

**Program Structure for  
First Year Engineering (Semester I & II)  
Mumbai University  
(With Effect from 2016-2017)**

**Semester I**

| Course Code  | Course Name                  | Teaching Scheme (Contact Hours) |           |            | Credits Assigned |            |           |            |            |
|--------------|------------------------------|---------------------------------|-----------|------------|------------------|------------|-----------|------------|------------|
|              |                              | Theory                          | Pract.    | Tut.       | Theory           | TW/Pract   | Tut.      | Total      |            |
| FEC101       | Applied Mathematics-I        | 04                              | -         | 01         | 04               | -          | 01        | <b>05</b>  |            |
| FEC102       | Applied Physics-I            | 03                              | 01        | -          | 03               | 0.5        | -         | <b>3.5</b> |            |
| FEC103       | Applied Chemistry -I         | 03                              | 01        | -          | 03               | 0.5        | -         | <b>3.5</b> |            |
| FEC104       | Engineering Mechanics        | 05                              | 02        | -          | 05               | 01         | -         | <b>06</b>  |            |
| FEC105       | Basic Electrical Engineering | 04                              | 02        | -          | 04               | 01         | -         | <b>05</b>  |            |
| FEC106       | Environmental studies        | 02                              | -         | -          | 02               | -          | -         | <b>02</b>  |            |
| FEL101       | Basic Workshop Practice-I    | -                               | 04        | -          | -                | 02         | -         | <b>02</b>  |            |
| <b>Total</b> |                              | <b>21</b>                       | <b>10</b> | <b>01</b>  | <b>21</b>        | <b>05</b>  | <b>01</b> | <b>27</b>  |            |
| Course Code  | Course Name                  | Examination Scheme              |           |            |                  |            |           |            |            |
|              |                              | Theory                          |           |            |                  | Term Work  | Pract     | Oral       | Total      |
|              |                              | Internal Assessment             |           |            | End Sem Exam     |            |           |            |            |
|              |                              | Test1                           | Test2     | Avg        |                  |            |           |            |            |
| FEC101       | Applied Mathematics-I        | 20                              | 20        | 20         | 80               | 25         | -         | -          | <b>125</b> |
| FEC102       | Applied Physics-I            | 15                              | 15        | 15         | 60               | 25         | -         | -          | <b>100</b> |
| FEC103       | Applied Chemistry -I         | 15                              | 15        | 15         | 60               | 25         | -         | -          | <b>100</b> |
| FEC104       | Engineering Mechanics        | 20                              | 20        | 20         | 80               | 25         | -         | 25         | <b>150</b> |
| FEC105       | Basic Electrical Engineering | 20                              | 20        | 20         | 80               | 25         | -         | 25         | <b>150</b> |
| FEC106       | Environmental studies        | 15                              | 15        | 15         | 60               | -          | -         | -          | <b>75</b>  |
| FEL101       | Basic Workshop Practice-I    | -                               | -         | -          | -                | 50         | -         | -          | <b>50</b>  |
| <b>Total</b> |                              |                                 |           | <b>105</b> | <b>420</b>       | <b>175</b> |           | <b>50</b>  | <b>750</b> |

| Course Code | Course Name           | Teaching Scheme (Contact Hours) |        |      | Credits Assigned |          |      |       |
|-------------|-----------------------|---------------------------------|--------|------|------------------|----------|------|-------|
|             |                       | Theory                          | Pract. | Tut. | Theory           | TW/Pract | Tut. | Total |
| FEC101      | Applied Mathematics-I | 04                              | -      | 01   | 04               | -        | 01   | 05    |

| Course Code | Course Name           | Examination Scheme  |       |                  |              |    |           |       |      |       |
|-------------|-----------------------|---------------------|-------|------------------|--------------|----|-----------|-------|------|-------|
|             |                       | Theory              |       |                  |              |    | Term Work | Pract | Oral | Total |
|             |                       | Internal Assessment |       |                  | End Sem Exam |    |           |       |      |       |
|             |                       | Test1               | Test2 | Av of Test 1 & 2 |              |    |           |       |      |       |
| FEC101      | Applied Mathematics-I | 20                  | 20    | 20               | 80           | 25 | -         | -     | 125  |       |

### Objectives

1. To provide students with sound foundation in applied mathematics to solve real life problems in industry.
2. To provide hands on experience in using Scilab software to handle real life problems.

### Outcomes: Learner will be able to...

1. Apply the concepts of complex numbers to the engineering problems.
2. Apply the knowledge of  $n$ th order derivatives of standard functions to engineering problems.
3. Apply the principles of basic operations of matrices to the engineering problems.
4. Apply the basic principles of partial differentiation to engineering problems.
5. Apply concepts of partial differentiation (maxima and minima, Jacobian), expansion of functions as an application of successive differentiation.
6. Apply SCILAB programming techniques to model problems based on solution of simultaneous linear algebraic equations.

| Module | Detailed Contents   | Hrs.   |
|--------|---|--------|
| 01     | <b>Complex Numbers</b><br><b>Pre-requisite:</b> Review of Complex Numbers-Algebra of Complex Number, Different representations of a Complex number and other definitions, D'Moivre's Theorem.   |        |
|        | 1.1. Powers and Roots of Exponential and Trigonometric Functions.   | 3      |
|        | 1.2. Expansion of $\sin^n \theta$ , $\cos^n \theta$ in terms of sines and cosines of multiples of $\theta$ and Expansion of $\sin n\theta$ , $\cos n\theta$ in powers of $\sin\theta$ , $\cos\theta$  | 2      |
|        | 1.3. Circular functions of complex number and Hyperbolic functions. Inverse Circular and Inverse Hyperbolic functions. Separation of real and imaginary parts of all types of Functions.  | 4      |
| 02     | <b>Logarithm of Complex Numbers , Successive Differentiation</b>  |        |
|        | 2.1 Logarithmic functions, Separation of real and Imaginary parts of Logarithmic Functions.<br>2.2 Successive differentiation: $n$ th derivative of standard functions. Leibnitz's Theorem (without proof) and problems   | 4<br>4 |
| 03     | <b>Matrices</b><br><b>Pre-requisite:</b> Inverse of a matrix, addition, multiplication and transpose of a matrix<br>Types of Matrices (symmetric, skew-symmetric, Hermitian, Skew Hermitian, Unitary, Orthogonal Matrices and properties of Matrices). Rank of a Matrix using Echelon forms, reduction to normal form, PAQ in normal form, system of homogeneous and non – homogeneous equations, their consistency and solutions. Linear dependent and independent vectors. Application of inverse of a matrix to coding theory. | 9      |
| 04     | <b>Partial Differentiation</b><br>4.1 Partial Differentiation: Partial derivatives of first and higher order. Total differentials, differentiation of composite and implicit functions.   | 6      |

