ampere's Law, Maxwell Equation in matter, Boundary Conditions.

2.2 Poynting theorem and conservation laws
Continuity Equation, Poynting Theorem, Conservation Law Newton Third law in Electrodynamics

2.3 Wave equation
Wave equation, wave form Boundary conditions, Reflection and Transmission for a string

2.4 Electro Magnetic Waves in vacuum

Wave equation for E and B, Monochromatic Plane Waves, Energy and Momentum in EM Waves in vacuum

2.5 Electro Magnetic waves in Matter
Propagation in Linear Media, Reflection and Transmission at Normal Incidence Oblique Incidence

2.6 EM wave in conducting surface.

**Reference Books :**

**1.** Electrodyamics by David j.Griffiths

**UNIT – III**
**OPTICS (12)**

3.1 Interference by division of wave front (Biprism)
Introduction , Interference of Light Waves, Interference Pattern , Intensity Distribution, Fresnel Biprism

3.2 Interference by division of amplitude (Newton's rings)
Interference by Plane parallel Wave, Cosine Law, Interference by a film with Non-Parallel reflecting surface, Wedge, Newton's Rings.

3.3 Michelson's interferometer
Interference by Plane film illuminated by a point source, Michelson's Interferometer.

3.4 Fraunhoffer diffration (Single slit)
Introduction, Types of Diffraction,Single Slit Frauhoffer Diffraction, Position of Maxima and Minima,Graphical Method for determining roots

3.5 Frauhoffer diffraction Double slit & multiple slits
Double slit Fraunhoffer diffraction by N- Parallel slits

3.6 Diffraction Gratings, Grating and Resolving Power
Diffraction Grating, Construction of Grating, Grating Spectrum, Resolution, Resolving Power of a diffraction Grating

3.7 Fresnel diffraction and Zone Plate
Types of Diffraction, Fresnel diffraction, Fresnel Half Period zones, Zone plate Application of Zone, Lens

3.8 Production of Plane Polarised light & double refraction
Introduction , Polarisation of Light waves, Representation of various types of light, Polarization by Reflection,Brewster's Law, Laws of Malus and proof, Geometry of Calcite Crystal, Double Refraction, Nicol’s Prism, Applications.

3.9 Quarter & Half – wave plate, elliptical & circular polarized lights

Huygen's Theory of Double Refraction, Quarter Wave plate, Half Wave Plate, Elliptically and Circularly Polarised light.

3.10 Production & detection of elliptical & circular Polarised lights

Elliptically polarised Light, Circularly polarised light, Conversion of Elliptically polarized light to Circularly polarised light, Analysis of polarized light of Different Kinds.

3.11 Theory of Laser
Introduction, Spontaneous Emission, Stimulated Emission, Relation between Spontaneous and Stimulated emission Probabilities, Population Inversion, Pumping, Active systems.

3.12 Different kinds of Lasers
Ruby laser Working Semiconductor laser,He-Ne laser ,Application of Laser.

**Reference Books :**


1. Engineering Physics By Malik and Singh
2. Optics by Ajoy Ghatak
3. Optics by Pedrotti and Pedrotti.


**UNIT – IV**

**QUANTUM MECHANICS (6)**

4.1 Failures of classical physics
Limitations of classical physics, Blackbody Radiation, Spectral Lines, Photoelectric Effect, Planck's Quantum Hypothesis, Einstein's Theory of photoelectric Effect, Compton effect, Existence of stationary states, Stern-Gerlach Experiment

4.2 DeBroglie waves & Uncertainity Principle
Introduction, Matter waves Electron Diffraction Experiment Standing waves of an electron in orbit, Uncertainity Principle Single Slit Experiment, Application of Uncertainty Principle.

4.3 Wave function, Schrodinger Equation & probablity interpretation
Time Dependent Schrodinger Equation ,1- D Equation for a free particle, extension to 2-D, Inclusion of forces, Probability current Density

4.4 Operators , expectation values & Time independent Schrodinger Equation
Operators ,Expectation Value, Ehrenfest Theorem, time independent schrodinger Equation and Admissibility Conditions on Wave function.

