FIRST YEAR FIRST SEMESTER

### A. THEORY

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>CODE</th>
<th>THEORY</th>
<th>CONTACTS (PERIODS/WEEK)</th>
<th>CREDITS</th>
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</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>1</td>
<td>HU101</td>
<td>English Language &amp; Communication</td>
<td>L 2  T 1  P 3  TOTAL 3</td>
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<tr>
<td>2</td>
<td>PH101</td>
<td>Engineering Physics</td>
<td>L 3  T 1  P 4  TOTAL 4</td>
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<tr>
<td>3</td>
<td>M 101</td>
<td>Mathematics</td>
<td>L 3  T 1  P 4  TOTAL 4</td>
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<tr>
<td>4</td>
<td>ME 101</td>
<td>Mechanical Sciences</td>
<td>L 3  T 1  P 4  TOTAL 4</td>
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<td>5</td>
<td>EC101</td>
<td>Basic Electronics Engineering</td>
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<td>6</td>
<td>CH 101</td>
<td>Environment &amp; Ecology</td>
<td>L 3  T 1  P 3  TOTAL 3</td>
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Total of Theory 22 22

### B. PRACTICALS

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<thead>
<tr>
<th>SL. NO.</th>
<th>CODE</th>
<th>THEORY</th>
<th>CONTACTS (PERIODS/WEEK)</th>
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<tr>
<td>7</td>
<td>PH 191</td>
<td>Engineering Physics Lab</td>
<td>L 3  T 3  P 2</td>
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<td>Electronics Engineering Lab</td>
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<td>9</td>
<td>ME 191</td>
<td>Engineering Graphics</td>
<td>L 3  T 3  P 2</td>
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<tr>
<td>10</td>
<td>ME 192</td>
<td>Workshop Practical</td>
<td>L 3  T 3  P 2</td>
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Total of Practical 12 8

Total of Semester 34 30
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<tr>
<th>SL NO.</th>
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<td>L</td>
<td>T</td>
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<tr>
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<td>PH 201</td>
<td>Engineering Physics</td>
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<tr>
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<td>M 201</td>
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<td>ME 201</td>
<td>Mechanical Sciences</td>
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<tr>
<td>4</td>
<td>CS 201</td>
<td>Introduction to Computing</td>
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<tr>
<td>5</td>
<td>EE 201</td>
<td>Basic Electrical Engg.</td>
<td>3</td>
<td>1</td>
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<tr>
<td>6</td>
<td>CH 201</td>
<td>Engineering Chemistry</td>
<td>3</td>
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<td><strong>Total of Theory</strong></td>
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|       |        |                      |   |   |   |       |
| 7     | PH 291 | Engineering Physics Lab | 3 | 2 | 3/2| 1     |
| 8     | CH 291 | Engineering Chemistry Lab | 3 | 2 | 3/2| 1     |
| 9     | CS 291 | Computing Lab        | 3 | 3 | 3 | 2     |
| 10    | EE 291 | Electrical Engineering Lab | 3 | 3 | 3 | 2     |
| 11    | ME 291 | Engineering Graphics  | 3 | 3 | 3 | 2     |
| 12    | ME 292 | Workshop Practical    | 3 | 3 | 3 | 2     |
|       |        | **Total of Practical** | 15|    |    | 10    |

|       |        |                      |   |   |   |       |
|       |        | **Total of Semester** | 36|    |    | 31    |
Syllabus of First Year B.E/B.Tech

(ME, CE, BT, FT, CHE, PE, IT, CSE, BME, Marine, LT, TT, Ceramic, AUE) from 2007

ENGLISH LANGUAGE & COMMUNICATION

Code : HU 101 (First Semester)
Contact : 2L + 1T = 3
Credits: 3

Guidelines for Course Execution

Objective of the Course
To impart basic skills of communication in English through intensive practice to the first year UG students of Engineering so as to enable them to function confidently and effectively in that language in the professional sphere of their life.

Desired Entry Behaviour
The student must have some basic command of English that is must be able to:

1. Write reasonably grammatically
2. Understand (if not use) at least some 2500 general purpose words of English to express himself in writing and 1500 words to talk about day-to-day events and experiences of life.
3. Understand slowly-delivered spoken material in Standard Indian English, and
4. Speak reasonably clearly (if not fluently) on routine matters with his fellow students.

Strategies for Course Execution

- The topics must be conveyed through plenty of examples. Lecture classes must be conducted as lecture-cum-tutorial classes.
- It is a course that aims to develop skills. It is therefore “practical” in orientation. Plenty of exercises of various kinds must be done by the students both inside and outside the classroom.
- The teacher must not depend on a single or a set of two or three text books. He must choose his materials from diverse sources.
- Keeping in view the requirements of his students, the teacher may have to prepare some teaching and exercise material.
- For practice in listening, good tape recorders can be used if the more advanced facilities (for example, language laboratory) are not available. In fact they can be used very fruitfully.
- The teacher must function as a creative monitor in the classroom.
- Minimum time should be spent in teaching phonetic symbols, stress, intonation, etc. The aim should be to enable the students to find out for himself the correct pronunciation of a word from a learner’s dictionary. In teaching speaking, emphasis should be on clarity, intelligibility and reasonable fluency rather than on “correct” pronunciation of words. Classroom presentation and group discussion sessions should be used to teach speaking.

End Results from the Course

Some Key Concepts

Communication as sharing; context of communication; the speaker / writer and the listener / reader; medium of communication; barriers to communication; brevity, clarity and appropriateness in communication.

Writing
Selecting material for expository, descriptive, and argumentative pieces, business letters; formal report; summarizing and abstracting; expressing ideas within a restricted word limit; paragraph division; the introduction and the conclusion; listing reference material; use of charts, graphs and tables; punctuation and spelling; semantics of connectives, modifiers and modals; variety in sentences and paragraphs.
Reading Comprehension
Reading at various speeds (slow, fast, very fast); reading different kinds of texts for different purposes
(for example, for relaxation, for information, for discussion at a later stage, etc.); reading between the
lines.

Speaking
Achieving desired clarity and fluency; manipulating paralinguistic features of speaking (voice quality,
pitch, tone, etc.); pausing for effectiveness while speaking; task-oriented, interpersonal, informal and
semiformal speaking; task-oriented, interpersonal, informal and semiformal speaking; making a short,
classroom presentation.

Group Discussion
Use of persuasive strategies including some rhetorical devices (for emphasizing, for instance; being polite
and firm; handling questions and taking in criticism of self; turn-taking strategies and effective intervention
; use of body language.

Telephonic Conversation.

Listening Comprehension
Achieving ability to comprehend material delivered at relatively fast speed; comprehending spoken
material in Standard Indian English, British English and American English; intelligent listening in
institutions such as an interview in which one is a candidate.

Syllabus Details:
Grammar – Correction of sentence, Vocabulory / word formation, Single word for a group of words, Fill in
the blank, transformation of sentences, Structure of sentences – Active / Passive Voice – Direct / Indirect
Narration (5 lectures)

Essay – Descriptive – Comparative – Argumentative – Thesis statement- Structure of opening / concluding
paragraphs – Body of the essay (7 lectures)

Reading Comprehension – Global – Contextual – Inferential – Select passages from recommended text
(8 lectures)

(7 lectures)

Report Writing – Structure , Types of report – Practice Writing (8 lectures)

Communication / Public Speaking skills , Features of effective speech, verbal-nonverbal
(7 lectures)

Group discussion – principle – practice (6 lectures)

Distribution of marks:
Examination

<table>
<thead>
<tr>
<th>Letters including official</th>
<th>10</th>
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</thead>
<tbody>
<tr>
<td>Precis</td>
<td>10</td>
</tr>
<tr>
<td>Comprehension (chart / graph)</td>
<td>10</td>
</tr>
<tr>
<td>Report writing including technical/scientific</td>
<td>10</td>
</tr>
<tr>
<td>Essay</td>
<td>10</td>
</tr>
<tr>
<td>Grammar</td>
<td>20</td>
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<tr>
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<td>70</td>
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</table>

Assessment

| Class tests | 10 |

| Unit Tests |

| Reading ability | 5 |
SYLLABUS OF ENGINEERING PHYSICS COURSE

Code: PH-101(First Semester)
Contacts: 4L
Credit: 4

Module 1: Classical Mechanics

1.1 Newtonian Mechanics – Newton’s laws of motion-system of particles (2 body problem) conservation of linear and angular momentum (1D and 2D elastic and in-elastic collision) and related problems

References / Books:

1. Mark MaCormack : “Communication”
2. John Mitchell “ How to write reports”
3. S R Inthira & V Saraswathi “ Enrich your English – a) Communication skills b) Academic skills “ Publisher CIEFL & OUP
8. A Text Book for English foe Engineers & Technologists
9. Written Communication in English by Sara-Freeman – Orient Longman
10. English skills for Technical Students by British Council
11. The Young Writer’s TheraurusS by A.J.Koutsoukis – Orient Longman
13. Succeeding Through Communication – Subhash Jagota, EXCEL BOOKS
14. Art of Effective Communication – Charles J Margerison, EXCEL BOOKS
15. Communication Skill For Effective Management – A.Ghanekar.EPH
17. Communication Skill for Technical Students – Faratullah, Orient Longman
18. English Skills for Technical Students – Orient Longman
21. English for Engineers & Technologists Vol.1 & 2 – Orient Longman
22. Speak English (with Audio Cassettes Vol.1 – Vol.8) – Don Dallas,Orient Longman
1.2 Lagrangian formulation - difficulties to handle coupled equations, Constraints (both time dependent and time independent), Degrees of freedom, Generalised co-ordinates, Generalized force, potential and kinetic energy, Lagrange’s equation of motion and Lagrangian, Ignorable co-ordinates, Hamilton’s equation and Hamiltonian. The course should be discussed along with physical problems of 1-D motion.