|           |  |                                  |
|-----------|--|----------------------------------|
|           | 4.2. Euler's Theorem on Homogeneous functions with two and three independent variables (with proof).Deductions from Euler's Theorem  | <b>3</b>                         |
| <b>05</b> | <b>Applications of Partial Differentiation , Expansion of Functions</b><br>5.1 Maxima and Minima of a function of two independent variables, Jacobian.<br>5.2 Taylor's Theorem (Statement only) and Taylor's series, Maclaurin's series (Statement only).Expansion of $e^x$ , $\sin(x)$ , $\cos(x)$ , $\tan(x)$ , $\sinh(x)$ , $\cosh(x)$ , $\tanh(x)$ , $\log(1+x)$ , $\sin^{-1}(x)$ , $\cos^{-1}(x)$ , $\tan^{-1}(x)$ , Binomial series.   | <b>4</b><br><b>4</b>             |
| <b>06</b> | <b>Indeterminate forms, Numerical Solutions of Transcendental Equations and System of Linear Equations</b><br>6.1 Indeterminate forms, L- Hospital Rule, problems involving series.<br>6.2 Solution of Transcendental Equations: Solution by Newton Raphson method and Regula –Falsi Equation.<br>6.3 Solution of system of linear algebraic equations, by (1) Gauss Elimination Method, (2) Gauss Jacobi Iteration Method, (3) Gauss Seidal Iteration Method. (Scilab programming for above methods is to be taught during lecture hours) | <b>2</b><br><b>4</b><br><b>3</b> |

### Term Work:

General Instructions:

1. Batch wise tutorials are to be conducted. The number of students per batch should be as per University pattern for practicals.
2. Students must be encouraged to write Scilab Programs in tutorial class only. Each Student has to write at least 4 Scilab tutorials (including print out) and at least 6 class tutorials on entire syllabus.
3. SciLab Tutorials will be based on (i) Gauss Elimination Method (ii) Gauss Seidal Iteration method (iii) Gauss Jacobi Iteration Method (iv) Newton Raphson Method (v) Regula –Falsi method (vi) Maxima and Minima of functions of two variables

The distribution of Term Work marks will be as follows -

1. Attendance (Theory and Tutorial) : 05 marks
2. Class Tutorials on entire syllabus : 10 marks
3. SciLab Tutorials : 10 marks

### Assessment:

#### Internal Assessment Test:

Assessment consists of two class tests of 20 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 35% syllabus is completed. Duration of each test shall be one hour.

#### End Semester Theory Examination:

1. Question paper will comprise of total 06 questions, each carrying 20 marks.
2. Total 04 questions need to be solved.
3. Question No: 01 will be compulsory and based on entire syllabus wherein sub-questions of 2 to 5 marks will be asked.
4. Remaining questions will be randomly selected from all the modules.
5. Weightage of each module will be proportional to number of respective lecture hrs as mentioned in the syllabus.

**References:**

1. A text book of Applied Mathematics, P.N.Wartikar and J.N.Wartikar, Vol – I and –II by Pune VidyarthiGraha.
2. Higher Engineering Mathematics, Dr.B.S.Grewal, Khanna Publication
3. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley EasternLimited, 9thEd.
4. Matrices, Shanti Narayan.S. Chand publication
5. Numerical Methods, Dr. P. Kandasamy , S. Chand Publication
6. Howard Anton and Christ Rorres. Elementary Linear Algebra Application Version. 6th edition. John Wiley & Sons, INC.
7. Eisenberg, Murray. Hill Ciphers and Modular Linear Algebra. 3 Nov 1999 (accessed November - 2 December 2001)
8. <<http://www.math.umass.edu/~murray/Hillciph.pdf>>

| Course Code | Course Name         | Teaching Scheme (Contact Hours) |        |      | Credits Assigned |          |      |       |
|-------------|---------------------|---------------------------------|--------|------|------------------|----------|------|-------|
|             |                     | Theory                          | Pract. | Tut. | Theory           | TW/Pract | Tut. | Total |
| FEC102      | Applied Physics – I | 03                              | 01     | --   | 03               | 0.5      | --   | 3.5   |

| Course Code | Course Name         | Examination Scheme  |       |                  |              |    |           |       |      |       |
|-------------|---------------------|---------------------|-------|------------------|--------------|----|-----------|-------|------|-------|
|             |                     | Theory              |       |                  |              |    | Term Work | Pract | Oral | Total |
|             |                     | Internal Assessment |       |                  | End Sem Exam |    |           |       |      |       |
|             |                     | Test1               | Test2 | Av of Test 1 & 2 |              |    |           |       |      |       |
| FEC102      | Applied Physics – I | 15                  | 15    | 15               | 60           | 25 | --        | --    | 100  |       |

### Objectives

1. To impart knowledge of basic concepts in applied physics.
2. To provide the knowledge and methodology necessary for solving problems in the field of engineering.

