Mahindra École Centrale

Bahadurpally, Hyderabad 500043

ACADEMIC REGULATIONS FOR FOUR-YEAR UNDERGRADUATE DEGREE PROGRAMS

(Applicable to students joining in the Academic Year 2018-19 and onwards)

1) COURSES OF STUDY AND AWARD OF B. TECH. DEGREE

The Institute awards B-Tech degree in the following four four-year undergraduate (UG) programs:

S. No.	**B. Tech. Degree Program**
1	Civil Engineering
2	**Computer Science and Engineering**
3	Electrical Engineering
4	Mechanical Engineering

a) A student who has passed all the individual courses in the corresponding curriculum is entitled to be awarded the Bachelor of Technology (B. Tech.) degree provided he complies with the subsequent rules.

b) A student cannot be awarded the Bachelor of Technology (B. Tech.) degree with a Cumulative Performance Index (CPI) strictly less than 4.0.

c) A student must not earn not less than 165 credits (see b)) for the award of the B-Tech. degree.

d) A student after securing admission into one of the four B. Tech. degree programs must pursue the course of study for a duration of 8 semesters (or 4 years). Each semester shall have a minimum of 90 days of instruction including Examinations, as per AICTE norms. The B. Tech. degree program has to be completed within at most 8 consecutive years from the date of admission to the program.

e) The first two years of the B. Tech. degree program are termed as the Core Program and the last two as the Professional Program. The maximum duration to complete all academic requirements of either the Core or the Professional Program is four consecutive years from the year of the registration into the corresponding program; students who fail to do so shall forfeit their seats in the B. Tech. course.

f) Elective courses are available in the professional program. Students in consultation with faculty members may propose their choices from among the offered elective courses; the proposal needs approval by a departmental committee nominated by the Dean of Academics.

g) Cancellation of Admission: All students admitted provisionally or otherwise to any program shall submit copies of their mark sheets, provisional certificates, etc. of the qualifying examination and other documents by the last date specified for the purpose in the Academic Calendar. MEC reserves the right to cancel the admission at any later time if it is found that the student had supplied false information or suppressed relevant information while seeking admission.

h) Any matter relating to the award of the B. Tech. degree that is not covered in the existing regulations is to be decided upon by a standing committee (nominated by the Director) composed of faculty members and chaired by the Dean Academics.

2) CREDITS AND ACADEMIC PERFORMANCE

a) Credit representation: Each lecture hour contributes to *one credit*, while one hour of tutorial or practical contributes toward *half a credit*.

No. of lecture hours per week	No. of tutorial hours per week	No. of practical hours per week	Total credits
2	1	2	2*1 + 1*0.5 + 2*0.5 = 3.5

b) Grades and Grade Points: At the end of the semester, a student is awarded a letter grade (based on a prescribed process) in each of his courses by the concerned Instructor-in-Charge taking into account his performance in the various examinations, quizzes, assignments, laboratory work (if any), etc., besides regularity of attendance in classes. The grades are submitted in the undergraduate office within the prescribed time limit of 72 hours after the end semester examination. There are eight letter grades: A, B^+, B, C^+, C, D, E and F. The letter grades and their numerical equivalents on a 10-point scale (called Grade Points) are as follows. The letter grades: A, B^+, B, C^+, C and D are considered as passing grades; students who are awarded any of these grades in a course, acquire the corresponding number of credits allotted to the course. The letter grades: E and F are considered as failing grades; students who are awarded any of these grades in a course, do not acquire the corresponding number of credits allotted to the course; such students have to take up a supplementary examination to get a passing grade.

Letter Grades	A	B^+	B	C^+	C	D	E	F
Grade Points	10	9	8	7	6	4	2	0

In addition to the letter grades mentioned above, there is an additional letter grade, viz., 'I' which stands for Incomplete. A student may be awarded the grade 'I' (Incomplete) in a course if he has missed, for a genuine reason such as a medical reason, as decided by the instructor in charge or the Dean Academics, , a part of the course requirement but has

done satisfactorily in all other parts.. An 'I' grade must, however, be converted by the Instructor-in Charge into an appropriate letter grade and communicated to the undergraduate office by the last date specified in the academic calendar. Any outstanding 'I' grade after this date shall be automatically converted into the 'F' grade.

c) Project Grades: Project grades shall be submitted by the last date specified for the submission of grades. An 'I' grade may be given only on medical grounds or by recommendation of the project evaluation committee to the Dean Academics.