4.5 Solution for generalised potential
Motion of a particle in a Potential – Classical view .

4.6 Particle in a box
Square well potential with Rigid walls, Energies and Wave functions

**Reference Books:**


1. Modern Physics by A. Beiser
2. Quantum Mechanics by Aruldhas.


**UNIT – V**
**CONDENSED MATTER PHYSICS (6)**

5.1 CRYSTALLOGRAPHY-I

Introduction, Crystal ,Single, poly and Amorphous state, Lattice Points and Space Lattice, Unit cell, Primitive Unit Cell in 2-D ,Non-primitive Unit Cell in 2-D lattice ,Primitive unit cell in 3-D ,Non Primitive unit cell in 3-D,Bravais Lattice and crystal systems, Atomic Packing, Crystal structure

5.2 Crystallography-II

Miller Indices, Positions, Directions, Planes Obtaining Miller indices, Important Cubic crystal structures, SC, BCC, FCC, Closed Packed structures, Packing fraction, NaCl Structure, Diamond , ZnS Structure.

5.3 X-ray diffraction

Introduction, Bragg's Law, Diffraction Direction Experimental Methods of x-Ray Diffraction, Powder method Debye - Scherrer Method Measurement of Bragg Angle

5.4 Defects in crystals

Introduction, Classification of Imperfections, Point Defects, vacancies, Schottky defects, Intersitial, Frenkel defects, Impurities, Colour centres, Line defect Planar Defects, Volume Defects, Thermodynamical consideration for Existence of Defect equilibrium concentration of Schottky defects in metals, Equilibrium concentration of schottky defects in Ionic crystals, Frenkel defect in metals, Frenkel defects in ionic crystals

5.5 Electron theory of metals

Important properties of metals, electron theory of solids, classical free elecrtron theory, DC Electrical Conductivity, Gains of Drude Model, Sommerfeld quantum Model, Fermi Energy, Density of Energy States, carrier Concentration, Drawbacks of Sommerfeld Theroy

5.6 Band theory of solids

Introduction, Formation of Energy Bands in Crystals, Characteristics, Bonding, Classification, Intrinsic and Extrinsic Semiconductors, Band structure, Energy Bands, Fermi Level and Fermi Energy, Carrier Concentration, Density of electrons in Conduction band, Position of Fermi level, Hall Effect, Applications

**Reference Books:**


1. Solid state Physics by Dekker
2. Solid state Physics By C.Kittel

**MA1201** **MATHEMATICS – II**

**Externals: 60 Marks** **L-T-P-C***

**Internals : 40 Marks** **4-0-0-4**

**Objectives:**

- To learn the concepts of Eigen values, Eigen vectors, vector spaces and its basis.
- To provide an overview of ordinary differential equations
- To study the methods of solving improper integrals and the concepts of multiple integrals
- To study vector differential and integral calculus

**UNIT-I**

**Linear Algebra:** System of Linear equations ,Vector spaces, Subspaces, Linear combination of vectors, linear dependence and independence of vectors, Basis and Dimension of Vector Space.

Linear transformations, Range and Kernel of Linear Transformations, Rank-Nullity theorem. Matrix representations of Linear Transformation.Eigenvalues and Eigenvectors of a Linear Transformation and their properties , Cayley - Hamilton Theorem, Hermitian and skew Hermitian matrices. Quadratic forms, reduction of quadratic form to canonical form by orthogonal transformation.

**UNIT-II**

**Ordinary Differential Equations of first order:** Exact first order differential equation, finding integrating factors, linear differential equations, Bernoulli's , Riccati , Clairaut's differential equations, finding orthogonal trajectory of family of curves, Newton's Law of Cooling, Law of Natural growth or decay.

**UNIT-III**

**Ordinary Differential Equations of higher order:** Linear dependence and independence of functions, Wronskian of n- functions to determine Linear Independence and dependence of functions, Solutions of Second and higher order differential equations (homogeneous & non-homogeneous) with constant coefficients, Method of variation of parameters, Euler-Cauchy equation.