Module 2: Vibration and Wave :-
Simple harmonic motion - its expression and differential equation and solution, Superposition of two linear SHMs (with same frequency), Lissajous’ figures.
Damped vibration – differential equation and its solution, Critical damping, Logarithmic decrement, Analogy with electric circuits.
Forced vibration – differential equation and solution, Amplitude and Velocity resonance, Sharpness of resonance and Quality factor.
Progressive wave equation and its differential form, Difference between elastic (mechanical) and electromagnetic waves.

Module 3: Electricity and Magnetism
3.1 Examples of vector and scalar field, grad, div, curl, Line integral, surface integral, volume integral-physical examples in the context of electricity and magnetism, Stokes theorem and Gauss theorem [No Proof], Expression of grad, div, curl and Laplacian in Spherical and Cylindrical co-ordinates.
3.2 Coulomb’s law, Gauss’s law in integral form and conversion to differential form and application, Coulomb’s theorem, Electrostatic potential and field, Poisson’s Eqn and Laplace’s eqn (Application to Cartesian, Spherically and Cylindrically symmetric systems – effective 1D problems) Electric current, drift velocity, current density, continuity equation, steady current, conservation of charge, ampere, esu.
3.3 Lorentz force, force on a small current element placed in a magnetic field, Biot-Savart law and its simple applications, divergence of magnetic field, vector potential, Ampere’s law in integral form and conversion to differential form- applications,
3.4 Faraday’s law of electro-magnetic induction in integral form and conversion to differential form, Maxwell’s field equations, Concept of displacement current, Maxwell’s wave equation and its solution for free space.

Code: PH-201(Second Semester)
Contact: 4L
Credit: 4

Module 1: Optics:
1.1 General concept of Polarization, Plane of vibration and plane of polarization, Malus’s law, Qualitative discussion on Plane, Circularly and Elliptically polarized light, Polarization through reflection and Brewster’s law, Double refraction (birefringence) - Ordinary and Extra-ordinary rays, Polaroid, Nicol prism.
1.2 Interference of electromagnetic waves, Conditions for sustained interference, double slit as an example. Spatial and Temporal Coherence, Conservation of energy and intensity distribution, Newton’s ring (No deduction necessary)
1.3 Diffraction of light – Fresnel and Fraunhofer class, Fraunhofer diffraction for single slit and double slits: Intensity distribution, N-slits and plane transmission grating, (No deduction of the intensity
Module 2: Quantum Mechanics:

2.1 Concept of dependendence of mass with velocity, mass energy equivalence, energy- momentum relation, Inadequacy of Classical Physics in explaining (i) Black body radiation (derivation required) - Rayleigh Jeans’ law, Wien’s law, Ultraviolet catastrophe, Planck’s radiation law (Calculation of the average energy of the oscillator) , (ii) Einstein’s Photoelectric effect, (iii) Compton effect (calculation of Compton wavelength is required).

4L

2.2 Wave-particle duality and de Broglie’s hypothesis, Concept of matter waves, Davisson-Germer experiment, Notion of wave packets and Heisenberg’s uncertainty principle, notion of group velocity and phase velocity..

4L

2.3 Concept of probability and probability density, operators, commutators. Formulation of quantum mechanics and Basic postulates, Operator correspondence, Time dependent Schroedinger’s equation, formulation of time independent Schroedinger’s equation by method of separation of variables, Physical interpretation of wave function $\psi$ (normalization and probability interpretation), Expectation values, Application of Schroedinger equation – Particle in an infinite square well potential (1-D and 3-D potential well), Discussion on degenerate levels.

9L

Module 3: Statistical Mechanics:

3.1 Concept of energy levels and energy states. Microstates, macrostates and thermodynamic probability, equilibrium macrostate, MB, FD, BE statistics (No deduction necessary), fermions, bosons (definitions in terms of spin, examples), physical significance and application, classical limits of quantum statistics Fermi distribution at zero & non-zero temperature, Calculation of Fermi level in metals, also total energy at absolute zero of temperature and total number of particles, Bose-Einstein statistics – Planck’s law of blackbody radiation..

7L

Module 4: Crystallography:

4.1 Elementary ideas of crystal structure - lattice, basis, unit cell, Fundamental types of lattices – Bravais lattice, Simple cubic, f.c.c. and b.c.c. lattices, (use of models in the class during teaching is desirable] Miller indices and miller planes, Co-ordination number and Atomic packing factor.

X-rays – Origin of Characteristic and Continuous X-ray, Bragg’s law (No derivation), Determination of lattice constant.

7L

Module 5: Laser and Fibre optics


Optical Fibres – Core and cladding, total internal reflection step index and graded index fibre, Calculation of Numerical aperture and acceptance angle, losses in the fibre, applications.

5L

Reference:
Engineering Physics 1 (TMH WBUT Series), Bhattacharya & Pal, TMH
West Bengal University of Technology  
BF-142, Salt Lake City, Kolkata-700064  
Syllabus of First Year B.E./B.Tech  
(ME,CE,BT,FT,CHE,PE,IT,CSE,BME,Marine,LT,TT,Ceramic,AUE) from 2007  
Code: PH-191(First Semester)  
Contacts: 3P  
Credit: 2

Group 1: Experiment from Higher Secondary knowledge of Physics  
1. Determination of thermal conductivity of a good conductor by Searle’s method.  
2. Determination of thermal conductivity of a bad conductor by Lees and Cholton’s method.  
3. Determination of dispersive power of the material of given prism.  
Group 2: Experiments on General Properties of matter  
4. Determination of Young’s modulus by Flexure method and calculation of bending moment and shear force at a point on the beam.  
5. Determination of modulus of rigidity by static/dynamic method.  
6. Determination of co-efficient of viscosity by Poiseulle’s capillary flow method.  
Group 3: Experiments on Electricity and Magnetism  
7. Determination of dielectric constant of a given dielectric material.  
8. Use of Carry Foster’s bridge to determine unknown resistance.  
9. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.  
10. Determination of the thermo-electric power at a certain temperature of the given thermocouple.  
11. Determination of specific charge (e/m) of electron by J.J. Thomson’s method.  

a) A candidate is required to perform 3 experiments taking one from each group. Initiative should be taken so that most of the Experiments are covered in a college in the distribution mentioned above. Emphasis should be given on the estimation of error in the data taken.

b) In addition, a student should perform one more experiments where he/she will have to convert the non-electrical signals (viz. Temperature, Intensity of Light, Pressure etc.) present in an Experiment into electrical signals and measure them with the help of Multi-meters/Oscilloscopes. Student should calibrate the Sensor for Experiment before use.

c) Innovative experiment: One more experiment designed by the student or the concerned teacher or both.

Note:  
i. Failure to perform each experiment mentioned in b] and c) should be compensated by two experiments from two different groups mentioned in the above list.  
ii. At the end of the semester report should sent to the board of studies regarding experiments, actually performed by the college, mentioned in b] and c]  
iii. Experiment in b] and c] can be coupled and parts of a single experiment.

Code: PH-291(Second semester)  
Contacts: (2P)  
Credit: (2)

Group 1:  
1. Determination of wavelength of light by Newton’s ring method.  
2. Determination of wavelength of light by Fresnel’s bi-prism method  
4. Determination of numerical aperture and the energy losses related to optical fibre experiment
West Bengal University of Technology
BF-142, Salt Lake City, Kolkata-700064
Syllabus of First Year B.E/B.Tech
(ME, CE, BT, FT, CHE, PE, IT, CSE, BME, Marine, LT, TT, Ceramic, AUE) from 2007

Group 2:
5. Determination of Planck’s constant using photocell.
7. Determination of Stefan’s radiation constant
8. To study current-voltage characteristics, load response, areal characteristics and spectral response of photovoltaic solar cells.

Group 3:
9. Determination of Hall co-efficient of semiconductors.
10. Determination of band gap of semiconductors.
11. Determination of Rydberg constant by studying Hydrogen/ Helium spectrum
12. Verification of Bohr’s atomic orbital theory through Frank-Hertz experiment.

a) A candidate is required to perform 3 experiments taking one from each group. Initiative should be taken so that most of the Experiments are covered in a college in the distribution mentioned above. Emphasis should be given on the estimation of error in the data taken.

b) In addition a student should perform one more experiments where he/she will have to transduce the output of any of the above experiments or the experiment mentioned in c] into electrical voltage and collect the data in a computer using phoenix or similar interface.

c) Innovative experiment: One more experiment designed by the student or the concerned teacher or both.

Note:

i. Failure to perform each experiment mentioned in b] and c] should be compensated by one experiments mentioned in the above list.

ii. At the end of the semester report should sent to the board of studies regarding experiments, actually performed by the college, mentioned in b] and c]

iii. Experiment in b] and c] can be coupled and parts of a single experiment.