d) Change of Grade: A letter grade once awarded shall not be changed unless the request made by either the Instructor-in-Charge of the course is approved by the Dean Academics. However, any such request for change of grade must be made within six weeks of the start of the next semester in the prescribed form with all relevant records and justification.

e) Semester Performance Index (SPI): The Semester Performance Index (SPI) is a weighted average of the grade points earned by a student in all the courses credited and describes his/her academic performance in a semester. If the grade points associated with the letter grades awarded to a student are g1, g2, g3, g4, and g5 in five courses and the corresponding credits are c1, c2, c3, c4, and c5, the SPI is given by:

$$\text{SPI} = \frac{c1g1+c2g2+c3g3+c4g4+c5g5}{c1+c2+c3+c4+c5}$$

f) Cumulative Performance Index (CPI): The Cumulative Performance Index (CPI) indicates the overall academic performance of a student and is computed in the same manner as SPI by considering the grades in all the courses registered up to and including the most recently completed semester/summer term. When a student is permitted to repeat or substitute a course/examination, the new letter grade replaces the old letter grade in the computation of CPI; however, the previous grades remain in the Grade Report.

g) Grade Report: A copy of the Grade Report is issued to each student at the end of the semester. A duplicate copy, if required, may be obtained on payment of a prescribed fee.

3) DISTRIBUTION AND WEIGHTAGE OF MARKS

a) The performance of a student in each course of a semester shall be evaluated out of a possible maximum of 100 marks. The resulting marks will then be converted to appropriate letter grade.

b) Specifics of breakup of marks shall be defined at course level. This breakup of marks will be communicated by the instructor in charge at the beginning of the semester. The below-mentioned guidelines shall be followed:

   i. The distribution of marks for all courses shall follow the principles of continuous evaluation. Continuous evaluation during the semester – through mid-term examinations, quizzes, assignments, team projects, term papers, seminars, presentations, etc., (whichever of them applicable for a particular

course) – typically constitute between 40-50% of the total marks, whereas, the end-semester examination including lab will constitute 50-60% of the marks.

ii. For courses without a laboratory, there shall be at least one mid-semester examination along with any other forms of continuous evaluation methods described above (i.). The first mid-semester examinations shall cover units taught during the first spell of instructions i.e. from the beginning of the semester until the first mid-semester examination. A second mid-semester examination if any shall cover the units taught during the second spell of instructions i.e. the intervening period between first mid-semester examinations and the second mid-semester examinations. The end-semester examination will cover all the units taught during the entire semester. All end-semester examinations shall be for a total of 100 marks.

iii. For courses consisting of both theoretical and laboratory components or design or drawing or project (such as but not limited to Engineering Graphics, Engineering Drawing, Machine Drawing) as a part of the course, the evaluation process for the theory part shall follow the same procedure as described above, with typically a total marks for theory between 60-70 (out of the maximum of 100) and the rest of 30-40 marks being awarded to the laboratory part. The evaluation of the laboratory/practical part of the course shall also follow the principle of continuous evaluation. The instructor-in-charge shall inform the students whether an independent minimum passing mark in the theory part of the course as well as an independent minimum passing mark in the laboratory part of the course is required.

b) There shall be an industry-internship, in collaboration with industry/academia, to be taken up before the beginning of the 4^{th} year. The evaluation of the internship shall be based on the performance evaluation report from the industrial/academic partner and may be a viva. There shall be no credits awarded for the internship.

c) Project beginning during the first semester of academic year III may extend over the second semester. Provisional grade will be awarded at the end of the first phase of the project and upon successful completion of the project this grade is subject to revision at the end of the second phase. For each semester it shall be evaluated for a total of 100 marks. The evaluation shall be based on the report submitted at the end of the project and the presentation of the project to a committee. The committee shall consist of the supervisor of the team project and another faculty member of relevant experience.

d) B. Tech project shall begin in IV year I semester (phase-I) and will continue during IV year II semester (phase-II). Out of the total 100 marks for the project work, 25 marks shall be allotted for internal evaluation and 75 marks for final project report and end

semester examination (viva voce). The end semester examination of the project work shall be conducted by an expert committee consisting of at least two faculty members with relevant subject specialization. In addition, the project supervisor shall also be a member of the committee. Evaluation of the progress of the project shall be done one at the end of the first phase (semester) and a provisional grade is awarded. Upon successful completion of the project evaluation process a revised grade for both first and second phase shall be awarded.