### Outcomes: Learner will be able to...

1. Apply the concepts of crystallography and to use XRD techniques for analysis of crystal structure .
2. Apply the knowledge of Quantum mechanics to uncertainty principle and motion of free particle.
3. To comprehend the basic concepts of semiconductor physics and apply the same to electronic devices.
4. Apply the knowledge of superconductivity to SQUID and Magnetic levitation.
5. Apply the reasons for Acoustic defects and use this in the proper design of a Hall/Auditorium.
6. Use the knowledge of Piezoelectric and Magnetostriction effect for production of ultrasonic waves and its application in various fields.

| Module | Detailed Contents   | Hrs. |
|--------|---|------|
| 01     | <b>CRYSTAL STRUCTURE</b><br>Introduction to crystallography; Study of characteristics of unit cell of Diamond, ZnS, NaCl and HCP; Miller indices of crystallographic planes & directions; interplanar spacing; X-ray diffraction and Bragg's law; Determination of Crystal structure using Bragg's diffractometer; Frenkel and Schotkey crystal defects; Ionic crystal legacy (3,4,6,8); Liquid crystal phases.   | 07   |
| 02     | <b>QUANTUM MECHANICS</b><br>Introduction, Wave particle duality; de Broglie wavelength; experimental verification of de Broglie theory; properties of matter waves; wave packet, phase velocity and group velocity; Wave function; Physical interpretation of wave function; Heisenberg's uncertainty principle; Electron diffraction experiment and Gama ray microscope experiment; Applications of uncertainty principle; Schrodinger's time dependent wave equation; time independent wave equation; Motion of free particle; Particle trapped in one dimensional infinite potential well. | 09   |
| 03     | <b>SEMICONDUCTOR PHYSICS</b><br>Splitting of energy levels for band formation; Classification of semiconductors(direct & indirect band gap, elemental and compound); Conductivity, mobility, current density (drift & diffusion) in semiconductors(n type and p type); Fermi Dirac distribution function; Fermi energy level in intrinsic & extrinsic semiconductors; effect of impurity concentration and temperature on fermi level; Fermi Level diagram for p-n junction(unbiased, forward bais, reverse bias); Breakdown mechanism (zener&avalanchy), Hall Effect                         | 14   |

|           |  |           |
|-----------|--|-----------|
|           | Applications of semiconductors: Rectifier diode, LED, Zener diode, Photo diode, Photovoltaic cell, BJT, FET, SCR., MOSFET  |           |
| <b>04</b> | <b>SUPERCONDUCTIVITY</b><br>Introduction, Meissner Effect; Type I and Type II superconductors; BCS Theory (concept of Cooper pair); Josephson effect<br>Applications of superconductors- SQUID, MAGLEV   | <b>03</b> |
| <b>05</b> | <b>ACOUSTICS</b><br>Conditions of good acoustics; Reflection of sound(reverberation and echo); absorption of sound; absorption coefficient; Sabine's formula; Acoustic Design of a hall; Common Acoustic defects and acoustic materials  | <b>03</b> |
| <b>06</b> | <b>ULTRASONICS</b><br>Ultrasonic Wave generation; Magnetostriction Oscillator; Piezoelectric Oscillator;<br>Applications of ultrasonic: Eco sounding; NDT; ultrasonic cleaning(cavitation); ultrasonic sensors; Industrial applications of ultrasonic(soldering, welding, cutting, drilling) | <b>03</b> |

**Suggested Experiments: (Any five)**

1. Study of Diamond, ZnS, NaCl crystal structure.
2. Study of HCP structure.
3. Study of Miller Indices, Plane and direction.
4. Study of Hall Effect.
5. Determination of energy band gap of semiconductor.
6. Study of Ultrasonic Distance Meter.
7. Study of I / V characteristics of Zener diode.
8. Determination of 'h' using Photo cell.
9. Study of I / V characteristics of semiconductor diode

The distribution of Term Work marks will be as follows –

1. Attendance (Theory and Practical) : 05 marks
2. Assignments : 10 marks
3. Laboratory work (Experiments and Journal) : 10 marks

**Assessment:**

**Internal Assessment Test:**

Assessment consists of two class tests of 15 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 35% syllabus is completed. Duration of each test shall be one hour.

**End Semester Theory Examination:**

1. Question paper will comprise of total 06 questions, each carrying 15 marks.
2. Total 04 questions need to be solved.
3. Question No: 01 will be compulsory and based on entire syllabus wherein sub-questions of 2 to 3 marks will be asked.
4. Remaining questions will be randomly selected from all the modules.
5. In question paper weightage of each module will be proportional to number of respective  
1. lecture hrs as mentioned in the syllabus.

**References:**

1. A text book of Engineering Physics-Avadhanulu&Kshirsagar, S.Chand
2. Applied Solid State Physics –Ranikant, Wiley India
3. Solid State Electronic Devices- B. G. Streetman, Prentice Hall Publisher
4. Physics of Semiconductor Devices- S. M. Sze, John Wiley & sons publisher
6. Modern Engineering Physics – Vasudeva, S.Chand
7. Concepts of Modern Physics- ArtherBeiser, Tata McGraw Hill
8. Engineering Physics- V. Rajendran, Tata McGraw Hill
9. Introduction to Solid State Physics- C. Kittel, John Wiley & Sons publisher
10. Engineering Physics-H. K. Malik, McGraw Hill

| Course Code | Course Name           | Teaching Scheme (Contact Hours) |        |      | Credits Assigned |          |      |       |
|-------------|-----------------------|---------------------------------|--------|------|------------------|----------|------|-------|
|             |                       | Theory                          | Pract. | Tut. | Theory           | TW/Pract | Tut. | Total |
| FEC103      | Applied Chemistry – I | 03                              | 01     | --   | 03               | 0.5      | --   | 3.5   |

| Course Code | Course Name           | Examination Scheme  |       |    |                  |              |           |       |      |       |
|-------------|-----------------------|---------------------|-------|----|------------------|--------------|-----------|-------|------|-------|
|             |                       | Theory              |       |    |                  | End Sem Exam | Term Work | Pract | Oral | Total |
|             |                       | Internal Assessment |       |    | Av of Test 1 & 2 |              |           |       |      |       |
|             |                       | Test1               | Test2 |    |                  |              |           |       |      |       |
| FEC103      | Applied Chemistry – I | 15                  | 15    | 15 | 60               | 25           | --        | --    | 100  |       |

### Objectives

1. To provide necessary background in applied chemistry relevant to chemical industries.
2. To provide exposure in conducting experiments and interpret and report the results in professional format.