**UNIT-IV**

**Integral Calculus :** Convergence of improper integrals, tests of convergence, Beta and Gamma functions - elementary properties, differentiation under integral sign, differentiation of integrals with variable limits - Leibnitz rule. Rectification, double and triple integrals, computations of surface and volumes, change of variables in double integrals - Jacobians of transformations, integrals dependent on parameters – applications.

**UNIT-V**

**Vector Calculus :** Scalar and vector fields, level surfaces, directional derivative, Gradient, Curl, Divergence, Laplacian, line and surface integrals, theorems of Green, Gauss and Stokes.

**Text Books:**

1.Advanced Engineering Mathematics (3rd Edition) by R. K. Jain and S. R. K. Iyengar, Narosa Publishing House, New Delhi

**Suggested References:**

1. Advanced Engineering Mathematics (8th Edition) by Erwin Kreyszig, Wiley-India.

2. Dr. M.D. Raisinghania, Ordinary and Partial differential equations, S.CHAND, $17^{th}$ Edition 2014.

*L-T-P-C stands for number of lectures, tutorials, practices and credits

## Scripting Languages

| | L | T | P | C |
|---|---|---|---|---|
| **CS1201** | **4** | **0** | **0** | **4** |

**Prerequisites**

1. Programming in C and Data Structures.

**Objectives**

1. To learn scripting languages- Python, Perl, PHP

**Outcome**

1. Student will be able to write dynamic web pages and will also be able to build a basic search engine using python and also search through text files using Perl.

**UNIT-I**

Python - Introduction-Variables, Strings, numbers, comments, Lists- introducing list, lists and looping, common list operations, removing items from list, numerical lists, list comprehensions, strings as lists, tuples, file I/O, functions, conditional statements and iterative statements.

**UNIT –II**

Python - Dictionaries, common operations with dictionaries, looping through dictionaries, nesting, classes, inheritance, modules and classes, exceptions and testing. Exceptions, sorting, introduction to standard libraries, building a Search Engine using all the above concepts.

**UNIT-III**

Perl – Data types, scalar functions, Quoting Basics, Functions, Control Structures, Inputs, Error Handling.

**UNIT-IV**

Perl – File input output, text processing functions, Hashes, DBM Databases, Regular Expressions.

**UNIT- V**

HTML – Styles, links, images, Static and Dynamic pages, Paragraphs and Fonts, Lists, CSS introduction, Introduction to HTML5 and semantics.

PHP – Loops, String Functions, Email function, Data and time, Image Uploading, Error Handling.

**Text Books:-**


3. Programming Python, 4th Edition Powerful Object-Oriented Programming By Mark Lutz
4. Learning Perl, Randal L Schwartz.
5. Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech

**EE1001/2001** **BASIC ELECTRICAL & ELECTRONICS ENGINEERING**
**(Common to CSE, CIVIL, Chemical, ME & MME)**

**Externals: 60Marks** **L-T-P-C***

**Internals: 40Marks** **4-0-2-6**

## Objectives:

This course introduces the concept of

- Electrical DC and AC circuits, basic law's of electricity, different methods to solve the electrical networks
- Construction operational features of energy conversion devices i.e., DC and AC machines, transformers.
- It also emphasis on basics of electronics, semiconductor devices and their characteristics and operational features.

**UNIT- I DC CIRCUIT ANALYSIS**

**Electrical Circuits -** R-L-C Parameters, Voltage and Current Independent and Dependent Sources, Source Transformation – V–I relationship for Passive elements, Kirchoff's Laws, Network reduction techniques – series, parallel, series parallel, star–to-delta, delta-to-star transformation, Mesh Analysis and Nodal Analysis

**UNIT- II AC CIRCUIT ANALYSIS**

**Single Phase AC Circuits -** R.M.S. and Average values, Form Factor, steady state analysis of series, Parallel and Series parallel Combinations of R, L and C with Sinusoidal excitation, concept of reactance, Impedance, Susceptance and Admittance – phase and phase difference, Concept of Power Factor, j-notation, complex and Polar forms of representation.

