### First Semester

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject Name</th>
<th>L-T-P</th>
<th>Contact hrs/week</th>
<th>Credits</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MATHS101</td>
<td>Calculus</td>
<td>4-1-0</td>
<td>5</td>
<td>4</td>
<td>50</td>
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<tr>
<td>2.</td>
<td>EC102</td>
<td>Introduction to Electronics</td>
<td>3-0-2</td>
<td>5</td>
<td>3+1</td>
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<tr>
<td>3.</td>
<td>ME103</td>
<td>Workshop Practice</td>
<td>0-0-4</td>
<td>4</td>
<td>2</td>
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<tr>
<td>4.</td>
<td>CH101</td>
<td>Applied Chemistry</td>
<td>4-0-3</td>
<td>7</td>
<td>4+2</td>
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<tr>
<td>5.</td>
<td>HSS102</td>
<td>Communication Skills</td>
<td>2-0-0</td>
<td>2</td>
<td>2</td>
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<td>6.</td>
<td>EE-E101</td>
<td>Basic Electrical Engineering</td>
<td>3-1-2</td>
<td>6</td>
<td>3+1</td>
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</table>

### Second Semester

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject Name</th>
<th>L-T-P</th>
<th>Contact hrs/week</th>
<th>Credits</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MATHS201</td>
<td>Differential Equations and</td>
<td>4-1-0</td>
<td>5</td>
<td>4</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transforms</td>
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<tr>
<td>2.</td>
<td>HSS201</td>
<td>Ethics and Self Awareness</td>
<td>2-0-0</td>
<td>2</td>
<td>2</td>
<td>50</td>
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<tr>
<td>3.</td>
<td>-</td>
<td>Physics Course 1*</td>
<td>4-0-3</td>
<td>7</td>
<td>4+2</td>
<td>50</td>
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<tr>
<td>4.</td>
<td>CS204</td>
<td>Computer Programming</td>
<td>3-0-2</td>
<td>5</td>
<td>3+1</td>
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<tr>
<td>5.</td>
<td>GS201</td>
<td>Introduction to Environment Science</td>
<td>3-0-0</td>
<td>3</td>
<td>3</td>
<td>50</td>
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<tr>
<td>6.</td>
<td>EE-E201</td>
<td>Electrical Measurement and</td>
<td>3-1-2</td>
<td>6</td>
<td>3+1</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Instrumentation</td>
<td></td>
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</tbody>
</table>
## Summer Vacations training (four weeks):

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject Name</th>
<th>L-T-P</th>
<th>Contact hrs/week</th>
<th>Credits</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IPD201</td>
<td>Innovative product design</td>
<td>0-0-20</td>
<td>20</td>
<td>2</td>
<td>50</td>
</tr>
</tbody>
</table>

**Note:** Students will undergo four week in-house training during summer vacations in their respective branches. They will be trained to handle laboratory and practical aspects in their field of engineering.

* Practical marks are for continuous and end semester evaluation

# Any one of the following three papers to be chosen by the institute

- **Paper Title:** Oscillation and optics  
  **Paper Code:** APH 101 / APH 201
- **Paper Title:** Quantum and Statistical Physics  
  **Paper Code:** APH 103 / APH 203
- **Paper Title:** Physics of Materials  
  **Paper Code:** APH 207 / APH 107
SEMESTER I

Paper Title : Calculus
Paper Code : MATHS101
Pre Requisite : 10+2
Max (Univ. Exam) Marks : 50  Time of examination: 3hrs.
Internal Assessment : 50
Course Duration: 45 lectures of one hour each.

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

Objectives
• To understand the behaviour of infinite series and its use.
• To learn the concepts of functions of two and more than two variables and their applications.
• To learn the methods to evaluate multiple integrals and their applications to various problems.
• To understand the concepts of Vector calculus and their use in engineering problems.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Topic</th>
<th>No. of Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><strong>FUNCTIONS OF ONE VARIABLE</strong></td>
<td>9</td>
</tr>
<tr>
<td>2.</td>
<td><strong>DIFFERENTIAL CALCULUS OF FUNCTIONS OF TWO AND THREE VARIABLES</strong></td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Concept of limit and continuity of a function of two and three variables, Partial derivatives, total derivative, Euler’s theorem for homogeneous functions, composite function, differentiation of an implicit function, chain rule, change of variables, Jacobian, Taylor’s theorem, Errors and increments, Maxima and minima of a function of two and three variables, Lagrange’s method of multipliers (Scope as in Chapter 12, Sections 12.1 – 12.6, 12.8 – 12.9 of Reference 1).</td>
<td></td>
</tr>
</tbody>
</table>
### 3. SOLID GEOMETRY
Cylinder, Cone, Quadric surfaces, Surfaces of revolution.  
(Scope as in: 10.6, 10.7 of Reference 1).

3

### 4. INTEGRAL CALCULUS OF FUNCTIONS OF TWO AND THREE VARIABLES
Double and triple integrals, Change of order of integration, Change of Variables, Applications to area, volume and surface area.  
(Scope as in Chapter 13 of Reference 1).