### Outcomes: Learner will be able to...

1. Apply the knowledge of types of hardness of water and its estimation.
2. Apply the knowledge of various softening and disinfecting methods.
3. Apply the knowledge of various polymers, their synthesis, properties and uses along with their fabrication techniques.
4. Apply the knowledge of thermodynamics in studying different chemical systems in equilibrium obeying Gibb's phase rule.
5. Apply the knowledge of lubricants, types, properties and mechanisms to avoid frictional resistance.
6. Demonstrate the knowledge of Portland cement and carbon nanomaterials.

| Module | Detailed Contents  | Hrs. |
|--------|--|------|
| 01     | <b>Water</b><br>Impurities in water, Hardness of water, Determination of Hardness of water by EDTA method and problems, Softening of water by Hot and Cold lime Soda method and numerical problems. Zeolite process and numerical problems. Ion Exchange process and numerical problems. Potable water standard as per BIS w.r.t. i) pH, ii) Alkalinity, iii) TDS, iv) Hardness; Drinking water or Municipal water -Treatments removal of microorganisms by adding Bleaching powder, Chlorination (no breakpoint chlorination), Disinfection by Ozone, Electrodialysis, Reverse osmosis, and Ultra filtration. BOD, COD- definition & significance, sewage treatment (only activated sludge process), Numerical problems related to COD. | 12   |
| 02     | <b>Polymers</b><br>Introduction to polymers, Classification, Types of polymerization, Thermoplastic and Thermosetting plastic; Compounding of plastic, Fabrication of plastic by Compression, Injection, Transfer and Extrusion moulding. Preparation, properties and uses of Phenol formaldehyde, PMMA, Kevlar. Effect of heat on the polymers (Glass transition temperature), Viscoelasticity. Conducting polymers, Engineering Plastics, Polymers in medicine and surgery. Rubbers :<br>Natural rubber- latex, Drawbacks of natural rubber, Vulcanization of rubber, Preparation, properties and uses of Buna-S, Silicone and Polyurethane rubber.  | 12   |
| 03     | <b>Lubricants</b><br>Introduction, Definition, Mechanism of lubrication, Classification of lubricants, Solid lubricants (graphite & Molybdenum disulphide), Semisolid lubricants, Liquid lubricants, Additives in blended Oils. Important properties of lubricants - Definition and significance of - Viscosity, Viscosity index, Flash and fire points, Cloud and pour points, Oiliness,  | 07   |

|           |   |           |
|-----------|---|-----------|
|           | Emulsification, Acid value and numerical problems, Saponification value and numerical problems.   |           |
| <b>04</b> | <b>Phase Rule</b><br>Gibb's Phase Rule, Terms involved with examples, One Component System (Water), Reduced Phase Rule, Two Component System (Pb- Ag), Advantages and Limitations of Phase Rule.  | <b>04</b> |
| <b>05</b> | <b>Important Engineering Materials</b><br>Cement – Manufacture of Portland Cement, Chemical Composition and Constitution of Portland Cement, Setting and Hardening of Portland Cement, Concrete, RCC and Decay.<br>Nanomaterials, preparation (Laser and CVD) method, properties and uses of CNTS, Fullerene - properties and uses. | <b>05</b> |

### **Suggested Experiments:**

- 1) To determine total, temporary and permanent hardness of water sample.
- 2) Removal of hardness using ion exchange column.
- 3) To determine acid value of a lubricating oil.
- 4) To determine free acid pH of different solutions using pHmeter
- 5) To determine metal ion concentration using colorimeter.
- 6) To determine flash point and fire point of a lubricating oil
- 7) To determine Chloride content of water by Mohr's Method.
- 8) To determine melting point and /or glass transition temperature of a polymer
- 9) Molecular weight determination of polymers by Oswald Viscometer.
- 10) To determine the percentage of lime in cement.
- 11) Hardening and setting of cement using Vicat's apparatus
- 12) Determination of Viscosity of oil by Redwood Viscometer.

Term Work shall consist of minimum five experiments. The distribution of marks for term work shall be as follows:

- |   |            |
|---|------------|
| 1 Attendance (Practical and Theory)         | : 05 marks |
| 2 Laboratory Work (Experiments and journal) | : 10 marks |
| 3 Assignments and Viva on practical's       | : 10 marks |

### **Assessment:**

#### **Internal Assessment Test:**

Assessment consists of two class tests of 15 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 35% syllabus is completed. Duration of each test shall be one hour.

#### **End Semester Theory Examination:**

1. Question paper will comprise of total 06 questions, each carrying 15 marks.
2. Total 04 questions need to be solved.
3. Question No: 01 will be compulsory and based on entire syllabus wherein sub-questions of 3 marks will be asked.
4. Remaining questions will be mixed in nature.( e.g. Suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3 )
5. In question paper weightage of each module will be proportional to number of respective lecture hrs as mentioned in the syllabus.

**References:**

1. Engineering Chemistry - Jain& Jain (DhanpatRai)
2. Engineering Chemistry – Dara&Dara (S Chand)
3. Engineering Chemistry - Wiley India (ISBN – 9788126519880)
4. A Text Book of Engineering Chemistry – Shashi Chawla (DhanpatRai)

| Course Code | Course Name           | Teaching Scheme (Contact Hours) |        |      | Credits Assigned |          |      |       |
|-------------|-----------------------|---------------------------------|--------|------|------------------|----------|------|-------|
|             |                       | Theory                          | Pract. | Tut. | Theory           | TW/Pract | Tut. | Total |
| FEC104      | Engineering Mechanics | 05                              | 02     | -    | 05               | 01       | -    | 06    |

| Course Code | Course Name           | Examination Scheme  |       |                  |              |           |       |      |       |
|-------------|-----------------------|---------------------|-------|------------------|--------------|-----------|-------|------|-------|
|             |                       | Theory              |       |                  |              | Term Work | Pract | Oral | Total |
|             |                       | Internal Assessment |       |                  | End Sem Exam |           |       |      |       |
|             |                       | Test1               | Test2 | Av of Test 1 & 2 |              |           |       |      |       |
| FEC104      | Engineering Mechanics | 20                  | 20    | 20               | 80           | 25        | --    | 25   | 150   |

### Objectives

1. To acquaint the concept of equilibrium in two and three dimensional system.
2. To study and analyse motion of moving bodies.