Recommended Text Books and Reference Books:
1. R.K. Kar (Engineering Physics)
2. Mani and Mehta (Modern Physics)
3. Arthur Baiser (Perspective & Concept of Modern Physics)

Classical Mechanics
1. H. Goldstein
2. A.K. Roychaudhuri
3. R.G. Takwal and P.S. Puranik
4. Rana and Joag
5. M. Speigel (Schaum Series)
6. J.C. Upadhya (Mechanics)
7. Gupta Kumar and Sharma

Electricity and Magnetism
1. Reitz, Milford and Christy
2. David J. Griffith
3. D. Chattopadhyay and P.C. Rakshit
Vibration and Waves
1. Kingsler and Frey
2. D.P. Roychaudhury
3. N.K. Bajaj (Waves and Oscillations)
4. K. Bhattacharya
5. R.P. Singh (Physics of Oscillations and Waves)
6. A.B. Gupta (College Physics Vol.II)
7. Chattopadhya and Rakshit (Vibration, Waves and Acoustics)
8. D. P. Roychaudhury

Optics
1. Möller (Physical Optics)
2. A.K. Ghatak
3. E. Hecht (Optics)
4. E. Hecht (Schaum Series)
5. F.A. Jenkins and H.E. White
6. 6. Chita Ranjan Dasgupta (Degree Physics Vol 3)

Quantum Physics
1. Eisberg and Resnick
2. A.K. Ghatak and S. Lokenathan
3. S.N. Ghoshal (Introductory Quantum Mechanics)
4. E.E. Anderson (Modern Physics)
5. Haliday, Resnick and Crane (Physics vol.III)

Quantum Statistics
1. Sears and Sallinger (Kinetic Theory, Thermodynamics and Statistical Thermodynamics)
2. Mondal (Statistical Physics)
3. S.N. Ghoshal (Atomic and Nuclear Physics)
4. Singh and Singh
5. B.B. Laud (Statistical Mechanics)

Crystallography
2. A.J. Dekker
3. Aschroft and Mermin
4. Ali Omar
5. R.L. Singhal
6. Jak Tareen and Trn Kutty (Basic course in Crystallography)

Module 5: Laser and Fibre Optics
1. A.K. Ghatak and Thyagarajan (Laser)
2. Tarasov (Laser)
3. P.K. Chakraborty (Optics)
4. B. Ghosh and K.G. Majumder (Optics)
5. B.B. Laud (Laser and Non-linear Optics)
Code: EE 201  
Contacts: 3L+1T=4  
Credits: 4

**Electrostatics:** Coulomb’s law. Electric Field Intensity, electric field due to a group of charges, continuous charge distribution. Electric flux, Flux density. Electric potential, potential difference. Gauss’s law, proof of gauss’s law, its applications to electric field and potential calculation. Capacitor, capacitance of parallel plate capacitor, spherical capacitor, isolated spheres, concentric conductors, parallel conductors. Energy stored in a capacitor.  

5L

**DC Network Theorem:** Definition of electric circuit, network, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit. Kirchhoff’s law. Principle of superposition. Source equivalence and conversion, Thevenin’s theorem, Norton Theorem, nodal analysis, mesh analysis, star-delta conversion. Maximum power transfer theorem with proof.  

5L

**Electromagnetism:** Biot-savart law, Ampere’s circuital law, field calculation using Biot-savart and amperè’s circuital law. Magnetic circuits, Analogous quantities in magnetic and electric circuits, Faraday’s law, self and mutual inductance. Energy stored in a magnetic field, Hysteretic and Eddy current losses. Electro-mechanical energy conversion.  

5L

**DC Machines:** Construction, Basic concepts of winding (Lap and wave).  
DC generator: Principle of operation, EMF equation, characteristics (open circuit, load)  
DC motors: Principle of operation, Speed-torque Characteristics (shunt and series machine), starting (by 3 point starter), speed control (armature voltage and field control)  

6L

**AC fundamental:** Production of alternating voltage, waveforms, average and RMS values, peak factor, form factor, phase and phase difference, phasor representation of alternating quantities, phasor diagram, behavior of AC series, parallel and series parallel circuits, power factor, power in AC circuit, Effect of frequency variation in RLC series and parallel circuits, Resonance in RLC series and parallel circuit. Q factor, band width of resonant circuit.  

9L

**Single phase transformer:** Core and shell type construction, EMF equation, no load and on load operation, phasor diagram and equivalent circuit, losses of a transformer, open and short circuit tests, regulation and efficiency calculation.  

4L

**3 phase induction motor:** Types, Construction, production of rotating field, principle of operation, equivalent circuit and phasor diagram, rating, torque-speed characteristics (qualitative only). Starter for squirrel cage and wound rotor induction motor. Brief introduction of speed control of 3 phase induction motor (voltage control, frequency control, resistance control)  

5L

**Three phase system:** Voltages of three balanced phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams. Power measurement by two watt meters method.  

3L

**General structure of electrical power system:** power generation to distribution through overhead lines and under ground cables with single lone diagram  

1L

Text books:  
4. Basic Electrical Engineering, J.P. Tewari, New age international publication
Reference books:
1. Basic Electrical Engineering (TMH WBUT Series), Abhijit Chakrabarti & Sudipta Nath, TMH
3. Hughes Electrical & Electronics Technology, 8/e, Hughes, Pearson Education.
4. Introduction to Electrical Engineering, M.S. Naidu & S, Kamakshaiah, TMH

**BASIC ELECTRICAL ENGINEERING LABORATORY (Second Semester)**

(Paper code: EE 291)

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<th>Sl. No</th>
<th>Name of the Experiments</th>
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<tbody>
<tr>
<td>1.</td>
<td>Characteristics of Fluorescent lamps</td>
</tr>
<tr>
<td>2.</td>
<td>Characteristics of Tungsten and Carbon filament lamps</td>
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<tr>
<td>3.</td>
<td>Verification of Thevenin’s theorem.</td>
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<tr>
<td>4.</td>
<td>Verification of Norton’s theorems.</td>
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<tr>
<td>5.</td>
<td>Verification of Maximum power theorem.</td>
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<tr>
<td>6.</td>
<td>Verification of Superposition theorem</td>
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<tr>
<td>7.</td>
<td>Calibration of ammeter and voltmeter.</td>
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<tr>
<td>8.</td>
<td>Study of R-L-C Series circuit</td>
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<tr>
<td>9.</td>
<td>Study of R-L-C parallel circuit</td>
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<tr>
<td>11.</td>
<td>No load characteristics of D.C shunt Generators</td>
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<tr>
<td>12.</td>
<td>Starting and reversing of speed of a D.C. shunt</td>
</tr>
<tr>
<td>13.</td>
<td>Speed control of DC shunt motor.</td>
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</table>

**ENVIRONMENT & ECOLOGY**

Code: Ch 101 (First Semester)

Contacts: 3L = 3

Credits: 3

General
Basic ideas of environment, basic concepts related to environmental perspective, man, society and environment, their inter relationship. 1L

Mathematics of population growth and associated problems, definition of resource, types of resource, renewable, nonrenewable, potentially renewable, effect of excessive use vis-à-vis population growth,
definition of pollutant and contaminant. Environmental impact assessment.

2L

Environmental degradation:
Acid rain, toxic element, particulates, noise pollution, air pollution and its effect on man.

1L

Overall methods for pollution prevention, environmental problems and sustainable development, components of environment

1L

Ecology
Elements of Ecology:
System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem, biotic and abiotic components.
Ecological balance and consequence of change:
Effect of abiotic factor on population, flow chart of different cycles with only elementary reaction [oxygen, nitrogen, phosphate, sulphur], food chain [definition and one example of each food chain]

3L

Air Pollution and Control
Atmospheric Composition: Troposphere, stratosphere, mesosphere, thermosphere, tropopause, stratopause and mesopause

1L

Energy Balance:
Conductive and convective heat transfer, radiation heat transfer, simple global temperature modal [Earth as a black body, earth albedo]), problems.

3L

Green-house effects:
Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food.

1L

Climate, weather:
Difference between climate and weather
Global warming and its consequence:
Adiabatic lapse rate, atmospheric stability, temperature inversion, radiation inversion
Atmospheric dispersion:
Maximum mixing depth, ventilation coefficient, smokestack plumes and atmospheric lapse rate.

1L

The point-source Gaussian plume model excluded.
Source and effect of pollutants:
Toxic chemicals in the environment, toxic chemicals in air, suspended particulate matter, carbon dioxide, sulphur dioxide, nitric oxide, lead, carbon monoxide.

2L

Primary and secondary pollutants:
Emission standard, criteria pollutant, oxides of carbon, oxide of nitrogen, oxide of sulphur, particulate, PAN

Depletion Ozone layer:
CFC, destruction of ozone layer by CFC, impact of other greenhouse gases, effect of ozone modification.