9

### 5. VECTOR DIFFERENTIAL CALCULUS
Vector-valued functions and space curves, arc lengths, unit tangent vector, Curvature and torsion of a curve, Gradient of a Scalar field, Directional Derivative (Scope as in Chapter 11, Sections 11.1, 11.3, 11.4, Chapter 12, Section 12.7 of Reference 1).

8

### 6. VECTOR INTEGRAL CALCULUS
Line integrals, Vector fields, Work, Circulation and Flux, Path Independence, Potential functions and Conservative fields, Green’s theorem in the plane, Surface Areas and Surface Integrals, Stoke’s Theorem, Gauss Divergence Theorem (Statements only) (Scope as in Chapter 14 of Reference 1).

7

### Outcomes
- The students are able to test the behavior of infinite series.
- Ability to analyze functions of more than two variables and their applications.
- Ability to evaluate multiple integrals and apply them to practical problems.
- Ability to apply vector calculus to engineering problems

### References:

Course Objectives:
1. To introduce the field of electronics along with the applications.
2. To understand the fundamental concepts of basic semiconductor devices and digital electronics.
3. To become familiar with basic principle of operational amplifier along with its applications.
4. To make students familiar with the basic concept of Communication System.

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

Lecture wise breakup

Part A

Introduction to Electronics: Evolution of Electronic Devices and Integrated Circuit, Applications of electronics, Need and application of electronics in different areas
(4)

Semiconductor Devices: Concept of active and passive devices, Intrinsic and Extrinsic Semiconductors, conductivity of semiconductors and its temperature dependence, Semiconductor Devices: Structure, principle of operation, characteristics and applications of PN-Junction (Rectifier, Clipper and Clamper), BJT, Current Components in BJT, Input & Output characteristics Common Emitter (CE), Common Base (CB), Common Collector (CC) configurations.
(12)

Digital Electronics I: Number System and conversion, Binary arithmetic, basic and universal logic gates, minimization of Boolean expression using Boolean Algebra and K map.
(4)

Part B

Digital Electronics II: Concept of flip-flops, RS, D, JK and T types, basic operation of counters and registers, introduction to RAM & ROM, Basic principle and characteristics of Analog to Digital Converters (ADCs) and Digital to Analog Converters (DACs), types of DACs and ADCs.
(8)

Operational Amplifier and its applications: Block diagram, characteristics, inverting and non-inverting configurations, Op-amp as summing amplifier, difference amplifier, integrator and differentiator
(8)

Communication Systems: Various frequency bands used for communication, Block diagram of Analog and Digital communication, need of modulation, comparison of Analog and Digital communication systems.

(6) Recommended Books:
1. Integrated Electronics, Millman & Halkias (Mc-Graw Hill)
2. Electronics Devices & Circuit Theory, RL Boylestead & L Nashelsky (PHI)

Course Name : INTRODUCTION TO ELECTRONICS (Practical)

List of Experiments:

1. Familiarization with electronic components and usage of Multimeter
2. Familiarization with CRO and Signal Generator.
3. To study the V-I characteristics of pn junction diode and determine static resistance and dynamic resistance.
4. To implement clipper and clamper circuits.
5. To plot the characteristics of BJT configurations.
6. To verify Truth Table of different logic gates.
7. To verify Truth Table of different logic gates flip-flops.
8. To study Op-amp as summing amplifier.
9. To study Op-amp difference amplifier.
10. To study Op-amp integrator and differentiator.
**Paper Title:** Workshop Practice  
**Paper Code:** ME 203 / ME103  
**Time of examination:** 3hrs.  
**Internal Assessment :** 50  
**Course Prerequisites:** Basic Workshop Practices

<table>
<thead>
<tr>
<th>Course Objectives (CO)</th>
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| Student will be able to:  
1. Know different machines, tools and equipment, Identify different Engineering materials, metals and non-metals.  
2. Understand different Mechanisms, Use of Machines, Tools and Equipment.  

<table>
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<tr>
<th>Course Outcome :</th>
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</table>
| This course is designed to help students achieve the following outcomes.  
1) Familiarity with common machines, Tools and Equipment in basic Workshop Practices.  
2) On hand basic workshop practices in Electronics, Electrical, Machine, Welding, Fitting, Sheet Metal. Smithy, Foundry and Carpentry Workshops in Engineering professions.  
3) Applications of Basic Workshop Practices.. |

**SYLLABUS**

Instruction for Students: The candidate will be attending a laboratory session of three hours weekly.

Practice of basic exercises related with different shops. On hand basic workshop practices in Electronics, Electrical, Machine, Welding, Fitting, Sheet Metal. Smithy, Foundry and Carpenter Workshops in Engineering professions.