4) ATTENDANCE REQUIREMENTS

a) A student shall be eligible to receive a passing grade in a course offered in a specific semester, if he acquires a minimum of 75 % attendance in lectures, tutorials and lab individually in that course during the same semester.

b) A student with up to 10% of shortage of attendance in a course (an attendance of at least 65%) in a semester may apply to the Dean of Academics; such exceptions shall be granted only on genuine and valid reasons on representation by the candidate with supporting evidence, and on payment of a stipulated fee.

c) A student with attendance below 65% in a course in a semester could be condoned on a case by case basis at the discretion of the Director; such exceptions shall be granted only on genuine and valid reasons on representation by the candidate with supporting evidence, and on payment of a stipulated fee.

d) A student with attendance below 75% in a course during a semester, who has not been exempted by the Dean of Academics, will receive an F grade by default in the corresponding course.

5) ACADEMIC PROGRESSION REQUIREMENTS

a) The Student Performance Committee, chaired by the Dean of Academic Affairs informs and advises students on their academic performance.

b) The Student Performance Committee, gives their recommendation to the director on the academic progression of all admitted students.

c) A student completing an academic year (N) may be promoted to the next academic year (N+1) when he has acquired at least:

   a. 60% of the credits in the current academic year (N)
   b. 90% of the credits in all previous academic years (<N)

d) Students who receive failing grades in courses are permitted to avail supplementary examinations for those courses. With the permission of the SPC students may also be allowed to take up these courses with extra-load during a regular semester.

e) When a student in any given semester acquires at least 60% of the credits prescribed during that semester, he may be permitted to take up the full course load during the next semester; otherwise, the student may be advised to take up a reduced course load.

f) Marks obtained in a supplementary examination will be used to re-compute the grade in

the corresponding course. However, the supplementary examination may replace either the end-semester or both the end-semester and mid-semester examination-components (whichever is more beneficial to the student) of the total marks and no other evaluations like the laboratory component or projects, assignments, etc.

6) WITHHOLDING OF RESULTS

If the student has not paid dues, if any, to the Institute or if any case of indiscipline is pending against him, the result of the student will be withheld and he will not be allowed into the next semester and/or his degree will be withheld.

7) TRANSITORY REGULATIONS

1. Students of previous batches may be given equivalent subjects as per the revised regulations, which they have to pass in order to obtain the required number of credits.

8) GENERAL

1. Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".
2. The academic regulations should be read as a whole for the purpose of any interpretation.
3. In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Director is final.
4. The Institute may change or amend the academic regulations or syllabi from time to time and the changes or amendments made shall be applicable to all the students with effect from the corresponding notification date.

Computer Science and Engineering (2018)						
Semester 1						
	Code	**Course**	**L**	**T**	**P**	**Credits**
1	MA 101	Mathematics – I	4	1	0	5
2	CH 101	Chemistry – I	2	1	0	3
3	ES 101	Introduction to Electrical Engineering	2	1	2	4
4	ES 102	Engineering Drawing	0	0	3	1.5
5	ES 103	Earth and Environmental Sciences	2	0	0	2
6	ES 104	Thermodynamics	2	1	0	3
7	SE 101	Media Project	0	0	3	1.5
8	HS 101	English and Humanities – I	1	2	2	4
9	FL 101	French Language & Culture – I	0	2	0	0
						24
			13	8	10	
		Total contact hours	31			
Semester 2						
	Code	**Course**	**L**	**T**	**P**	**Credits**
1	MA 102	Mathematics – II	3	1	0	4
2	PH 101	Physics – I	2	1	2	4
3	CH 102	Chemistry – II	2	0	2	3
4	ES 105	Electronics	2	1	2	4
5	ES 106	Introduction to Computer Science	2	1	2	4
6	ES 107	Workshop Practice	0	0	2	0
7	SE 102	Introduction to Enterprises & Economy	2	1	0	3
8	HS 102	Professional Ethics	0	1	0	1
9	FL 102	French Language & Culture – II	0	2	0	0
						23
			13	8	10	
		Total contact hours	31			

Semester 3						
	Code	**Course**	**L**	**T**	**P**	**Credits**
1	MA 203	Mathematics – III	3	1	0	4
2	PH 202	Physics – II	3	1	2	5
3	ES 208	Mechanics	2	1	0	3
4	ES 209	Signals & Systems	2	1	2	4
5	ES 210	Data Structures	2	2	2	5
6	CS 201	Discrete Mathematical Structures	2	0	0	2
7	FL 203	French Language & Culture – III	0	2	0	0
						23
			14	8	6	
		Total contact hours	28			