1L

Standards and control measures:
Industrial, commercial and residential air quality air quality standard, Control measure (ESP, Cyclone separator, bag house, catalytic converter, scrubber (ventury). Statement with brief reference)

1L

Water Pollution and Control
Hydrosphere:
Hydrological cycle

1L

Natural water
Pollutants : their origin and effects :
Oxygen demanding wastes, pathogens, nutrients, salts, thermal application, heavy metals, pesticides, volatile organic compounds 1L
River / lake / ground water pollution
River
DO, 5day BOD test, BOD reaction rate constants, temperature dependents of BOD, effect of oxygen demanding wastes on river [Deoxygenation, reaeration], COD , Oil, Grease, pH. 2L
Lake
Eutrophication [Definition, source and effect] 1L
Ground Water:
Aquifers, hydraulic gradient, ground water flow. (Definition only) 1L
Standard and control:
Waste water standard [BOD,COD,Oil, Grease], Water treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening], wastewater treatment, primary treatment , secondary treatmens [Trickling filters, rotating biological contractor, activated sludge, sludge treatment, oxidation ponds], tertiary treatment definition. 3L
Arsenic pollution :
Biochemical effect, contamination, speciation 2L
Land Pollution
Lithosphere
Composition
Pollutants
Municipal, industrial, commercial, agricultural, hazardous solid wastes 1L
Recovery and conversion method 2L
Waste and waste management
Land filling, incineration, composting
Noise Pollution 2L
Sources, effects
Definition of noise, effect of noise pollution , noise classification, transport noise, occupational noise, neighbourhood noise, definition of noise intensity, noise threshold limit value.

References / Books:

2. Basak: Environmental Engineering TMH
7. Fundamentals of environmental studies by D.K.Sinha, & A.D.Mukherjee
8. Introduction to Environmental Engineering Sc. by G.Mmasters
9. Environmental Chemistry by A.K.De, New Age International
10. Environmental Management- Mukherjee, Vikas
11. Environmental Management- Pandey, Vikas
12. Environmental Chemistry – Sindhu P.S., New Age International
13. Water Pollution & Management – Varshney C.K., New Age International
15. Water Pollution: Causes, Effects & Control – Goel P.K., New Age International
16. Environmental Pollution Control Engg – Rao C.S., New Age International
17. Land Treatment of Waste Water – Gohil M.B., New Age International
18. Environmental Pollution Analysis – Khokar S.M., New Age International
20. Environmental Studies – De A.K., New Age International
INTRODUCTION TO COMPUTING

Code : CS 201(First Semester)
Contacts : 2L + 1T = 3
Credits : 3

Fundamentals of Computer:
History of Computer, Generation of Computer, Classification of Computers

Basic Anatomy of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices

Binary & Allied number systems representation of signed and unsigned numbers. BCD, ASII. Binary Arithmetic & logic gates

Assembly language, high level language, compiler and assembler (basic concepts)

Basic concepts of operating systems like MS DOS, MS WINDOW, UNIX, Algorithm & flow chart

C Fundamentals:
The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements

Operators & Expressions:
Arithmetic operators, relational and logical operators, type, conversion, increment and decrement operators, bit wise operators, assignment operators and expressions, precedence and order of evaluation.

Input and Output: Standard input and output, formatted output -- printf, formatted input scanf.

Flow of Control:
Statement and blocks, if - else, switch, loops - while, for do while, break and continue, go to and labels

Fundamentals and Program Structures:
Basic of functions, function types, functions returning values, functions not returning values, auto, external, static and register variables, scope rules, recursion, function prototypes, C preprocessor, command line arguments.

Arrays and Pointers:
One dimensional arrays, pointers and functions, multidimensional arrays.

Structures Union and Files:
Basic of structures, structures and functions, arrays of structures, bit fields, formatted and unformatted files.

Recommended reference Books:
Introduction To Computing (TMH WBUT Series), E. Balagurusamy, TMH

Kerninghan, B.W. The Elements of Programming Style
Yourdon, E. Techniques of Program Structures and Design
Schied F.S. Theory and Problems of Computers and Programming
Gottfried Programming with C Schaum
Kerninghan B.W. & Ritchie D.M. The C Programming Language
Rajaraman V. Fundamental of Computers
Balaguruswamy Programming in C
Kanelkar Y. Let us C

M.M.Oka Computer Fundamentals, EPH
Leon Introduction to Computers, Vikas
Leon- Fundamental of Information Technology, Vikas
BASIC ELECTRONICS ENGINEERING

Code: EC 101 (First Semester)
Contacts: 3L + 1T = 4
Credits: 4

Introduction:
Crystalline material: mechanical properties, energy band theory, Fermi levels 2L

Conductors, Semiconductors and Insulators: electrical properties, band diagrams. Semiconductors: intrinsic and extrinsic, energy band diagram, electrical conduction phenomenon, P-type and N-type semiconductors, drift and diffusion carriers, mass action law and continuity equation (statement only) 6L

Formation of P-N junction, energy band diagram, built-in-potential forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener breakdown, Avalanche breakdown and its reverse characteristics, junction capacitance and varactor diode. 6L

Simple diode circuits, load line, linear piecewise model; rectifiers: half wave, full wave, its PIV, DC voltage and current, ripple factor, efficiency Clipper and Clamper circuits 6L

Introduction to Transistors:
Formation of PNP / NPN junctions, energy band diagram; transistor mechanism and principle of transistors, CE, CB, CC configuration, Ebers-Moll model of transistor; transistor characteristics: cut-off active and saturation mode, early effect. 4L

Biasing and Bias stability: calculation of stability factor with variation of Ico Different operating modes; CE, CB, CC and their properties; small signal low frequency operation of transistors; equivalent circuits h parameters as a two port network. 4L

Transistors as amplifier: expression of voltage gain, current gain, input impedance and output impedance, frequency response for CE amplifier with and without source impedance (qualitative) 4L

Introduction to Field Effect Transistor:
Construction and characteristics of JFET (N channel only), Transfer characteristics; construction and characteristics of MOSFET (N channel only), depletion and enhancement type; CS, CG, CD configuration 4L

Feed Back Amplifier:
Concept (Block diagram), properties, positive and negative feed back, loop gain, open loop gain, feed back factors; topologies of feed back amplifier; effect of feed back on gain, output impedance, input impedance, sensitivities (qualitative), bandwidth stability; effect of positive feed back: instability and oscillation, condition of oscillation, Barkhausion criteria. 5L
Operational Amplifier:
Introduction to integrated circuits, operational amplified and its terminal properties, specification of M741

Application of operational amplifiers: concept of virtual earth, inverting and non-inverting mode of operation, voltage summing, difference, constant gain multiplier, voltage follower, comparator, integrator, differentiator.

Special Semiconductor devices:
Silicon Controlled Rectifier (SCR): constructional features, physical operation, characteristics, simple application (Saw tooth generator); concept of TRIAC, DIAC and UJT; insulated gate bipolar transistor (IGBT)

Cathode Ray Oscilloscope:
Construction features of cathode ray tube, concept of dual beam CRO; application of CRO for different electrical measurements: amplitude frequency and phase of sine wave, Lissajous figure.

Recommended reference Books:

- Malvino: Electronic Principle
- Millman & Halkias: Integrated Electronics
- Mottershed: Electronics Devices & Circuits
- Millman & Grabal: Microelectronics
- Schilling & Belove: Electronics Circuits
- Salivahanan: Electronics Devices & Circuits
- Manish Mukherjee: Foundation Of Electronics Devices & Circuits
- Bhargava: Basic Electronics and Linear Circuits
- Rakshit & Chattopadhyay: Foundation of Electronics
- Storey: Electronics
- Basavrag: Basic Electronics, Vikas
- Mann, K.: Introductory A.C. Circuits Theory, Universities Press
- Ray Dilip Kumar: Physics of Semiconductor Devices, Universities Press
- Chattopadhyay & Rakshit: Electronics : Fundamentals & Application, New Age
- Paul P. John: Electronics Devices & Circuits, New Age
- Poornachandra: Electronics Devices & Circuits

ENGINEERING CHEMISTRY
Code: CH 201(Second Semester)
Contacts: 3L = 3
Credits: 3

Chemical Thermodynamics:
Concept of Thermodynamic System: diathermal wall, adiabatic wall, isolated system, closed system, open system, extensive property, intensive property
Introduction to first law of thermodynamics: different statements, mathematical form; internal energy: physical significance, mathematical expression (ideal and real gas), Enthalpy: physical significance,
Cp and Cv: definition and relation; adiabatic changes; reversible and irreversible processes; application of first law of thermodynamics to chemical processes: exothermic, endothermic processes, law of Lavoisier and Laplace, Hess's law of constant heat summation, Kirchhoff's law

Second law thermodynamics; Joule Thomson and throttling processes; inversion temperature; evaluation of entropy: characteristics and expression, entropy change in irreversible process, entropy change for irreversible isothermal expression of an ideal gas, entropy change of a mixture of gases

Work function and free energy: physical significance, mathematical expression for ideal and real gases obeying Vander Waals' equation, Gibbs Helmholtz equation

Condition of spontaneity and equilibrium; non ideal systems, activity and activity coefficient, partial molar properties, chemical potential to multicomponent systems, Gibbs Duhem relation; application of thermodynamics to phase transition

Atoms and Molecules:
Homonuclear and heteronuclear diatomics, covalent bonds, ionic bonds and electronegativity concepts, hybridization and shapes of molecules, non-covalent interaction (Vander Waals and hydrogen bonding).

Solid State Chemistry:
Introduction to stoichiometric defects (Schottky & Frenkel) and non-stoichiometric defects (Metal excess and metal deficiency); role of silicon and germanium in the field of semiconductor, transistors, rectifier and photovoltaic cells; the process for preparing microminiaturized semiconductor devices: integrated circuits

Instrumental Methods of Analysis:
Introduction to instrumental metals such as IR, UV,-Vis, NMR and Mass spectrometry.