Jobs: Butt Joint in Flat Position using SMAW.  
Lap Joint using Spot Welding  
Edge Joint in Horizontal Position using SMAW  
Tee Joint in Flat position using SMAW  
Corner Joint in vertical position using SMAW.  
Defect Identification and marking.  
Edge preparation and Fillet making, Tacking, Distortion identification
Electronics Workshop: To know about Soldering mechanism and techniques
Familiarity with Electronic Components / symbols
Testing of electronic components
Application of Soldering: Circuit Assembly
List of Jobs:
Practice of Soldering and de-soldering
Identification and testing of a) passive electronic components b) Active electronic components
Assembly of Regulated Power supply circuit

Electrical Workshop:
Introduction of Various Electric wirings, Wiring Systems, Electrical wiring material and fitting, different type of cables, Conduit pipe and its fitting, inspection points, switches of all types, Distribution boards, M.C.B’s etc.
Electric Shock and its management.
Electric Tools: Conversance with various tools and to carry out the following:
   a) Measurement of wire sizes using SWG and micrometer
   b) Identification of Phase and neutral in single phase supply

Jobs:
To control a lamp with a single way switch
To control a lamp from two different places
To assemble a fluorescent lamp with its accessories
To control a lamp, fan and a three pin socket in parallel connection with single way switches

Fitting Shop:
Introduction of Fitting, different type of operations, Tools, materials, precision instruments like Vernier caliper and Micrometer etc,
Safety precautions and Practical demonstration of tools and equipments

Jobs: To make a square from MS Flat, Punching, Cutting, Filling techniques and practice, Tapping, Counter Drilling

Smithy Workshop:
Jobs: Drawing and Upsetting Practice using Open Hearth Furnace.
Cold working process practice
Heat Treatment \: Annealing and hardening process

Jobs: To perform Marking, Facing, Turning, taper Turing, Grooving, Knurling, parting, Drilling, Reaming operations on lathe machine, Hacksawing practice on Power hacksaw, Shaping operation practice on Shaper
Carpentry Shop: Classification of Tree, Timber. Advantages and uses of Timber, Seasoning of Wood, Tools Used, Defects and Prevention of Wood,

Jobs:
Tee Joint
Cross Joint
Tenon Joint,
L Shape Joint
Practice of Wood Working Lathe
Practice on multi-purpose Planer

Foundry Shop: Introduction to Foundry, Advantages and Disadvantages of castings process, Introduction to pattern and various hand tools, Ingredients of Green sands, Various Hand Molding processes, Introduction to Casting Defects,

Jobs: Identification and uses of hand tools, Preparation of Green sand in Muller, Preparation of Sand Mould of Single piece solid pattern, Split pattern, Preparation of Green sand Core, casting of a Mould and study its defects.

<table>
<thead>
<tr>
<th>RECOMMENDED BOOKS</th>
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</thead>
<tbody>
<tr>
<td><strong>NAME</strong></td>
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<tr>
<td>1.</td>
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<tr>
<td>2</td>
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</tbody>
</table>
**Paper Title**: Applied Chemistry  
**Paper Code**: CH101 / CH201  

**Course Duration**: 45 lectures of one hour each.  

**Max (Univ. Exam) Marks**: 50  
**Time of examination**: 3hrs.  

**Internal Assessment**: 50  

**Objective**: To teach fundamentals of basic chemical sciences essential for the development of new technologies to all branches of engineering.  

**Note for the examiner**: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.  

**Details of the Course:**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Contents</th>
<th>Contact hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PART A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>CATALYSIS: Catalysis and general characteristics of a catalytic reactions, homogenepus catalysis, kinetics of acid, base and enzyme catalysis – Michealis Menten equations. Heterogenous catalysis. Application of catalysis for industrially important processes—hydrogenation (Wilkinson’s catalyst), hydroformylation, acetic acid process and Wacker process.</td>
<td>6</td>
</tr>
<tr>
<td>3.</td>
<td>ELECTROCHEMISTRY: Introduction to electrochemistry, types of electrodes, Ion selective electrodes, Reference electrodes, Fuel cells (hydrogen-oxygen, propane-oxygen, methanol-oxygen fuel cells), Corrosion: Types of corrosion, dry and wet corrosion and their mechanisms, types of electrochemical corrosion (galvanic, pitting, waterline, differential aeration, soil, microbiological, inter-granular, stress corrosion), Factors influencing corrosion, Prevention of corrosion.</td>
<td>8</td>
</tr>
<tr>
<td><strong>PART B</strong></td>
<td></td>
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<tr>
<td>4.</td>
<td>POLYMER CHEMISTRY: Classification of polymers, Mechanism and methods of polymerisation, idea of number average and weight average molecular masses of polymers, preparation, properties and uses of polystyrene, polyester, polyamide, phenol-formaldehyde, silicones and epoxy resins,</td>
<td>5</td>
</tr>
</tbody>
</table>
transition of organic molecules, Woodward-Fieser Rules for calculating $\lambda_{\text{max}}$ for dienes. **IR**- Introduction, Principle of IR spectroscopy- Fundamental vibrations, Application to simple organic molecules (effect of masses of atoms, bond strength, nature of substituent, hydrogen bonding on IR frequency), sample preparation for IR.