Semester 4						
	Code	**Course**	**L**	**T**	**P**	**Credits**
1	ES 211	Numerical Methods	3	0	2	4
2	CS 202	Digital Logic Design and Computer Architecture	3	1	0	4
3	CS 203	Design and Analysis of Algorithms	2	1	2	4
4	CS 204	Object Oriented Programming	2	0	2	3
5	CS 205	Theory of Computation	3	0	0	3
6	SE 203	Design Thinking	1	0	2	2
7	FL 204	French Language & Culture – IV	0	2	0	0
						20
			14	4	8	
		Total contact hours	26			

Semester 5						
	Code	**Course**	**L**	**T**	**P**	**Credits**
1	MA 304	Mathematics – IV	3	1	0	4
2	ES 312	Introduction to Materials Sciences	2	0	2	3
3	CS 306	Principles of Programming Languages	2	0	0	2
4	CS 307	Operating Systems	3	0	2	4
5	CS 308	Database Management Systems	3	0	2	4
6	CS 309	Microprocessors and Interfacing	2	0	2	3
7	HS-E1	HSS + Mgmt. - Elective – I	2	0	0	2
8	FL 305	French Language & Culture – V	0	2	0	0
						22
			17	3	8	
		Total contact hours	28			
Semester 6						
	Code	**Course**	**L**	**T**	**P**	**Credits**
1	CS 310	Computer Networks	3	0	2	4
2	CS 311	Web Programming	2	0	2	3
3	CS 312	Software Engineering	2	0	2	3
4	CS 313	Machine Learning	2	0	2	3
5	PR 301	Third year team project	0	0	6	3
6	E1	Elective – I	3	0	0	3
7	HS-E2	HSS + Mgmt. - Elective – II	2	0	0	2
8	FL 306	French Language & Culture – VI	0	2	0	0
						21
			14	2	14	
		Total contact hours	30			

Semester 7						
	Code	**Course**	**L**	**T**	**P**	**Credits**
1	CS 414	Distributed Systems	3	0	2	4
2	CS 415	Compiler Design	3	0	0	3
3	CS 416	Cryptography and Network Security	3	0	2	4
4	HS-E3	HSS + Mgmt. - Elective – III	2	0	0	2
5	E2	Elective – II	3	0	0	3
6	E3	Elective – III	3	0	0	3
7	PR402	Year-4 Project	0	1	4	3
8	FL 407	French Language & Culture –VII	0	2	0	0
						22
			17	3	8	
		Total contact hours	28			
Semester 8						
	Code	**Course**	**L**	**T**	**P**	**Credits**
1	E4	Elective – IV	3	0	0	3
2	E5	Elective – V	3	0	0	3
3	PR 403	Year-4 Project	0	5	8	9
4	FL 408	French Language & Culture – VIII	0	2	0	0
						15
			6	7	8	
		Total contact hours	21			

Total credits **170**

List of Electives for Semesters 6, 7 and 8:

S.No.	Code	Course	L	T	P	Credits
1	CS 452	Advanced Data Analytics	3	0	0	3
2	CS 453	Mobile Communication and Computing	3	0	0	3
3	CS 454	VLSI Design Using Verilog	3	0	0	3
4	CS 456	Social Computing	3	0	0	3
5	CS 457	Deep Learning	3	0	0	3
6	CS 458	Information Retrieval and Natural Language Processing	3	0	0	3
7	CS 461	High Performance Computing	3	0	0	3
8	CS 462	Cryptography and Information Security	3	0	0	3
9	CS 463	Performance Evaluation of Computer Networks	3	0	0	3
10	CS 464	Wireless Sensor Networks	3	0	0	3
11	EE 451	Information Theory and Coding	3	0	0	3
12	EE 471	Digital Image Processing	3	0	0	3
13	EE 472	Computer Vision	3	0	0	3
14	EE 484	Advanced Microprocessors	3	0	0	3
15	EE 485	IoT System Architecture and Design	3	0	0	3
16	EE 486	Sensors and Instrumentation	3	0	0	3
17	EE 487	High Performance Embedded Systems	3	0	0	3
18	ME 452	Introduction to Operations Research	3	0	0	3
19	ME 467	Introduction to Robotics	3	0	0	3
20	ME 469	Computational Fluid Dynamics	3	0	0	3
21	ME 470	Robotics: Dynamics and Control	3	0	0	3
22	MA 450	Numerical Linear Algebra	3	0	0	3
23	MA 451	Meshfree Methods	3	0	0	3