Reaction Dynamics:
Reaction laws: rate and order; molecularity; first and second order kinetics; mechanism and theories of reaction rates (Transition state theory, Arrhenius equation)

Transition and Metal Chemistry:
Structures of coordination compounds corresponding to coordination number 6; types of ligands; isomerism (geometrical, optical, ionization, linkage and coordination).

Structure and Reactivity of Organic Molecule:
Inductive effect; resonance; hyperconjugation; electromeric effect; carbanion and free radicals; brief study of some addition, elimination and substitution reactions

Polymerization:
Concepts, classifications and industrial applications; polymerization processes, degree of polymerization (addition and condensation polymerization); preparation, structure and use of some common polymers: plastic (PE, PP, PVC bakelite), rubber (natural rubber, SBR, NBR), fibre (nylon 6,6, polyester); conducting and semiconducting polymers

Industrial Chemistry:
Solid, liquid and gaseous fuels; constituents of coal, carbonization of coal, coal analysis, proximate and ultimate analysis; classification of coal Petroleum, gasoline, octane number, aviation fuel, diesel, cetane number; natural gas, water gas.

Electrochemistry:
Conductance of electrolytic solutions, specific conductance, equivalent conductance, molar conductance
and ion conductance; effect of temperature and concentration; basic ideas and inter ionic attractions; transport numbers and hydration ions, electrochemicals cells; cell emf and its thermodynamic significance; single electrode potentials and its applications; hydrogen half cell and calomel half cell; conductometric titrations: SA vs SB & SA vs WB; precipitation titration KCl vs AgNO₃.

**Recommended reference Books:**

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rakshit P. C.</td>
<td>Physical Chemistry</td>
</tr>
<tr>
<td>Dutta R. L.</td>
<td>Inorganic Chemistry</td>
</tr>
<tr>
<td>Levine</td>
<td>Physical Chemistry</td>
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<tr>
<td>Finar I. L.</td>
<td>Organic Chemistry</td>
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<tr>
<td>Sarkar Samir</td>
<td>Fuels and Combustion</td>
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<tr>
<td>Carey</td>
<td>Organic Chemistry</td>
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<tr>
<td>Glasston Samuel</td>
<td>Text Book of Physical Chemistry</td>
</tr>
<tr>
<td>Lee J. D.</td>
<td>Concise Inorganic Chemistry</td>
</tr>
<tr>
<td>Ghosh P.</td>
<td>Polymer Science and Technology of Plastics &amp; Rubbers</td>
</tr>
<tr>
<td>Gopalanan-</td>
<td>Applied Chemistry for Engineers,Vikas</td>
</tr>
<tr>
<td>Gopalan-</td>
<td>Concise coordination Chemistry,Vikas</td>
</tr>
<tr>
<td>Sharma</td>
<td>Physical Chemistry,Vikas</td>
</tr>
<tr>
<td>Raman</td>
<td>Physical Chemistry,Vikas</td>
</tr>
<tr>
<td>Rao Y.V.C.</td>
<td>Chemical Engineering Thermodynamics, Univs Press</td>
</tr>
<tr>
<td>Moore W.J.</td>
<td>Physical Chemistry, Orient Longman</td>
</tr>
<tr>
<td>Satyanarayan Rao V.</td>
<td>Polarography &amp; Allied Techniques, Universities Press</td>
</tr>
<tr>
<td>Mann F.G.</td>
<td>Practical Organic Chemistry, Orient Longman</td>
</tr>
<tr>
<td>Sathyaranarana, D.N.</td>
<td>Electronic Absorptions Spectroscopy &amp; Related Techniques, Univs Press</td>
</tr>
<tr>
<td>Negi A.S.</td>
<td>A Textbook of Physical Chemistry, New Age International</td>
</tr>
<tr>
<td>Chakraborthy D.K.</td>
<td>Solid State Chemistry, New Age International</td>
</tr>
<tr>
<td>Singh S.K</td>
<td>Fundamentals of Engg Chemistry, New Age Int.</td>
</tr>
<tr>
<td>Gupta M.C.</td>
<td>Atomic &amp; Molecular Spectroscopy, New Age</td>
</tr>
<tr>
<td>Gowarikar V.R.</td>
<td>Polymer Science, New Age</td>
</tr>
<tr>
<td>Misra G.S.</td>
<td>Introductory Polymer Chemistry, New Age</td>
</tr>
<tr>
<td>Mukherji S.M.</td>
<td>Organic Chemistry Vol.1,2,3, New Age</td>
</tr>
<tr>
<td>Nasipuri D.</td>
<td>Stereochemistry of Organic Compounds, New Age</td>
</tr>
<tr>
<td>Kalsi P.S.</td>
<td>Spectroscopy of Organic Compounds, New Age</td>
</tr>
<tr>
<td>Kalsi P.S.</td>
<td>Organic Reactions &amp; their Mechanism, New Age</td>
</tr>
<tr>
<td>Chakraborthy D.K.</td>
<td>Absorption &amp; Catalysis by Solids, New Age</td>
</tr>
<tr>
<td>Kalidas C.</td>
<td>Chemical Kinetic Methods, New Age</td>
</tr>
<tr>
<td>Reddy K.H.</td>
<td>Bioinorganic Chemistry</td>
</tr>
</tbody>
</table>
Syllabus of First Year B.E/B.Tech

ENGINEERING CHEMISTRY LABORATORY

Code: CH 291(Second Semester)
Contacts: 3/2 P
Credits: 1

Suggested List of Experiments

1. Acid–base titration (estimation of commercial caustic soda)
2. Redox titration (estimation of iron using permanganometry)
3. Complexometric titration (estimation of hardness of water using EDTA titration)
4. Preparation and analysis of a metal complex (for example thiourea / copper sulfate or nickel chloride / ammonia complexes)
5. Chemical Kinetics (determination of relative rates of reaction of iodide with $\text{H}_2\text{O}_2$ at room temperature (clock reaction)
6. Heterogeneous equilibrium (determination of partition coefficient of acetic acid between n-butanol and water)
7. Photochemical oxidation-reduction (study of photochemical reduction of ferric salt)
8. Viscosity of solutions (determination of percentage composition of sugar solution from viscosity)
9. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution
10. pH-metric titration for determination of strength of a given HCl solution against a standard NaOH solution.

COMPUTING LAB

Code: CS 291(Second Semester)
Contacts: 3 P
Credits: 2

Exercises should include but not limited to:

1. DOS System commands and Editors (Preliminaries)
2. UNIX system commands and vi (Preliminaries)
3. Simple Programs: simple and compound interest. To check whether a given number is a palindrome or not, evaluate summation series, factorial of a number, generate Pascal’s triangle, find roots of a quadratic equation
4. Programs to demonstrate control structure: text processing, use of break and continue, etc.
5. Programs involving functions and recursion
6. Programs involving the use of arrays with subscripts and pointers
7. Programs using structures and files.

BASIC ELECTRONICS ENGINEERING LAB

Code: EC 191(First Semester)
Contacts: 3P
Credits: 2

1. Familiarization with Electronic components such as Resistors, Capacitors, Diodes, Transistors etc.
2. Familiarization with electrical devices and measuring equipment like DC power supply, Multimeter, Trainer kit etc.
3. Familiarization with measuring and testing equipment like CRO, Signal generator.
4. Study on V-I characteristics of Junction Diode.
5. Study on V-I characteristics of Zener Diode.
7. Study on characteristics of Field Effect Transistors.
10. Characteristics Curve for common base emmitor & common collector transducers
11. Study of working of data acquisition system.
MATHEMATICS

Code: M 101 (First Semester)
Contacts: 3L + 1 T = 4
Credits: 4

Infinite Series:
Sequence, Convergence and Divergence of Infinite series – and typical examples of convergent and divergent series.

- Comparison test (statement only) and related problems 1L
- Ratio test (statement only) and related problems 1L
- Cauchy’s root test (statement only) and related problems 1L
- Alternating series, Leibnitz’s theorem (without proof), absolute convergence and related problems 2L

Calculus of Functions of One Variable:
Review of limit and continuity and differentiability.

- Successive differentiation, Leibnitz’s theorem (without proof but with problems of the type of recurrence relations in derivatives of different orders and also to find \( (y_n)_0 \)) 3L
- Rolle’s theorem (statement only); Mean Value Theorems—Lagrange & Cauchy (statement only), Taylor’s theorem (without proof and problems in respect of direct use and applications of the theorem only), Expansions of functions by Taylor and Maclaurin series. Maclaurin’s expansion in infinite series of the functions: log (1+x), \( e^x \), sinx, cosx, \((a+x)^n\) , n being a negative integer or a fraction L’Hospital’s Rule (statement only) and related problems 6L

Integration of \( \int_0^{\pi/2} \cos^m x \, dx, \int_0^{\pi/2} \sin^m x \, dx, \int_0^{\pi/2} \cos^n x \sin^m x \, dx, \int_0^{\pi/2} \cos \, m x \sin \, n x \, dx, m, n \) are positive integers.

Application:
Rectification 1L

Three Dimensional Geometry (Cartesian):
Direction Cosine, Direction Ratio; Equation of a Plane (general form, normal form and intercept form); Equation of a Straight Line passing through one point and two points; Pair of intersecting planes representing a straight line.