### 6. COORDINATION CHEMISTRY:
Introduction, Crystal Field Theory, Splitting of octahedral, tetrahedral and square planar complexes, crystal field stabilization energies of octahedral and tetrahedral complexes and its applications.

### Books suggested:


### Practicals:

Instruction for Students: The candidate will be attending a laboratory session of two hours weekly and has to perform any eight experiments.

- Volumetric analysis: iodometric titrations, complexometric titrations, Acid-base titrations
- Analysis of lubricants: Viscosity/surface tension/saponification value/acid value
- Instrumental techniques for chemical analysis: conductometry, potentiometry, UV-visible/IR spectrophotometer.
• Preparation of few organic compounds/inorganic complexes/polymer

Books Recommended:


Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

Part –A

Lecture Wise Breakup                                      No. of Lectures

1. Fundamentals of Communication Skills (02)  
   Scope and Significance of Communication Skills, Listening, Speaking, Reading and Writing

2. Writing Skills (04)  
   Basics of Grammar – Word Order, Sentence Construction, Placing of Subject and Verbs, Parts of Speech, Use of Tenses, Articles, Prepositions, Phrasal Verbs, Active-Passive, Narration

3. Vocabulary Building and Writing (03)  
   Word Formations, Synonyms, Antonyms, Homonyms, One-Word Substitutes, Idioms and Phrases, Abbreviations of Scientific and Technical Words

4. Speaking Skills (03)  
   Introduction to Phonetic Sounds, English Phonemes, Stress, Rhythm and Intonation, Countering Stage Fright and Barriers of Communication

5. Reading and Comprehension (02)  

Part –B

Lecture Wise Breakup                                      No. of Lectures

1. Advanced Communication Skills (02)  
   Scope, Significance, Process of Communication in an organization, Types and Levels, Communication Networks, Technical Communication, Tools of Effective Communication

2. Speaking Skills and Personality Development (05)  
   Interpersonal Communication, Presentation Skills, Body Language and Voice Modulation, Persuasion, Negotiation and Linguistic Programming, Public Speaking, Group Discussions, Interviews and Case Studies, Power Point Presentations , Relevant to the context and locale, Technical Presentations,
Conducting, Meeting and Conferences

3. **Communication and Media**
   Social and Political Context of Communication, Recent Developments in Media

4. **Advanced Techniques in Speaking Skills**
   Importance of Listening/Responding to native and global accents, Telephonic Interviews and Video Conferencing

5. **Advanced Techniques in Technical Writing**
   Job Application, CV Writing, Business Letters, Memos, Minutes, Reports and Report Writing Strategies, E-mail Etiquette, Blog Writing, Instruction Manuals and Technical Proposals

**Practical Sessions**

1. Individual presentations with stress on delivery and content
2. Overcoming Stage Fright - Debates, extempore
3. How to discuss in a group - Group Discussion
4. Discussion on recent developments and current debates in the media
5. How to prepare for an Interview and face it with confidence
6. Conducting meeting and conferences
7. Exercises on Composition & Comprehension, Reading Improvement

**TEXT BOOKS**


**REFERNCE BOOKS**

11. Lock, R., “Student Activities for taking charge of your Career Direction and Job Search”, Cole Publishing
Note for the paper setter: Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

**PART-A**

1. **DC circuits**
   06 hours
   Voltage and current sources, network analysis by mesh and node analysis, superposition theorem, Thevenin’s theorem, Norton’s theorem, maximum-power transfer theorem (numerical based on these theorem).

2. **Single Phase AC Fundamentals**
   06 hours
   Alternating current systems, average and RMS values of alternating, quantities, phasor notation, solution and phasor diagram of single phase ac circuits with sinusoidal source excitation.

3. **Three Phase AC Fundamentals**
   06 hours
   Three phase voltages and currents generation, voltages and currents in star and delta connected systems, power in a three phase system, solution of three phase balanced circuits, power and power factor measurement by two watt-meters method.

**PART B**

4. **Magnetic Circuit**
   05 hours
   Introduction to magnetic circuit, comparison of electric and magnetic circuits, B/H curve, magnetic circuits calculations, self and mutual inductance.

5. **Transformers**
   06 hours
   Introduction, Basic Principle, EMF equation, losses, efficiency and condition for maximum efficiency, voltage regulation, open circuit and short circuit tests.

6. **Electric Machines**
   07 hours
   Operating principle and application of DC machine and three phase induction motors.