### Outcomes: Learner will be able to...

1. Illustrate the concept of force, moment and apply the same along with the concept of equilibrium in two and three dimensional systems with the help of FBD.
2. Demonstrate the understanding of Centroid and its significance and locate the same.
3. Correlate real life application to specific type of friction and estimate required force to overcome friction.
4. Establish relation between velocity and acceleration of a particle and analyse the motion by plotting the relation
5. Illustrate different types of motions and establish Kinematic relations for a rigid body
6. Analyse body in motion using force and acceleration, work-energy, impulse-momentum principles

| Module | Detailed Contents  | Hrs. |
|--------|--|------|
| 01     | <b>1.1 System of Coplanar Forces:</b><br>Resultant of concurrent forces, parallel forces, non-concurrent<br>Non-parallel system of forces, Moment of force about a point, Couples, Varignon's Theorem. Force couple system. Distributed Forces in plane. | 05   |
|        | <b>1.2 Centroid</b> for plane Laminas.   | 04   |
| 02     | <b>2.1 Equilibrium of System of Coplanar Forces:</b><br>Condition of equilibrium for concurrent forces, parallel forces and non-concurrent non-parallel general forces and Couples.  | 06   |
|        | <b>2.2 Types of support:</b> Loads, Beams, Determination of reactions at supports for various types of loads on beams. (Excluding problems on internal hinges)   | 03   |
|        | <b>2.3 Analysis of plane trusses:</b> By using Method of joints and Method of sections. (Excluding pin jointed frames).  | 05   |
| 03     | <b>3.1 Forces in space:</b><br><b>Resultant of Non-coplanar Force Systems:</b> Resultant of concurrent force system, parallel force system and non-concurrent non-parallel force system.   | 05   |
|        | <b>Equilibrium of Non-coplanar Force Systems:</b> Equilibrium of Concurrent force system, parallel force system and non-concurrent non-parallel force system.  | 07   |
|        | <b>3.2 Friction:</b><br>Introduction to Laws of friction, Cone of friction, Equilibrium of bodies on inclined plane, Application to problems involving wedges, ladders.  | 07   |
|        | <b>1.3 Principle of virtual work:</b><br>Applications on equilibrium mechanisms, pin jointed frames.   | 04   |

|           |  |           |
|-----------|--|-----------|
| <b>04</b> | <b>4.1 Kinematics of a Particle:</b> -Rectilinear motion, Velocity & acceleration in terms of rectangular co-ordinate system, Motion along plane curved path, Tangential& Normal component of acceleration, Motion curves (a-t, v-t, s-t curves), Projectile motion. | <b>10</b> |
| <b>05</b> | <b>5.1 Kinematics of a Rigid Body :-</b> Introduction to general plane motion, Instantaneous center of rotation for the velocity, velocity diagrams for bodies in plane motion.  | <b>06</b> |
| <b>06</b> | <b>6.1 Kinetics of a Particle: Force and Acceleration:</b> -Introduction to basic concepts, D'Alemberts Principle, Equations of dynamic equilibrium, Newton's second law of motion.  | <b>04</b> |
|           | <b>6.2 Kinetics of a Particle: Work and Energy:</b> Principle of work and energy, Law of conservation of energy.   | <b>03</b> |
|           | <b>6.3 Kinetics of a Particle: Impulse and Momentum:</b> Principle of linear impulse and momentum. Law of conservation of momentum. Impact and collision.  | <b>03</b> |

### List of Experiments:-

1. Polygon law of coplanar forces.
2. Non-concurrent non-parallel (General).
3. Bell crank lever.
4. Support reaction for beam.
5. Inclined plane (to determine coefficient of friction).
6. Collision of elastic bodies (Law of conservation of momentum).
7. Kinematics of particles
8. Kinetics of particles

Any other experiment based on above syllabus.

### Term work:-

Term work shall consist of minimum six experiments (at least one experiments on Dynamics), assignments consisting numerical based on above syllabus, at least 3 numerical from each module.

The distribution of marks for term work shall be as follows:

- |   |            |
|---|------------|
| 1. Attendance (Theory and Practical)                  | : 05 marks |
| 2. Laboratory work (Experiment/ programs and journal) | : 10 marks |
| 3. Assignments  | : 10 marks |

### Assessment:

#### **Internal Assessment Test:**

Assessment consists of two class tests of 20 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 35% syllabus is completed. Duration of each test shall be one hour.

#### **End Semester Theory Examination:**

1. Question paper will comprise of total 06 questions, each carrying 20 marks.
2. Total 04 questions need to be solved.
3. Question No: 01 will be compulsory and based on entire syllabus wherein sub-questions of 2 to 5 marks will be asked.
4. Remaining questions will be mixed in nature.( e.g. Suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3 )
5. In question paper weightage of each module will be proportional to number of respective lecture hrs as mentioned in the syllabus.

**Oral Examination:** - Oral examination will be based on entire syllabus

**References:**

1. Engineering Mechanics by R. C. Hibbeler.2
2. Engineering Mechanics by Beer &Johnston, Tata McGraw Hill
3. Engineering Mechanics by F. L. Singer, Harper& Raw Publication
4. Engineering Mechanics by Macklin & Nelson, Tata McGraw Hill
5. Engineering Mechanics by Shaum Series,
6. Engineering Mechanics by A K Tayal, Umesh Publication.
7. Engineering Mechanics by Kumar, Tata McGraw Hill
8. Engineering Mechanics (Statics) by Meriam and Kraige, Wiley Bools
9. Engineering Mechanics (Dynamics) by Meriam and Kraige, Wiley Bools

| Course Code | Course Name                  | Teaching Scheme (Contact Hours) |        |      | Credits Assigned |          |      |       |
|-------------|------------------------------|---------------------------------|--------|------|------------------|----------|------|-------|
|             |                              | Theory                          | Pract. | Tut. | Theory           | TW/Pract | Tut. | Total |
| FEC105      | Basic Electrical Engineering | 04                              | 02     | -    | 04               | 01       | -    | 05    |

| Course Code | Course Name                  | Examination Scheme  |       |                  |              |    |           |       |      |       |
|-------------|------------------------------|---------------------|-------|------------------|--------------|----|-----------|-------|------|-------|
|             |                              | Theory              |       |                  |              |    | Term Work | Pract | Oral | Total |
|             |                              | Internal Assessment |       |                  | End Sem Exam |    |           |       |      |       |
|             |                              | Test1               | Test2 | Av of Test 1 & 2 |              |    |           |       |      |       |
| FEC105      | Basic Electrical Engineering | 20                  | 20    | 20               | 80           | 25 | --        | 25    | 150  |       |