Elementary ideas of surfaces like sphere, Right Circular Cone and Right Circular Cylinder (through Geometrical configuration) and equations in standard forms.

Calculus of Functions of Several Variables:
Introduction of Function of several variables and examples. Knowledge of limit and continuity.

Partial derivative & related problems. Homogeneous Functions and Euler’s Theorem (statement only) & Problems upto 3 variables.
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Syllabus of First Year B.E/B.Tech
(ME, CE, BT, FT, CHE, PE, IT, CSE, BME, Marine, LT, TT, Ceramic, AUE) from 2007

Chain rules and related problems. 4L
Differentiation of implicit functions & related problems.
Total differentials and related problems.

Maxima, minima and saddle points – definition, condition of extrema & problems for two variables. 2L
Lagrange’s multiplier method – problems related to two variables only.

Line Integral, Double Integrals, Triple Integral – Discussion w.r.t. different types of limits and problems; Moment of Inertia, Centre of Gravity. 3L

Jacobian – Definition and related problems for two variables. 2L
Applications to areas and volumes, surface area of revolution.

Vector Calculus:
Scalar and Vector fields – Definition and Terminologies; Products: dot, cross, box, vector triple product. 2L

Gradient, directional derivative, divergence, curl. (with problems). 2L

Tangent planes and normals and related problems. 1L

Statements of
Green’s theorem, Divergence theorem, Stokes’ theorem with applications. 4L

Total 48L

References / Books:

4. Integral Calculus, Das & Mukherjee
5. An Introduction to Real Analysis- S.K.Mapa
6. Higher Algebra – Lahiri & Roy
7. Higher Algebra, Ghosh & Chakraborty
8. Higher Algebra, Bernard & Child
9. Differential Calculus, Maity & Ghosh
10. Integral Calculus, Maity & Ghosh
11. Engineering Mathematics, Prof.T.Majumdar
12. An Introduction to Analysis, Mallick & Arora
13. Undergraduate Engg Math- Jana, Vikas
14. Engineering Math Vol 1,2,3- Lakshami, Vikas
15. Calculus of One Variable – Pandey G.S. (New Age International)
17. Integral Calculus – Dhami H.S. (New Age International)

MATHEMATICS
Code: M 201(Second Semester)
Contacts: 3L + 1T = 4
Credits: 4
Linear Algebra:
Introduction to the idea of a matrix; equality of matrices; special matrices. Algebraic operations of matrices: commutative property, associative property and distributive property. Transpose of a matrix (properties \((A')' = A\), \((A+B)' = A' + B'\), \((cA)' = cA\), \((AB)' = B'A'\) to be stated (without proof) and verified by simple examples). Symmetric and Skew symmetric matrices.

Properties of determinant (statement only); minor, co-factors and Laplace expansion of determinant; Cramer's rule and its application in solving system of linear equations of three variables.

Singular and non-singular matrices; adjoint matrix; inverse of a matrix \((AB)^{-1} = B^{-1}A^{-1}\) to be stated and verified by example. Elementary row and column operations on matrices; definition of rank of a matrix; determination of rank of a matrix using definition.

System of Linear Equations:
Consistency and Inconsistency. Gauss elimination process for solving a system of linear equations in three unknowns.

Vector Space:
Basic idea of set, mapping, Binary Composition and Scalar field. Definition of vector space over the field of real numbers; Examples of vector space; Definition of sub-space of a vector space and a criterion for a sub-space; Definition of Linear combination, Linear independence and linear dependence of vectors with examples. Definition of basis and dimension of vector space; Definition of Linear transformation: Definition of kernel and images of a Linear transformation; Kernel and Images of a Linear Transformation forming sub-spaces; Nullity and Rank of a Linear Transformation; Dim Ker T + Dim Im T = Dim V; Definition of Inner product space; Norm of a vector; Orthogonal and Ortho-normal set of vectors.

Eigenvalues and Eigenvectors of a matrix; Eigenvalues of a Real Symmetric Matrix; Necessary and Sufficient Condition of diagonalization of matrices (statement only); Diagonalization of a matrix (problems restricted to 2 x 2 matrix).

Ordinary Differential Equations (ODE):
Definition of order and degree of ODE; ODE of the first order: Exact equations; Definition and use of integrating factor; Linear equation and Bernoulli's equation. ODE of first order and higher degree, simple problems.


Verification of Legendre function \((P_n(x))\) and Bessel function \((J_n(x))\) as the solutions of Legendre and Bessel equations respectively. Graphical representations of these solutions.

Laplace Transform (LT):
Definition; Existence of LT; LT of elementary functions; First and second shifting properties; Change of scale property; LT of derivative of functions. LT of \((t^n f(t))\), LT of \(f(t) / t^n\), LT of periodic function and unit step function. Convolution theorem (statement only).

Inverse LT; Solution of ODE's (with constant coefficients) using LT.

Numerical Methods:
Error: Absolute, Percentage, Relative errors. Truncation error, Round off error.
Difference operator (forward, backward, central, shift and average operators); Different table, Propagation of Error. Definition of Interpolation and Extra-polation. Newton's forward and backward interpolation formula; Lagrange interpolation formula and corresponding error formulae (statement only).
Numerical Differentiation: Using Newton’s forward and backward interpolation formula.
Numerical Integration: Trapezoidal rule and Simpson's 1/3rd rule and corresponding error terms (statement only).

Recommended Reference Books:

Kreyszig E. Advance Engineering Mathematics
Krishnamurthy V., Mainra V.P. and Arora J.L. An Introduction to Linear Algebra
Boyce and Diprima Elementary Differential Equations and Boundary Value Problems
Grewal B.S. Engineering Mathematics
S.K.Rathor Higher Engineering Mathematics II.EPH
Lakshmninarayn Engg Math,Vikas
Jana UG Engg. Mathematics,Vikas
Chakraborty A. Elements of Ord.Diff. Equations,New Age
Bhattacharya P.B. First Course in Linear Algebra,New Age
Gupta S.K. Numerical Methods for Engineers, New Age
Jain M.K. Numerical Solutions of Differential Equations
Balachandra Rao Numerical Methods with Programs in Basic, Fortran Pascal and C++
Rao S.B. Differential Equations with Applications & Programs, Universities Press

Total 48L
West Bengal University of Technology  
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(ME, CE, BT, FT, CHE, PE, IT, CSE, BME, Marine, LT, TT, Ceramic, AUE) from 2007

Murray D.A.  
Introductory Course in Differential Equations

Bagchi S.C.  
First Course on Representation Theory & Linear Lie Groups, Universities Press

Arumugam  
Engineering mathematics, I, II & III, Scitech

ME 101 : Mechanical Sciences (First Semester)  
Contact : 3L + 1T = 4  
Credit : 4  
Assuming 12 weeks available,  
No. of periods : 12 x 4 = 48

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Topics to be covered</th>
<th>Assigned Lectures &amp; Tutorials</th>
<th>Recommended Text Books</th>
</tr>
</thead>
</table>

25
|   | Syllabus of First Year B.E/B.Tech  
|---|-----------------------------------------------------------------------------------
|   | **(ME,CE,BT,FT,CHE,PE,IT,CSE,BME,Marine,LT,TT,Ceramic,AUE )from 2007**            |
|   | **West Bengal University of Technology**                                        |
|   | **BF-142, Salt Lake City, Kolkata-700064**                                      |
| 1. | Introduction to Statics: Fundamental idealization : Particle and Rigid body concept; Types of forces (collinear, concurrent, parallel, concentrated, distributed), Vector and scalar quantities, Transmissibility of a force (sliding vector); Lame’s Theorem |
| 2. | Introduction to Vector Algebra, Vector Operations, Parallelogram law, Free vector, Bound Vector; representation of Forces and Moments in terms of i,j,k; Cross product and Dot product and their applications. |
| 3. | Two and three dimensional force systems; Moment and Couple, Varignon’s theorem, Resultants, Free body concept. Resolution of a coplanar force by its equivalent Force-couple system. |
| 5. | Concept of Friction; Laws of Coulomb friction, Angle of Repose |
| 6. | Distributed Force : Centroid and Centre of Gravity |
| 7. | Moments of inertia of plane figures : M.I. of plane figures : MI of plane figure with respect to an axis in its plane; MI of plane figure with respect to an axis perpendicular to the plane of the figure, Parallel axis theorem; Mass moment of inertia of symmetrical bodies, e.g. cylinder, sphere, rod. |
| 8. | Principle of virtual work with simple application |
| 2L | Engineering Mechanics, Vol-I (Statics) by Meriam & Kraige Chap. – 1 & 2 |
| | Prob. 22,23,26,31,35,43,45 |
| 3L | Engineering Mechanics, Vol-I (Statics) by Meriam & Kraige Chap – 2  
| | Prob. 7,13,17,20,32,37,45,  
| | 51,58,60,63,66,68,83,91,92, 94,  
| | 97, 102 |
| 2L + 1T | - DO – [Chap – 3]  
| | Prob. 4,8,10,21,26,28,63,65,71,80 |
| 2L + 1T | - DO – [Chap – 6]  
| | Prob. 3,5,9,15 |
| 2L | - DO – [Chap – 5]  
| | Prob. 6,15,18,39,41,42,51,  
| | 53,72 |
| 3L + 1T | - DO – [Chap Appendix A & B]  
| | Prob. A/1, A/12, A/21, A/29,  
| | A/33 |
| 2L + 1T | - DO – [Chap – 7]  
| | Prob. 1, 2, 3 |
| 9. | Concept of simple stresses and strains: Normal stress, Shear stress, Bearing stress, Normal strain, Shearing strain, Hooke’s law, poisson’s ratio, Examples |
| 11. | Concept of thermal stress |
| 12. | Introduction to Dynamics : Kinematics and Kinetics; Rectilinear motion of particles; determination of position velocity and acceleration – under uniform rectilinear motion (uniform and nonuniform accelerated rectilinear motion), Relative motion, construction of x-t, v-t and a-t graphs (simple problems) |
| 13. | Plane curvilinear motion of particles : Rectangular components (Projectile motion), Normal and Tangential components, Radial and Transverse components, simple problems |
| 14. | Plane kinematics of Rigid bodies : Translation and Rotation |
| 15. | Kinetics of particles : Rectilinear motion of particles; Plane kinetics of Rigid bodies : Rectilinear motion |
| 16. | Equation of motion, D.Alembert’s principle |
| 17. | Principle of work and energy applied to particle and rigid bodies, Principle of conservation of energy, Power and efficiency, simple examples |
| 2L + 1T | Elements of Strength of Materials by Timo & Young, ** [Chap – 1] |
| 2L | Prob. Art 1.2, 3,4,5,8,9,10 and problem sheet. Art 1.3, Prob. 3,5,7 |
| 1L | DO – [Chap – 1] Problem Sheet |
| 2L + 1T | Engineering Mechanics (Vol-II) Dynamics by Mariam & Kraige [Chap – 2] |
| 2L + 1T | Prob. 2,4,8,12,23,24,174,194 and Problem sheet |
| 2L + 1T | DO – [Chap – 2] |
| 2L + 1T | Prob. 57,72,83,98,123,126 and Problem sheet |
| 2L + 1T | DO – [Chap – 5] |
| 2L + 1T | Prob. 1,3,6,18 and Problem sheet |
**Strength of Materials by S. Ramamruthan may be consulted for problems.**