7. **Electrical Generation and Transmission**
   06 hours

**Recommended Books:**

**Paper Title** : Basic Electrical Engineering Practical

**Time of examination: 2hrs.**

**Instruction for Students:** Note: Perform at least eight experiments.

1. Measure resistance and inductive reactance of a choke coil make a series RLC circuit using the choke coil and obtain its phasor diagram.
2. To prove Superposition and Maximum Power Transfer theorem.
3. To prove Thevenin’s and Norton’s theorem.
4. Study the resonance in an RLC series and parallel circuits.
5. To find out the relationship between line current & phase current, between line voltage & phase voltage for star and delta connected loads supplied from balanced three phase supply.
6. To measure power and power factor using wattmeter in single phase circuit.
7. Perform Open circuit and short circuit tests on a single phase transformer to draw equivalent circuit.
8. To connect, start and reverse the direction of a 3 Phase Induction Motor and measure speed / torque.
9. Study and demonstration of earthing system for protection against shocks.
10. To measure power and power factor using two wattmeter of three phase load.
SEMESTER II

Paper Title : Differential Equations and Transforms
Paper Code : MATHS201
Pre Requisite : Calculus (MATHS101)

Course Duration: 45 lectures of one hour each.

Max (Univ. Exam) Marks : 50          Time of examination: 3hrs.
Internal Assessment : 50

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

Objectives

- To learn the methods to formulate and solve linear differential equations and their applications to engineering problems
- To learn the concepts of Laplace transforms and to evaluate Laplace transforms and inverse Laplace transform
- To apply Laplace transforms to solve ordinary differential equations
- To learn the concept of Fourier series, integrals and transforms.
- To learn how to solve heat, wave and Laplace equations.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Topic</th>
<th>No. of Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>PART A</td>
<td></td>
<td>13</td>
</tr>
<tr>
<td>1.</td>
<td>ORDINARY DIFFERENTIAL EQUATIONS</td>
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<tr>
<td></td>
<td>Review of geometrical meaning of the differential equation ( y' = f(x, y) ), directional fields, Exact differential equations (Scope as in Chapter 8, Sections 8.1-8.7 of Reference 2), Integrating factors (Scope as in Chapter 8, Sections 8.8-8.10 of Reference 2), Solution of differential equations with constant coefficients: method of differential operators (Scope as in Chapter 9, Sections 9.1-9.5 of Reference 2). Non – homogeneous equations of second order with constant coefficients: Solution by method of variation of parameters, Reduction by order (Scope as in Chapter 9, Section 9.7, 9.10 of Reference 2).</td>
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</tbody>
</table>
### Power series method of solution (Scope as in Chapter 10, Section 10.2 of Reference 2).

### 2. Laplace Transforms
Laplace transform, Inverse transforms, shifting, transform of derivatives and integrals. Unit step function, second shifting theorem, Dirac’s Delta function. Differentiation and integration of transforms. Convolution Theorem on Laplace Transforms. Application of Laplace transforms to solve ordinary differential equations with initial conditions (Scope as in Chapter 5, Sections 5.1 – 5.5 of Reference 1).

### PART B

### 3. Fourier Series and Transforms: Periodic functions, Fourier series, Even and odd series, half range expansions, Complex Fourier Series, Approximation by trigonometric polynomials. Fourier integrals, Fourier Cosine and Sine transforms, Fourier Transforms (Scope as in Chapter 10, Sections 10.1 – 10.5, 10.7 – 10.10 of Reference 1).

### 4. Partial Differential Equations: Partial differential equations of first order, origin, solution of linear partial differential equations of first order, Integral surfaces passing through a given curve (Scope as in Chapter 2, Sections 1, 2, 4, 5 of Reference 4).

### 5. Boundary Value Problems: D’Alembert’s solution of wave equation, separation of variables: one dimension and two dimension heat and wave equation, Laplace equation in Cartesian and Polar coordinates (Scope as in Chapter 11, Sections 11.1, 11.3 – 11.5, 11.8 – 11.9 of Reference 1).

### Outcomes
1. The student will learn to solve Ordinary Differential equations.
2. The students will be able to apply the tools of Laplace Transforms to model engineering problems and solve the resulting differential equations.
3. Students will understand the nature and behavior of trigonometric (Fourier) series and apply it to solve boundary value problems.

### References:
Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

Lecture Wise Breakup

<table>
<thead>
<tr>
<th>PART A</th>
<th>No. of Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Introduction to Ethics</strong> (06)</td>
<td></td>
</tr>
<tr>
<td>Concept of Ethics – Nature, Scope, Sources, Types, Functions and Factors influencing Ethics, Approaches to Ethics – Psychological, Philosophical and Social, Broader Ethical Issues in Society.</td>
<td></td>
</tr>
<tr>
<td>**2. Values, Norms, Standards and Morality (04)</td>
<td></td>
</tr>
<tr>
<td>Concept and Role, Relation with Ethics, Psycho-Social Theories of Moral Development – Kohlberg and Carol Gilligan</td>
<td></td>
</tr>
<tr>
<td><strong>3. Ethics and Business</strong> (05)</td>
<td></td>
</tr>
<tr>
<td>Concept of Business Ethics – Nature, Objectives and Factors influencing Business Ethics, 3 C’s of Business Ethics, Ethics in Business Activities, Ethical Dilemmas in Business, Managing Ethics</td>
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| PART B                                      |                 |
| 4. Self-Awareness (04)                      |                 |
| Concept of Self Awareness – Need, Elements, Self Assessment – SWOT Analysis, Self Concepts – Self-Knowledge, Assertiveness and Self-Confidence, Self-Esteem |                 |
| 5. Self-Development (11)                   |                 |
| Concept of Self-Development, Social Intelligence, Emotional Intelligence, Managing Time and Stress, Positive Human Qualities (Self-Efficacy, Empathy, Gratitude, Compassion, Forgiveness and Motivation), Personality Development Models – Johari Window, Transactional Analysis, Myers Briggs Type Indicator, Self-Awareness and Self-Development Exercises |                 |