**Resonance** – Series resonance and Parallel resonance circuits, concept of bandwidth and Q factor, Locus Diagrams for RL, RC and RLC Combinations for Various Parameters.

**UNIT- III NETWORK THEOREMS AND THREE PHASE AC CIRCUITS**

**Network Theorems** - Thevenin's, Norton's, Maximum Power Transfer, Superposition, Reciprocity, Tellegen's, Millman's and Compensation theorems

**Three phase ac circuits -**Three phase EMF generation, delta and Y connections, line and phase quantities, solution of three phase circuits, balanced supply voltage and balanced load, phasor diagram, measurement of power in three phase circuits

**UNIT- IV BASIC ELECTRONICS**

Introduction to electronics and electronic systems, Semiconductor and devices like diodes, zener diode, BJT, FET, MOSFET, Rectifier and ripple Filters, Transistor biasing. Small signal transistor amplifiers, Operational amplifiers, Feedback and Oscillators, Introduction to digital circuits

**UNIT- V ELECTRICAL MACHINES**

**DC machines:** Construction, EMF and Torque equations, Characteristics of DC generators and motors, speed control of DC motors and DC motor starters.

**Transformers :**Construction, EMF equation, ratings, phasor diagram on no load and full load, equivalent

circuit, regulation and efficiency calculations, open and short circuit tests, auto-transformers.

**Induction motors:** The revolving magnetic field, principle of orientation, ratings, equivalent circuit, Torque-speed characteristics, starters for cage and wound rotor type induction motors.

**TEXT BOOKS:**


1. Electrical Technology- Hughes Prentice Hall, 7th edition
2. Problems In Electrical Engineering- S. Parker Smith, 9 edition
3. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
4. Millman's Electronic Devices and Circuits – J.Millman and C.C.Halkias, Satyabratajit, TMH, 2/e, 1998.
5. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 6th edition.
6. Electric Machines –by I.J.Nagrath & D.P.Kothari,Tata Mc Graw Hill, 7th Edition.2005


**REFERENCES:**


1. Electronic Devices and Circuits - K. Lal Kishore, B.S. Publications, 2nd Edition, 2005.
2. Electronic Devices and Circuits – Anil K. Maini, Varsha Agarwal –Wiley India Pvt. Ltd. 1/e 2009.
4. Network Theory by N.C.Jagan & C.Lakshminarayana, B.S. Publications.
5. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
6. Electrical machines-PS Bhimbra, Khanna Publishers.

## HS1201 Communication Skills -II

**Externals:** **L-T-P-C***

**Internals:** **6-0-0-1**

**Objectives:**

- To improve the English language learning ability of the students by emphasizing on LSRW.
- To complement the comprehensibility of the Technical subjects in a better way.
- To make them competent to attempt and qualify in various tests.

**UNIT-I**

**Conversations** – Introduction - Types of Conversations - Telephonic conversations – Typing messages - Strategies for Effectiveness - Conversation Practice

**UNIT-II**

**Poetry Recitation** - Reading to understand and express– Newspaper Review – Movie reviews – Gossip articles

**UNIT-III**

**E-mail Writing**– **Paragraph Writing - Essay Writing** – Descriptive Writing - Narrative Writing – **Picture perception**

**Suggested References:**

*L-T-P-C stands for number of lectures, tutorials, practices and credits

**CE1001** **ENGINEERING DRAWING**

**Externals: 60Marks** **L-T-P-C**

**Internals: 40Marks** **4-0-0-4**

**Objectives:**

To understand the basic concepts of drawing and use of drafter.
To draw the basic geometrical constructions and curves used in engineering.
To understand and draw the projections of points, lines, planes and solids.
To know about isometric projections.

**Concepts and conventions:** Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning

***UNIT-1***

**Plane curves and free hand sketching:** Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales. Visualization concepts and Free Hand sketching: Visualization principles – Representation of three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

***UNIT-II***

**Projection of points, lines and plane surfaces:** Orthographic projection- principles- Principal planes- First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces - Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method

***UNIT-III***

**Projection of solids:** Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

***UNIT-IV***

**Projection of sectioned solids and development of surfaces:** Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of

simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

***UNIT V***

**Isometric and perspective projections:** Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

**Computer aided drafting (demonstration only)**

Introduction to drafting packages and demonstration of their use.