### Objectives

1. To provide knowledge on fundamentals of D.C. circuits and its applications.
2. To impart knowledge on fundamentals of 1- $\Phi$  A.C. circuits and its applications.
3. To inculcate knowledge on the basic operation and the performance of 1- $\Phi$  transformer.
4. To impart knowledge on fundamentals of 3- $\Phi$  A.C. circuits and its applications.
5. To provide knowledge on fundamentals of DC machines.

### Outcomes: Learner will be able to...

1. To evaluate D.C. circuits using network theorems.
2. To evaluate 1- $\Phi$  AC circuits.
3. To illustrate constructional features and operation of 1- $\Phi$  transformer.
4. To evaluate 3- $\Phi$  AC circuits.
5. To illustrate working principle of DC machines.
6. To conduct experiments on D.C. circuits and AC circuits.

| Module | Detailed Contents   | Hrs. |
|--------|---|------|
| 01     | <b>DC Circuits(Only Independent Sources):</b> Kirchoff 's laws, Ideal and practical voltage and current source, Mesh and Nodal analysis, Super node and Super mesh analysis, Source transformation, Star-delta transformation, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, (Source transformation not allowed for Superposition theorem, Mesh and Nodal analysis). | 18   |
| 02     | <b>AC Circuits:</b> Generation of alternating voltage and currents, RMS and Average value, form factor, crest factor, AC through resistance, inductance and capacitance, R-L, R-C and R-L-C series and parallel circuits, phasor diagrams, power and power factor, series and parallel resonance, Q factor and bandwidth.   | 12   |
| 03     | <b>Three Phase Circuits:</b> Three phase voltage and current generation, star and delta connections(balanced load only), relationship between phase and line currents and voltages, Phasor diagrams, Basic principle of wattmeter, measurement of power by one and two wattmeter methods.   | 06   |
| 04     | <b>Single Phase Transformer:</b> Construction, working principle, emf equation, ideal and practical transformer, transformer on no load and on load, phasor diagrams, equivalent circuit, OC and SC test, regulation and efficiency.  | 12   |
| 05     | <b>DC Machines:</b> Principle of operation of DC motors and DC generators, construction and classification of DC machines, emf equation.  | 04   |

**Term work:**

Term work consists of performing minimum 06 practical mentioned as below.

Final certification and acceptance of the term work ensures satisfactory performance of laboratory work.

The distribution of marks for term work shall be as follows:

|                                      |            |
|--------------------------------------|------------|
| Attendance (Theory and Practical)    | : 05 marks |
| Laboratory work (Experiment/journal) | : 10 marks |
| Assignments                          | : 10 marks |

**List of laboratory experiments (Minimum Six):**

1. Mesh and Nodal analysis.
2. Verification of Superposition Theorem.
3. Verification Thevenin's Theorem.
4. Study of R-L series and R-C series circuit.
5. R-L-C series resonance circuit
6. R-L-C parallel resonance circuit.
7. Relationship between phase and line currents and voltages in three phase system (star & delta)
8. Power and phase measurement in three phase system by one wattmeter method.
9. Power and phase measurement in three phase system by two wattmeter method.
10. OC and SC test on single phase transformer

**Assessment:****Internal Assessment Test:**

Assessment consists of two class tests of 20 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 35% syllabus is completed. Duration of each test shall be one hour.

**End Semester Theory Examination:**

1. Question paper will comprise of total 06 questions, each carrying 20 marks.
2. Total 04 questions need to be solved.
3. Question No: 01 will be compulsory and based on entire syllabus wherein sub-questions of 2 to 3 marks will be asked.
4. Remaining questions will be mixed in nature.( e.g. Suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3 )
5. In question paper weightage of each module will be proportional to number of respective lecture hrs as mentioned in the syllabus.

**Text Books**

1. V. N. Mittal and Arvind Mittal "Basic Electrical Engineering" Tata McGraw Hill, (Revised Edition)
2. Edition)
3. Electrical Engineering Fundamentals" by Vincent Del Toro, PHI Second edition, 2011
4. Edward Hughes: Electrical and Electrical Technology, Pearson Education (Tenth edition)
5. D P Kothari and I J Nagrath "Theory and Problems of Basic Electrical Engineering", PHI 13th edition 2011.

**Reference Books:**

1. B.L.Theraja "Electrical Engineering " Vol-I and II,
2. S.N.Singh, "Basic Electrical Engineering" PHI , 2011 Book name and author

| Course Code | Course Name           | Teaching Scheme (Contact Hours) |        |      | Credits Assigned |          |      |       |
|-------------|-----------------------|---------------------------------|--------|------|------------------|----------|------|-------|
|             |                       | Theory                          | Pract. | Tut. | Theory           | TW/Pract | Tut. | Total |
| FEC106      | Environmental Studies | 02                              | --     | --   | 02               | --       | --   | 02    |

| Course Code | Course Name           | Examination Scheme  |       |    |                  |              |           |       |      |       |
|-------------|-----------------------|---------------------|-------|----|------------------|--------------|-----------|-------|------|-------|
|             |                       | Theory              |       |    |                  | End Sem Exam | Term Work | Pract | Oral | Total |
|             |                       | Internal Assessment |       |    | Av of Test 1 & 2 |              |           |       |      |       |
|             |                       | Test1               | Test2 |    |                  |              |           |       |      |       |
| FEC106      | Environmental Studies | 15                  | 15    | 15 | 60               | --           | --        | --    | 75   |       |

### Objectives

1. Creating the awareness about environmental problems among students.
2. Imparting basic knowledge about the environment and its allied problems.
3. Developing an attitude of concern for the environment.
4. Motivating students to participate in environment protection and environment improvement.
5. Acquiring skills to help the concerned individuals in identifying and solving environmental problems.