BOOKS
8. Twain, Allan, “Self-Awareness”
Physics Course 1

Any one of the following three papers to be chosen by institute

Paper Title : Oscillations And Optics (Theory)
Paper Code   : APH 101 / APH 201
Course Duration: 45 lectures of one hour each.

Max (Univ. Exam) Marks : 50        Time of examination: 3hrs.
Internal Assessment : 50

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

PART A

Ultrasonics: Production and detection of ultrasonics (2)

SHM: Review of SHM, superposition of two SHM in one dimension, charge oscillations in LC circuits (3)

Damped Oscillations: Concept and cause of damping, differential equation of a damped oscillator and different kinds of damping, Methods of describing damping of an oscillator - logarithmic decrement, relaxation time, quality factor, band width. Series LCR circuit as a damped oscillator. (3)

Forced Oscillations: States of forced oscillations, differential equation of forced oscillator – its displacement, velocity and impedance, behaviour of displacement and velocity with driver’s frequency, Power, bandwidth, Quality factor and amplification of forced oscillator, resonance in forced oscillators, forced oscillations in series LCR circuit (4)

Wave Motion: Wave equation and its solution, characteristic impedance of a string, reflection and transmission of waves on a string at a boundary, reflection and transmission of energy, the matching of impedances (3)

PART B

Interference: Division of wave front and amplitude; Fresnel’s biprism, Newton’s rings, Michelson interferometer and its applications for determination of λ and dλ. (4)

Diffraction: Fresnel and Fraunhofer diffraction, qualitative changes in diffraction pattern on moving from single slit to double slit, plane transmission grating, dispersive power & resolving power of a grating. (5)
**Polarization:** Methods of polarization, analysis of polarized light, quarter and half wave plates, double refraction. (4)

**Lasers:** Elementary idea of LASER production, spontaneous emission, stimulated emission, Einstein’s coefficients, Helium-Neon, Ruby and semiconductor lasers, applications of lasers. (4)

**Fibre Optics:** Basics of optical fibre - its numerical aperture, coherent bundle, step index and graded index fibre, material dispersion, fibre Optics sensors, applications of optical fibre in communication systems. (3)

**Holography:** Basic principle, theory and requirements, applications (2)

**References:**

1. Physics for Engineers (Prentice Hall India) - N.K. Verma
3. Optics – Ajoy Ghatak

**Paper Title : Oscillations and Optics Practical**

**Internal Assessment:** 50

1. To study Lissajous figures obtained by superposition of oscillations with different frequencies and phases.
2. To find the wavelength of sodium light using Fresnel’s biprism.
3. (i) To determine the wavelength of He-Ne laser using transmission grating.
   (ii) To determine the slit width using the diffraction pattern.
4. To determine the wave length of sodium light by Newton’s rings method.
5. To determine the wave length of sodium light using a diffraction grating.
6. To find the specific rotation of sugar solution using a Bi-quartz Polarimeter.
7. To design a hollow prism and used it find the refractive index of a given liquid.
8. To determine the wavelength of laser using Michelson interferometer.
PART A

SPECIAL THEORY OF RELATIVITY

Inertial and non-inertial frames of reference, Galilean transformation, Michelson Morley Experiment, postulates of special theory of relativity, Lorentz transformation, Simultaneity, Length contraction, Time dilation, Doppler effect, Addition of velocities, variation of mass with velocity, mass-energy relation (7)

ORIGIN AND POSTULATES OF QUANTUM PHYSICS

Quantum theory of light, X-rays production, spectrum & diffraction (Bragg’s law), photoelectric effect, Compton effect, pair production, photons & gravity, black holes, de-Broglie hypothesis, particle diffraction, uncertainty principle and applications (7)

Postulates of quantum mechanics, Schrodinger theory, time-dependent and time-independent Schrodinger equation, wave function, Born interpretation and normalization, expectation values (3)

PART B

APPLICATIONS OF QUANTUM PHYSICS

Particle in a box (infinite potential well), finite potential step and barrier problems, tunneling, linear harmonic oscillator (one-dimensional) (4)

Hydrogen atom (qualitative), radiative transitions and selection rules, Zeeman effect, Spin-orbit coupling, electron spin, Stern-Gerlach experiment, exclusion principle, symmetric and antisymmetric wavefunctions (5)

STATISTICAL PHYSICS

References:

2. Solid State Physics, by C. Kittel (Wiley Eastern)
3. Solid State Physics, by S.O. Pillai (New Age International)
4. Statistical Physics and Thermodynamics by V.S. Bhatia