**Suggested Readings:**


1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50 Edition, 2010.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age publications
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern EconomyEdition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age

**PH 1601** **ENGINEERING PHYSICS LAB**

**Externals: 60Marks** **L-T-P-C***

**Internals: 40Marks** **0-0-2-2**

1. Coupled Pendula
2. Specific rotation - Polarimeter
3. Diffraction Grating
4. Dispersive power of a prism
5. Franck Hertz experiment
6. Photoelectric effect
7. Four probe Experiment
8. Hall effect
9. Ultrasonic Waves

**EE1601/2601 BASIC ELECTRICAL & ELECTRONICS ENGINEERING LABORATORY**

***List of Experiments:***

1. Verification of Network Theorems
2. R-L-C Series Circuit
3. Series and parallel resonanance
4. Three phase power measurement by two Wattmeter method
5. Speed control of DC motor
6. OC and SC Test of Single Phase Transformer
7. OCC of separately excited DC Shunt Generator
8. V-I characteristics of Diodes and BJT
9. Half-wave and full-wave rectifiers, rectification with capacitive filters, zener diode
10. Studies on logic gates

# ME1601 ENGINEERING WORKSHOP

| | |
|---|---|
| Instruction | : 3 Hours/Week (3 Practical) |
| Duration of External Exam | : 3 Hours |
| Scheme of External Exam | : 60 Marks |
| Scheme of Internal Exam | : 40 Marks |
| Credits | : 2 |

**Objectives:**
The budding Engineer may turn out to be a technologist, scientist, entrepreneur, practitioner, consultant etc. There is a need to equip the engineer with the knowledge of common and newer engineering materials as well as shop practices to fabricate, manufacture or work with materials. Essentially he should know the labour involved, machinery or equipment necessary, time required to fabricate and also should be able to estimate the cost of the product or job work. Hence engineering work shop practice is included to introduce some common shop practices and on hand experience to appreciate the use of skill, tools, equipment and general practices to all the engineering students.

**1. TRADES FOR EXERCISES:**
a. Carpentry shop–
Two joints (exercises) involving tenon and mortising, groove and tongue: Making middle lap T joint, cross lap joint, mortise and tenon T joint, Bridle T joint from out of 300 x 40 x 25 mm soft wood stock

b. Fitting shop–
Two joints (exercises) from: square joint, V joint, half round joint or dove tail joint out of 100 x 50 x 5 mm M.S. stock

c. Sheet metal shop–
Two jobs (exercises) from: Tray, cylinder, hopper or funnel from out of 22 or 20 guage G.I. sheet

d. House-wiring–
Two jobs (exercises) from: wiring for ceiling rose and two lamps (bulbs) with independent switch controls with or without looping, wiring for stair case lamp, wiring for a water pump with single phase starter.

e. Foundry–
Preparation of two moulds (exercises): for a single pattern and a double pattern.

f. Welding –
Preparation of two welds (exercises): single V butt joint, lap joint, double V butt joint or T fillet joint

**2. TRADES FOR DEMONSTRATION:**
a. Plumbing
b. Machine Shop
c. Metal Cutting

**Apart from the above the shop rooms should display charts, layouts, figures, circuits, hand tools, hand machines, models of jobs, materials with names such as different woods, wood faults, Plastics, steels, meters, gauges, equipment, CD or DVD displays, First aid, shop safety etc. (though they may not be used for the exercises but they give valuable information to the student). In the class work or in the examination knowledge of all shop practices may be stressed upon rather than skill acquired in making the job.**

**REFERENCE BOOKS:**

1. Engineering Work shop practice for JNTU, V. Ramesh Babu, VRB Publishers Pvt. Ltd., 2009
2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas
4. Dictionary of Mechanical Engineering, GHF Nayler, Jaico Publishing House.