### Outcomes: Learner will be able to...

1. Illustrate Depleting Nature of Environmental Resources, Global Environmental Crisis, Ecosystem concept.
2. Adapt to 3R (Reuse, Recovery, Recycle).
3. Study different control measures related to Environmental Pollution.
4. Illustrate and analyse various Case Studies related to Environmental Legislation.
5. Demonstrate the working of Renewable energy sources & Equipments.
6. Illustrate the Techniques of Disaster Management and Green Building.

| Module | Detailed Contents  | Hrs. |
|--------|--|------|
| 01     | <p><b>Overview of Environmental Aspects:</b></p> <ul style="list-style-type: none"> <li>• Definition, Scope and Importance of Environmental Study</li> <li>• Need for Public awareness of environmental education</li> <li>• Introduction to depletion of natural resources: Soil, Water, Minerals and Forests.</li> <li>• Global crisis related to – Population, water, sanitation &amp; Land.</li> </ul> <p><b>Ecosystem:</b></p> <ul style="list-style-type: none"> <li>• Study of ecosystems : Forest, desert and aquatic (in brief).</li> <li>• Energy flow in Ecosystem, overview of Food Chain, Food Web and Ecological Pyramid.</li> <li>• Concept of ecological succession and its impact on human beings (in brief).</li> </ul> <p><b>Case Study on Chipko Movement (Uttarakhand, India), (began in 1973).</b></p> | 4    |
| 02     | <p><b>Aspects of Sustainable Development:</b></p> <ul style="list-style-type: none"> <li>• Concept and Definition of Sustainable Development.</li> <li>• Social, Economical and Environmental aspects of sustainable development.</li> <li>• Control measures: 3R (Reuse, Recovery, Recycle),</li> <li>• Resource utilization as per the carrying capacity (in brief).</li> </ul> <p><b>Case Study on Narmada BachaoAndolan (Gujarat, India, in the mid and late 1980s).</b></p>   | 2    |

|           |   |          |
|-----------|---|----------|
| <b>03</b> | <p><b>Types of Pollution:</b></p> <ul style="list-style-type: none"> <li>• Water pollution: Sources of water pollution and Treatment of Domestic and industrial waste water (with flow-diagram of the treatment),</li> <li>• Land Pollution: Solid waste, Solid waste management by land filling, composting and incineration</li> <li>• Air pollution: Sources of air pollution, Consequences of air pollution :- Greenhouse effect (Explanation with schematic diagram), Photochemical Smog (Explanation with chemical reaction).<br/>Cleaning of gaseous effluents to reduce air contaminants namely dust particle or particulate matters by using:- (i) Electrostatic precipitators (ii) Venturi scrubber (Schematic diagram and working).</li> <li>• Noise pollution: Sources, effects, threshold limit for different areas and control methods.</li> <li>• E-Pollution: Definition, Sources and effects.</li> <li>• Nuclear pollution: Sources and effects.</li> </ul> <p><b>Case study on Water Pollution of Ganga River.</b><br/><b>Case study on London smog (U. K.)(December, 1952).</b><br/><b>Case Study of Fukushima Disaster (March, 2011).</b></p> | <b>8</b> |
| <b>04</b> | <p><b>Pollution Control Legislation:</b></p> <ul style="list-style-type: none"> <li>• Functions and powers of Central and State Pollution Control Board.</li> <li>• Environmental Clearance, Consent and Authorization Mechanism.</li> </ul> <p><b>Case Study of Dombivali MIDC- Boiler Blast Tragedy (Thane, Maharashtra, India), (May, 2016).</b></p>   | <b>3</b> |
| <b>05</b> | <p><b>Renewable Sources of Energy:</b></p> <ul style="list-style-type: none"> <li>• Importance of renewable sources of energy.</li> <li>• Principle and working with schematic diagram of :-<br/>(i) Solar Energy: (a) Flat plate collector and (b) Photovoltaic cell.<br/>(ii) Wind Energy: Wind Turbines.<br/>(iii) Hydropower: Hydropower generation from water reservoir of the dam.<br/>(iv) Geothermal Energy: Utilisation of underground sources of steam for power generation.</li> </ul>   | <b>4</b> |
| <b>06</b> | <p><b>Technological Advances to overcome Environmental problems:</b></p> <ul style="list-style-type: none"> <li>• Concept of Green Buildings,</li> <li>• Various indoor air pollutants and their effects on health.</li> <li>• Carbon Credit: Introduction and general concept.</li> <li>• Disaster Management: Techniques of Disaster Management to cope up with (i) Earthquake and (ii) Flood.</li> </ul> <p><b>Case Study on Earthquake in Latur (Maharashtra, India), (September,1993).</b><br/><b>Case Study on Cloudburst and Landslides at Kedarnath (Uttarakhand, India), (June, 2013).</b></p>   | <b>5</b> |

## Assessment:

### Internal Assessment Test:

1. Each test will be of 15 marks.
2. At least one question will be based on case study. Candidate is expected to explain the salient features of the incident and suggest preventive measures.

### End Semester Theory Examination:

1. Question paper will comprise of total six question, each carrying 15 marks.
2. Total four questions need to be solved.
3. Question Number One will be compulsory and it will be based on entire syllabus wherein sub-questions of 2 to 3 marks will be asked.
4. Remaining questions i.e. Q.2 to Q.6 will be mixed in nature and will be divided in three parts (a), (b) & (c) and they will belong to different modules.
5. In question paper, weight of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

**References:**

1. Environmental Studies by Benny Joseph, TataMcGraw Hill.
2. Environmental Studies by R.Rajagopalan, Oxford University Press.
3. Environmental Studies by. AnanditaBasak, Pearson Education.
4. Essentials of Environmental Studies by Kurian Joseph &Nagendran, Pearson Education.
5. Fundamentals of Environmental Studies by Varadbal G. Mhatre, Himalaya Publication House.
6. Perspective of Environmental Studies, by Kaushik and Kaushik,New Age International.
7. Renewable Energy by Godfrey Boyle, Oxford Publications.
8. Textbook of Environmental Studies by Dave and Katewa, Cengage Learning.
9. Textbook of Environmental studies by ErachBharucha, University Press.
10. Environmental pollution control engineering by C.S. Rao, New Age International (P) Limited Publishers.