The students should attempt solving problems given in the Question Bank (Problem Sheet) besides the problems as indicated against each topic of the Recommended Books.

References:
Mechanical Science 1 (TMH WBUT Series), P.K.Nag, S.Pati & T.K.Jana, TMH
Fundamentals of Mechanical Sciences, Bhattacharya & Mukhopadhyay, Pearson Education

**ME 201 : Mechanical Sciences (Second Semester)**
Contact : 3L
Credit : 3
Assuming 14 weeks available,
No. of periods : 14 x 3 = 42

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Topics to be covered</th>
<th>Assigned Lectures</th>
<th>Recommended Text Book</th>
</tr>
</thead>
</table>

36L + 12T = 48 Periods
<p>| | | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Introduction to Thermodynamics, Concepts of systems, control volume, state, properties, equilibrium, quasi-static process, reversible &amp; irreversible process, cycles.</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>Zeroeth Law and Temperature, Ideal Gas</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Heat and Work</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Real gases, Equations of State, Processes of Ideal Gases. Law of Corresponding States</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>(i) 1st Law of Thermodynamics for closed &amp; open systems (ii) Non Flow Energy Equation (iii) Steady State, Steady Flow Energy Equation</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>2nd Law of Thermodynamics – Statements, Equivalence of two statements, Definition of Heat Engines, Heat pumps, Refrigerators</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>Carnot Cycle; Carnot efficiency, Concept of absolute temperature, Thermodynamic scale of temperature</td>
<td>2</td>
</tr>
<tr>
<td>Chapter</td>
<td>Topic</td>
<td>Problems</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>8</td>
<td>Clausius inequality, Entropy and irreversibility.</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Properties of Pure Substances – Use of Steam Tables and Mollier Charts</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>Air Standard cycles – Otto and Diesel cycle and their efficiencies</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>Steam Power Cycle – Rakine cycle, p-v &amp; T-S plots, Rankine efficiency</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>Vapur compression refrigeration cycle</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total** = 26
### B. FLUID MECHANICS

1. Properties & Classification of Fluids – ideal & real fluids, Newton’s law of viscosity, Newtonian & Non Newtonian Fluids, Compressible & Incompressible fluids
   - Art: 1.1, 1.2, 1.3, 1.4, 1.4.1 to 1.4.9
   - Exercises: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6
   - Solved Examples (relevant)

2. Fluid Statics: Pressure at a point, Pascal’s law.

   - Uniform & non-uniform flow, Stream line, path line, streak line. Continuity equation.
   - Art: 3.1, 3.2, 3.3, 3.3.1 to 3.3.3, 4.1, 4.2, 4.2.1
   - Exercises: 3.1, 3.2, 3.3, 3.4, 3.5
   - Solved Examples 3.1, 3.2, 3.3, 3.4, 3.5

4. Dynamics of ideal fluids: Bernoulli’s equation, total head, velocity head, pressure head. Application of Bernoulli’s equation.
   - Art: 4.5, 4.6, 4.6.1, 4.6.2
   - Exercises: 4.1
   - Solved Examples: 4.9, 4.10, 4.11

   - Art: 5.7, 5.8, 5.8.1
   - Exercises: 5.1, 5.11 to 5.15
   - Solved Examples: 5.7, 5.8, 5.11, 5.12

**Total = 16**

The students should attempt solving the problems as indicated against each topic of the Recommended Books.

Reference:
- Mechanical Science 2 (TMH WBUT Series), P.K.Nag, S.Pati & T.K.Jana, TMH
- Fundamentals of Mechanical Sciences, Bhattacharya & Mukhopadhyay, Pearson Education.

**ME 192 : WORKSHOP PRACTICAL (First Semester)**
- Contacts: 3P
- Credits: 2
- Assuming 12 weeks: 12 x 3 = 36 Periods

1. Carpentry (Wood Working)
   - Timber, Seasoning and Preservation, Plywood and Plyboards, Carpentry Tools, Engineering applications.
   - Different Joints
2. Metal Joining
AC and DC welding, electrodes, constituents and functions of electrodes. Welding positions. Types of weld joint. Common welding defects such as cracks, slag inclusion and porosity.

3. Bench work and Fitting
Tools for laying out, chisels, files, hammers, hand hacksaw, their specifications and uses.

4. Jobs to be made in the Workshop

Group A
T-Lap joints and Bridle joint (Carpentry Shop) 12P

Group B
1a. Gas Welding practice on mild steel flat/sheet upto 3mm thick
1b. Lap joint by Gas Welding (upto 3mm thick)
1c. Manual Metal Arc Welding practice (upto 5mm thick) 15P
1d. Square butt joint by MMA Welding
1e. Lap joint by MMA Welding

Group C
Laying out (bench work); Sawing and Finishing by Filing. 9P

# Before practice, background lectures will be delivered on the topics. Tool specifications and their materials will be described. Brief reports on the work done will be submitted by the students and evaluation will be made on the basis of examination of the report and viva, conducted by the teachers.

Recommended Books
6. S.Crawford “Basic Engineering Processes” Hodder & Stoughton

ME 292 : WORKSHOP PRACTICAL(Second Semester)
Contacts : 3P
Credits : 2
Assuming 14 weeks : 14 x 3 = 42 Periods
West Bengal University of Technology  
BF-142, Salt Lake City, Kolkata-700064  
Syllabus of First Year B.E/B.Tech  
(ME,CE,BT,FT,CHE,PE,IT,CSE,BME,Marine,LT,TT,Ceramic,AUE )from 2007

1. Metal Cutting
Introduction to machining and common machining operations. Cutting tool materials, geometry of cutting tool, cutting fluid. Definition of machine tools, specification and block diagram of lathe, shaper, milling, drilling machine and grinder. Common lathe operations such as turning, facing and chamfering and parting. Difference between drilling and boring. Use of measuring instruments like micrometer / vernier caliper.

2. Tin Smithy – Surface development, 
Shearing and Bending of sheets, Making simple products by Tin Smithy practice.

3. Brazing – Basic Process of Brazing

4. Jobs to be made in the Workshop

Group A
1) Jobs on lathe with turning, facing, chamfering and parting operations 15P
2) Job on shaper and milling machine for finishing two sides of a job 12P
3) Drilling of holes of size 5 and 12 mm diameters on the jobs / External threads making by dies, Tap size drill hole/ hand tapping operations 3P

Group B
Demonstration of brazing 3P

Group C
Tin Smithy - making simple products on sheet metal 9P

42P

Before practice, background lectures will be delivered. Brief Reports on the work done will be submitted by the student. Evaluation will be done on the basis of reports and viva-voce examinations conducted by the teachers.

Recommended Books
6. S.Crawford “Basic Engineering Processes” Hodder & Stoughton

ME 101 : Mechanical Sciences
Contact : 3L + 1T = 4
Credit : 4

Introduction to Statics: Fundamental idealization: Particle and Rigid body concept; Types of forces (collinear, concurrent, parallel, concentrated, distributed), Vector and scalar quantities, Transmissibility of a force (sliding vector); Lami’s Theorem.
Introduction to Vector Algebra, Vector Operations, Parallelogram law, Free vector, Bound Vector; representation of Forces and Moments in terms of i,j,k; Cross product and Dot product and their applications.


Concept of Friction; Laws of Coulomb friction, Angle of Repose.