Paper Title: Quantum And Statistical Physics (Practical)

Internal Assessment: 50

1) To study the quantized energy level of the first excited state in the Argon using the Frank-Hertz setup.
2) To find the value of Planck’s constant and evaluate the work function of cathode material by used of photoelectric cell.
3) To study various characteristics of photo-voltaic cell: (a) Voltage-current characteristics, (b) loading characteristics, (c) power-resistance characteristics and (d) inverse square law behavior of the photo-current with distance of source of light from photo-voltaic cell.
4) To study the response of a photo-resistor to varying intensity of light falling on it and deduce spectral sensitivity of its semiconductor material.
5) To study the Balmer Series of Mercury and Hydrogen spectrum using diffraction grating and calculate Rydberg constant.
Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

Part - A

Crystal structure: Bonding forces and energies, Primary and Secondary bonds, Space Lattices, Symmetries in a cubic lattice, Crystal Structures (cubic and hexagonal cells), Assignment of coordinates, directions and planes in crystals, Linear, Planar and Space densities in crystals, close packed morphology (Hexagonal and cubic close packing), single and polycrystalline structures, interstitial spaces (trigonal, tetrahedral and octahedral voids)
Structure of ceramics (NaCl, Zinc blende, silica and silicates, diamond crystal, Graphite, Fullerences and carbon nanotubes)
Structure of polymers, crystallinity of long chain polymers
Crystal Structure analysis, X-ray diffraction and Bragg’s law, Powder method for study of X-ray diffraction pattern
Crystal Defects (Point, line, surface and volume imperfections) (14hrs)

Diffusion: Diffusion mechanisms, steady state diffusion, non-steady state diffusion, factors affecting diffusion, applications based on diffusion (corrosion resistance of Duralumin, carburization of steel, decarburization of steel, doping of semiconductors) (3hrs)

Elastic, Anelastic and Viscoelastic Behaviour Elastic behaviour and its atomic model, rubber like elasticity, anelastic behaviour, relaxation processes, viscoelastic behaviour, spring-dashpot model (3hrs)

Part - B

Plastic Deformations and strengthening mechanisms: Tensile properties (Yield strength, Tensile Strength, Ductility, Resilience, Toughness), Dislocations and plastic deformation, characteristics of dislocations, slip systems, slip in single crystals, plastic deformation of polycrystalline materials, mechanisms of strengthening in metals (grain size reduction, solid-solution strengthening, strain hardening), recovery, recrystallization and grain growth (5hrs)

Fracture, Fatigue and Creep: Fracture (Ductile and brittle fractures), principles of fracture mechanics, fracture toughness, ductile to brittle transitions Cyclic stresses, S-N curve, crack
initiation and propagation, factors that affect fatigue life, environmental effects, generalized creep behavior, stress and temperature effects.

(5hrs)


(6hrs)

Phase Transformations : Kinetics of phase transformation, kinetics of solid state reactions, Isothermal transformation diagrams, continuous cooling transformation, temper embrittlement

(4hrs)

References:

Paper Title : Physics of Materials (Practical)

Internal Assessment : 50

1. To find the energy band gap of the given semiconductor by four probe method.
2. To study the Hall Effect of a given semiconductor.
3. To determine the dielectric constant of the given materials.
4. To study the B-H curve of the ferromagnetic materials.
5. To determine the value of e/m for electron by long solenoid (helical) method.
6. To study the variation of magnetic field with distance along the axis of a circular coil carrying current by plotting a graph.
7. To find the Curie temperature of a Ferroelectric material by measuring Capacitance as a function of temperature.
8. To determine the thermal conductivity of an insulator material using guarded plate method (Lee's disc method).
9. To Study (a) Voltage-current characteristics (b) loading characteristics (c) Power-Resistance characteristics and (d) intensity response of photovoltaic cell.
Paper Title : Computer Programming (Theory)  
Paper Code : CS204 / CS104  

Max (Univ. Exam) Marks : 50  
Time of examination: 3hrs.  
Internal Assessment : 50  

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section. 

Objective: To get basic knowledge of computers, its components and Operating systems and Linux. Shell Commands. To acquire programming skills in C and basic knowledge of Object Oriented Programming. 

PART A  
1. Introduction: (8 hrs)  
Computer Basic, Block Diagram of Computer, Memory Hierarchy, Types of RAM, Secondary Memory Introduction to Operating Systems, Programming Languages, Program Structure, Linux Shell Commands, Bourne Shell, C Shell, Korn Shell  

2. Basic Constructs of C: (8 hrs)  
Keywords, Identifiers, Variables, Symbolic Constants, Data Types and their storage, Operands, Arithmetic Operators, Relational Operators, Logical Operators, Bitwise Operators, Increment & Decrement Operators, Expressions, Conditional Expressions, Assignment Operators and Expressions, Type Conversions, Precedence and Order of Evaluation, External Variables and Scope of Variables. Basic Input Output, Formatted I/O.  