| Course Code | Course Name                 | Teaching Scheme (Contact Hours) |        |      | Credits Assigned |          |      |       |
|-------------|-----------------------------|---------------------------------|--------|------|------------------|----------|------|-------|
|             |                             | Theory                          | Pract. | Tut. | Theory           | TW/Pract | Tut. | Total |
| FEL101      | Basic Workshop Practice - I | --                              | 04     | --   | --               | 02       | --   | 02    |

| Course Code | Course Name                 | Examination Scheme  |       |                  |              |           |       |      |       |
|-------------|-----------------------------|---------------------|-------|------------------|--------------|-----------|-------|------|-------|
|             |                             | Theory              |       |                  |              | Term Work | Pract | Oral | Total |
|             |                             | Internal Assessment |       |                  | End Sem Exam |           |       |      |       |
|             |                             | Test1               | Test2 | Av of Test 1 & 2 |              |           |       |      |       |
| FEL101      | Basic Workshop Practice - I | --                  | --    | --               | --           | 50        | --    | --   | 50    |

|                | Detailed Contents   | Hrs.      |
|----------------|---|-----------|
| <b>Note:</b>   | <p>The syllabus and the Term- work to be done during semester I and Semester II is given together. Individual Instructor for the course is to design the jobs for practice and demonstration and spread the work over entire two semesters. The objective is to impart training to help the students develop engineering skill sets. This exercise also aims in inculcating respect for physical work and hard labor in addition to some amount of value addition by getting exposed to interdisciplinary engineering domains.</p> <p>The two compulsory trades (Trade 1 – Fitting and Trade 2 – Carpentry) shall be offered in separate semesters.</p> <p>Select any four trade topics (two per semester) out of the topic at trade 3 to 11. Demonstrations and hands on experience to be provided during the periods allotted for the same. Report on the demonstration including suitable sketches is also to be included in the term – work</p> |           |
| <b>Trade 1</b> | <p><b>Fitting (compulsory)</b></p> <ul style="list-style-type: none"> <li>Use and setting of fitting tools for chipping, cutting, filing, marking, center punching, drilling, tapping.</li> <li>Term work to include one job involving following operations : filing to size, one simple male- female joint, drilling and tapping</li> </ul>  | <b>30</b> |
| <b>Trade 2</b> | <p><b>Carpentry (compulsory)</b></p> <ul style="list-style-type: none"> <li>Use and setting of hand tools like hacksaws, jack planes, chisels and gauges for construction of various joints, wood tuning and modern wood turning methods.</li> <li>Term work to include one carpentry job involving a joint and report on demonstration of a job involving wood turning</li> </ul>  | <b>30</b> |
| <b>Trade 3</b> | <p><b>Forging (Smithy)</b></p> <ul style="list-style-type: none"> <li>At least one workshop practice job (Lifting hook and handle) is to be demonstrated.</li> </ul>  | <b>15</b> |
| <b>Trade 4</b> | <p><b>Welding</b></p> <ul style="list-style-type: none"> <li>Edge preparation for welding jobs. Arc welding for different job like, Lap welding of two plates, butt welding of plates with simple cover, arc welding to join plates at right angles.</li> </ul>   | <b>15</b> |
| <b>Trade 5</b> | <p><b>Machine Shop</b></p> <ul style="list-style-type: none"> <li>At least one turning job is to be demonstrated.</li> </ul>  | <b>15</b> |
| <b>Trade 6</b> | <p><b>Electrical board wiring</b></p> <ul style="list-style-type: none"> <li>House wiring, staircase wiring, wiring diagram for fluorescent tube light, Godown wiring and three phase wiring for electrical motors.</li> </ul>  | <b>15</b> |
| <b>Trade 7</b> | <p><b>PCB Laboratory Exercises</b></p> <p>Layout drawing, Positive and negative film making, PCB etching and drilling, Tinning and soldering technique.</p>   | <b>15</b> |
| <b>Trade 8</b> | <p><b>Sheet metal working and Brazing</b></p> <ul style="list-style-type: none"> <li>Use of sheet metal, working hand tools, cutting , bending , spot welding</li> </ul>  | <b>15</b> |

|                 |   |           |
|-----------------|---|-----------|
| <b>Trade 9</b>  | <b>Plumbing</b> <ul style="list-style-type: none"> <li>• Use of plumbing tools, spanners, wrenches, threading dies, demonstration of preparation of a domestic line involving fixing of a water tap and use of coupling, elbow, tee, and union etc.</li> </ul>  | <b>15</b> |
| <b>Trade 10</b> | <b>Masonry</b> <ul style="list-style-type: none"> <li>• Use of masons tools like trowels, hammer, spirit level, square, plumb line and pins etc. demonstration of mortar making, single and one and half brick masonry , English and Flemish bonds, block masonry, pointing and plastering.</li> </ul>  | <b>15</b> |
| <b>Trade 11</b> | <b>Hardware and Networking:</b> <ul style="list-style-type: none"> <li>• Dismantling of a Personal Computer (PC), Identification of Components of a PC such as power supply, motherboard, processor, hard disk, memory (RAM, ROM), CMOS battery, CD drive, monitor, keyboard, mouse, printer, scanner, pen drives, disk drives etc.</li> <li>• Assembling of PC, Installation of Operating System (Any one) and Device drivers, Boot-up sequence. Installation of application software (at least one)</li> <li>• Basic troubleshooting and maintenance</li> <li>• Identification of network components: LAN card, wireless card, switch, hub, router, different types of network cables (straight cables, crossover cables, rollover cables) Basic networking and crimping.</li> </ul> <p><b>NOTE:</b> Hands on experience to be given in a group of not more than four students.</p> | <b>15</b> |

**Term work:**

Term work shall consist of respective reports and jobs of the trades selected the distribution of marks for term work shall be as follows.

- 1 Laboratory work (Job and Journal) : 40 marks
- 2 Attendance (Practical and Theory) : 10 marks