Distributed Force: Centroid and Centre of Gravity, Moments of inertia of plane figures : M.I. of plane figures : MI of plane figure with respect to an axis in its plane; MI of plane figure with respect to an axis perpendicular to the plane of the figure, Parallel axis theorem; Mass moment of inertia of symmetrical bodies, e.g. cylinder, sphere, rod.

Principle of virtual work with simple application.

Concept of simple stresses and strains: Normal stress, Shear stress, Bearing stress, Normal strain, Shearing strain, Hooke’s law, Poisson’s ratio, Examples.


Introduction to Dynamics: Kinematics and Kinetics; Rectilinear motion of particles; determination of position velocity and acceleration – under uniform rectilinear motion (uniform and nonuniform accelerated rectilinear motion), Relative motion, construction of x-t, v-t and a-t graphs (simple problems).

Plane curvilinear motion of particles: Rectangular components (Projectile motion), Normal and Tangential components, Radial and Transverse components, simple problems.

Plane kinematics of Rigid bodies: Translation and Rotation.


Principle of work and energy applied to particle and rigid bodies, Principle of conservation of energy, Power and efficiency, simple examples.

Principle of Linear Impulse and Momentum .

Books Recommended

2. Elements of Strength of Materials by Timo Shenko & Young
3. Strength of Materials by S. Ramamruthan
4. Mechanics for Engineering by Beer, F.P. and Johnston
5. Mechanics of Engineers (Statics) by Ferdinand P. Beer & E. Russel Johnston Jr.
9. Engineering Mechanics by Timo Shenko & Young

ME 201 : Mechanical Sciences

Contact : 3L
Credit : 3

A. THERMODYNAMICS

Introduction to Thermodynamics, Concepts of systems, control volume, state, properties, equilibrium, quasi-static process, reversible & irreversible process, cycles.

Zeroeth Law and Temperature, Ideal Gas.

Heat and Work.

Real gases, Equations of State, Processes of Ideal Gases. Law of Corresponding States.


Carnot Cycle; Carnot efficiency, Concept of absolute temperature, Thermodynamic scale of temperature.

Clausius inequality, Entropy and irreversibility.

Properties of Pure Substances – Use of Steam Tables and Mollier Charts.

Air Standard cycles – Otto and Diesel cycle and their efficiencies.

Steam Power Cycle – Rakine cycle, p-v & T-S plots, Rankine efficiency.

Vapour compression refrigeration cycle.

B. FLUID MECHANICS

Properties & Classification of Fluids – ideal & real fluids, Newton’s law of viscosity, Newtonian and non-Newtonian fluids, Compressible and Incompressible fluids.

Fluid Statics: Pressure at a point, Pascal’s law.


Dynamics of ideal fluids: Bernoulli’s equation, total head, velocity head, pressure head. Application of Bernoulli’s equation.

Measurement of flow rate: Venturimeter, pitot tube, orificemeter.

Books Recommended

2. Thermodynamics by C P Arora.

ME 191 : ENGINEERING GRAPHICS

Contacts : 3P
Credits : 2
Assuming 12 weeks : 12 x 3 = 36 Periods

1. LINES, LETTERING, DIMENSIONING, COPYING FIG. 6(1L)

2. SCALES 6(2L)
Plain scales, Diagonal scales, Comparative scales, Vernier scales

3. GEOMETRICAL CONSTRUCTION AND CURVES 6(2L)
Dividing of lines and angles in equal sectors, Construction of polygons, Polygons inscribed in circles, Parabola, Hyparabola, Ellipse, Cycloid, Involute, Archemedian spiral

4. PROJECTION OF POINTS, LINES, SURFACES 9(3L)
Orthographic Projection – First angle and third angle projection
More no. of problems should be practiced in first angle projection.
Projection of lines inclined to the planes

Periods
[Inclusive Lecture]
Projection of surfaces
Pentagon, Hexagon

5. PROJECTION OF SOLIDS 9(2L)
Cube, Pyramid, Prism, Cylinder, Cone, Frustums

Home Assignments to be given to the student to supplement the sessional work. Students should attempt to solve the problems given in the question bank (Problem Sheet). Evaluation will be made on the basis of drawing sheets submitted and viva-voce examination conducted by the teacher.

Recommended Books


ME 291 : ENGINEERING GRAPHICS
Contacts : 3P
Credits : 2
Assuming 14 weeks : 14 x 3 = 42 Periods

1. ISOMETRIC VIEW AND ISOMETRIC PROJECTION 6(2L)
(Prism, Pyramid, Cylinder, Cone and examples of simple solid objects / models).

2. SECTIONAL VIEWS OF SOLIDS, TRUE SHAPE OF A SECTION 6(1L)
Home assignments will be given.

3. RIVET HEADS, RIVETED JOINTS 3(1L)
(Rivet heads, types, lap-joint, butt joint - single / double cover)

4. THREADS, NUT-BOLT 6(2L)
(BSW and Metric threads, hexagonal and square headed bolts/nuts.)

5. DEVELOPMENT OF SURFACES 3(1L)
(Cube, Prism, Cylinder, Truncated Cone)
Home assignment will be given to the student.

6. INTERPENETRATION OF SURFACES 6(2L)
(Intersecting cylinders, Intersection of Cone and cylinder, Intersection of two prisms)

7. MACHINE PARTS 6P
West Bengal University of Technology  
BF-142, Salt Lake City, Kolkata-700064  
Syllabus of First Year B.E/B.Tech  
(ME,CE,BT,FT,CHE,PE,IT,CSE,BME,Marine,LT,TT,Ceramic,AUE )from 2007

8. COMPUTER AIDED DRAFTING  
(AutoCAD)  
Introduction : Cartesian and Polar Co-ordinate system, Absolute  
And Relative Co-ordinates; Basic editing Commands : Line, Point,  
Trace, Rectangle, Polygon, Circle, Arc, Ellipse, Polyline; Basic  
editing Commands : Basic Object Selection Methods, Window and  
Crossing Window, Erase, Move, Copy, Offset, Fillet, Chamfer, Trim,  
Extend, Mirror ; Display Commands : Zoom, Pan, Redraw, Regenerate;  
Simple dimensioning and text, Simple exercises.

Sessional work should be completed in the class. Problems sheet will be provided.  
Home assignments will be given. Evaluation will be made on the basis of sessional work and viva-voce examination.

Recommended Books :

1. Engineering Graphics (TMH WBUT Series), Jolhe, TMH  

ME 192  :  WORKSHOP PRACTICAL  
Contacts  :  3P  
Credits  :  2  
Assuming 12 weeks : 12 x 3 = 36 Periods

1. Carpentry (Wood Working)  
Timber, Seasoning and Preservation, Plywood and Plyboards, Carpentry Tools, Engineering applications.  
Different Joints

2. Metal Joining  
Definitions of welding, brazing and soldering processes, and their applications. Oxy-acetylene gas welding  
process, equipment and techniques. Types of flames and their applications. Manual metal arc welding  
technique and equipment.  
AC and DC welding, electrodes, constituents and functions of electrodes. Welding positions. Types of weld  
joint. Common welding defects such as cracks, slag inclusion and porosity.

3. Bench work and Fitting  
Tools for laying out, chisels, files, hammers, hand hacksaw, their specifications and uses.
4. Jobs to be made in the Workshop

Group A
T-Lap joints and Bridle joint (Carpentry Shop) 12P

Group B
1a. Gas Welding practice on mild steel flat/sheet upto 3mm thick
1b. Lap joint by Gas Welding (upto 3mm thick)
1c. Manual Metal Arc Welding practice (upto 5mm thick) 15P
1d. Square butt joint by MMA Welding
1e. Lap joint by MMA Welding

Group C
Laying out (bench work); Sawing and Finishing by Filing. 9P

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36P

Before practice, background lectures will be delivered on the topics. Tool specifications and their materials will be described. Brief reports on the work done will be submitted by the students and evaluation will be made on the basis of examination of the report and viva, conducted by the teachers.

Recommended Books
6. S.Crawford “Basic Engineering Processes” Hodder & Stoughton

ME 292 : WORKSHOP PRACTICAL
Contacts : 3P
Credits : 2
Assuming 14 weeks : 14 x 3 = 42 Periods

1. Metal Cutting

Introduction to machining and common machining operations. Cutting tool materials, geometry of cutting tool, cutting fluid. Definition of machine tools, specification and block diagram of lathe, shaper, milling, drilling machine and grinder. Common lathe operations such as turning, facing and chamfering and parting. Difference between drilling and boring. Use of measuring instruments like micrometer/ vernier caliper.

2. Tin Smithy – Surface development, Shearing and Bending of sheets, Making simple products by Tin Smithy practice.

3. Brazing – Basic Process of Brazing
4. Jobs to be made in the Workshop

**Group A**
1) Jobs on lathe with turning, facing, chamfering and parting operations 15P
2) Job on shaper and milling machine for finishing two sides of a job 12P
3) Drilling of holes of size 5 and 12 mm diameters on the jobs / External threads making by dies, Tap size drill hole/ hand tapping operations 3P

**Group B**
Demonstration of brazing 3P

**Group C**
Tin Smithy - making simple products on sheet metal 9P

**Before practice, background lectures will be delivered. Brief Reports on the work done will be submitted by the student. Evaluation will be done on the basis of reports and viva-voce examinations conducted by the teachers.**

**Recommended Books**
12. S.Crawford “Basic Engineering Processes” Hodder & Stoughton