3. Program Control Flow: (4 hrs)  
Statements and Blocks, Conditional Statements, IF, ELSE-IF, Switch Case statements, Control Loops, For, While and Do-While, Go to and Labels.  

4. Arrays & Functions: (8 hrs)
Pointers and Addresses, Arrays, Multi dimensional arrays, strings, pointer arrays, Functions, Function Prototyping, Scope of functions, Arguments, Call by value and call by references, static variables, recursion.

PART B

5. **Structures:** (4 hrs)
   Structures, Array of Structures, pointer to structures, Typedef, Unions, Bit fields, passing structures as an argument to functions, C-Preprocessor and Macros, Command line arguments.

6. **Input and Output** (7 hrs)
   Standard and Formatted Input and Output, File Access & its types, Line Input and Output, Types of Files, Binary & ASCII Files, Error handling, stderr and exit functions

7. **Introduction to Object Oriented Programming:** (6 hrs)
   Classes and Objects, Structures vs Classes, Abstraction, Encapsulation, Polymorphism, Inheritance.

**Recommended Books:**

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

1. Introduction to UNIX Shells, C Shell, Bourne Shell, Korn Shell
2. Writing and compiling C Program in Linux.
3. Introduction to basic structure of C program, utility of header and library files.
4. Implementation of program related to the basic constructs in C
5. Program using different data types in C
6. Programs using Loops and Conditional Statements in C
7. Programs using arrays single dimension and multi dimensions in C.
8. Implementation of Matrices and their basic functions such as addition, subtraction, multiplication, inverse.
9. Programs using functions by passing values using call by value and call by reference method
10. Programs related to structures and unions
11. Program to implement array using pointers
12. Programs related to string handling in C
13. Program to manage I/O files
14. Introduction to classes and program related to basic use of classes showing their advantages over structures.
15. Any other program related to theory program to enhance the understanding of students in the subject.
Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

PART A

General (04)
Introduction, components of the environment, environmental degradation.

Ecology (04)
Elements of ecology: Ecological balance and consequences of change, principles of environmental impact assessment.

Air pollution and control (06)
Atmospheric composition, energy balance, climate, weather, dispersion, sources and effects of pollutants, primary and secondary pollutants, greenhouse effect, depletion of ozone layer, standards and control measures.

PART B

Water pollution and control (06)
Hydrosphere, natural water, pollutants their origin and effects, river/lake/ground water pollution, standards and control.

Land Pollution (06)
Lithosphere, pollutants (municipal, industrial, commercial, agricultural, hazardous solid wastes): their origin and effects, collection and disposal of solid waste, recovery and conversion methods.

Noise Pollution (04)
Sources, effects, standards and control.
Books & References

Paper Title: Electrical Measurements & Instrumentation

Paper Code: EE-E201

Max. (Univ. Exam) Marks: 50
Internal Assessment: 50
Course Duration: 35 lectures of one hour each with 3 lectures per week.

Note for the paper setter: Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

Part-A

1. Units, Dimensions and Standards:
   04 hours
   Introduction to MKS & Rationalized MKSA System, SI Units, Standards of EMF, Resistance, Capacitance and Inductance, Systematic errors.

2. General Theory of Analog Measuring Instruments:
   08 hours
   Operating torque, damping & controlling torque, T/W ratio, Pointers & Scales. Principles of operation of various types of electro mechanical indicating / registering instruments viz. PMMC, dynamometer for DC & AC measurement of V, I, W, frequency, phase & power factor etc., energy meter, their sources of error & compensation, shunts & multipliers, multi-meter.

3. Potentiometers:
   06 hours
   Basic Potentiometer circuit, multiple range potentiometers, constructional details of potentiometers, applications of d-c potentiometers; self balancing potentiometers. A-C potentiometers, polar and co-ordinate types.

Part-B

4. Bridges:
   09 hours

5. Magnetic Measurements:
   05 hours
   Flux meter, B-H Curve, Hysteresis loop, Permeameters, AC Testing of Magnetic materials, Separation of iron losses, iron loss measurement by Wattmeter and Bridge methods.

6. Instrument Transformers:
   03 hours
   Theory and construction of current and potential transformers, ratio and phase angle errors and their minimization, Characteristics of CTs. & PTs., Testing of CTS & PTS.

BOOKS RECOMMENDED
Rai & sons.

2. Electronic Inst. & Measurement techniques. By W.D. Cooper.

ELECTRICAL MEASUREMENTS & INSTRUMENTATION LAB.

Time of examination: 2hrs.

Instruction for Students: Note: Perform at least eight experiments.

1. Study of principle of operation of various types of moving iron, PPMC and dynamo type measuring instruments.
6. Plotting of Hysteresis loop for a magnetic material using flux meter.
7. Measurement of frequency using Wein's Bridge.
8. To study the connections and use of Current and potential transformers and to find out ratio error.
9. Determination of frequency and phase angle using CRO.
11. To find 'Q' of an inductance coil and verify its value using Q- meter.
12. To measure power factor using three voltmeters/ ammeters method.