24	MA 452	Boundary Element Method and Boundary Integral Equations	3	0	0	3
25	MA 453	PDE Based Image Processing	3	0	0	3
26	MA 454	Topology and Operator Theory	3	0	0	3
27	MA 455	Infinite dimensional Control Theory	3	0	0	3
28	MA 456	Bayesian Statistics	3	0	0	3
29	MA 457	Financial Mathematics	3	0	0	3
30	MA 458	Nonlinear Conservation Laws and Applications	3	0	0	3

List of HS Electives: Semesters 6 & 7						
S.No.	**Code**	**Course**	**L**	**T**	**P**	**Credits**
1	HS 500	Selections from World Literature	2	0	0	2
2	HS 501	Business Communication	2	0	0	2
3	HS 502	Visual Story Telling	2	0	0	2
4	HS 503	Introduction to Culture Studies	2	0	0	2
5	HS 504	Literature and Visual Arts	2	0	0	2
6	HS 505	Cinema and Philosophy	2	0	0	2
7	HS 506	The Humanities for a Critical Understanding of the World	2	0	0	2
8	HS 507	Academic Writing	2	0	0	2
9	HS 508	Urban Studies: Reading the City	2	0	0	2
10	HS 509	Contemporary Shakespeare: Readings and Adaptations	2	0	0	2
11	HS 510	Philosophical Arguments	2	0	0	2

Course Code : MA 101

Course Name: Mathematics-I
Branch : Common to All Branches (CSE, ME, EEE and CE)

Course Credits: 5 (4-1-0)

Course Content:

1. Single variable calculus
Limit, Continuity, Integration and its Applications, Polar Coordinates, Differentiability, Applications of Differentiation, Mean value theorem and its Applications, Curve Sketching, Indeterminate Forms, Taylor's and Maclaurin's theorems, Fundamental Theorem of Calculus.

2. Functions of Several Variables
Limit, Continuity, Total Differential, Extrema of functions, Lagrange multiplier method, Double and Triple integrals, Change of Order of Integration.

3. Vector Calculus
Gradient, Divergence and Curl, Line, Surface and Volume Integrals, Theorems of Green, Stokes and Gauss and their applications.

4. Infinite Series
Sequences, Convergence and Divergence of a series, Tests for Convergence, Conditional and Absolute Convergence, uniform convergence of sequence of functions.

5. Ordinary Differential Equations: The existence and uniqueness theorem on the general first order differential equations (statement, without proof, with some simple examples). Variable separable method, reducible to variable separable. Exact differentiable equations, integrating factors. Linear differential equations, Bernoulli's equation. The general solution of the second order linear homogeneous equations with constant coefficients. Undetermined coefficients, Variation of parameters. Cauchy problem for differential equation systems. Existence theorem (without proof), differential linear systems with constant coefficients. Geometric study in phase plane of simple equations, orthogonal polynomials.

Text and Reference Books

- Tom M. Apostol, One Variable Calculus, with an Introduction to Linear Algebra (Text Book for First, Second and Fifth Modules)
- Tom M. Apostol, Multi-Variable Calculus and Linear Algebra, with Applications to Differential Equations and Probability (Text Book for Third and Fourth Modules)
- R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications (Reference Book)
- E. Kreyszig, Advanced engineering mathematics, John Wiley (1999).
- George B. Thomas, Jr., Maurice D. Weir, Joel Hass, Thomas' Calculus
- W. E. Boyce and R. DiPrima, Elementary Differential Equations (8th Edition), John Wiley (2005).

Course Code: CH 101
Course Name: Chemistry – I (Physical and Analytical Chemistry)
Credits: 3 (2-1-0)
Course Position: Semester 1
Objectives:

The objective of the course is to let the students understand basic chemistry and the relevance to engineering. Basic concepts of physical and analytical chemistry will be introduced in the lectures to develop their intuitive understanding of natural effects.

1.1.1.1.

Course Content:

Module – 1:Atomic structure and periodic properties (6lectures): Wave-particle duality. Schrodinger equation. Principles of quantum mechanics.Particle in a one-dimensional box solutions and its applications. Hydrogen atom wave functions.Shape and size of atomic orbitals. Multi-electron atoms – shielding – effective nuclear charge – orbital penetration. Periodic table and periodic properties of elements:electronic configuration, ionization energy and electron affinity.

Module – 2:Chemical bonding and intermolecular interactions (8 lectures): Molecular orbitals as linear combinations of atomic orbitals. Molecular orbital energy level diagrams of homonuclear and heteronuclear diatomic molecules - electronegativity. Multi-atomic molecules, molecular geometry and symmetry. Crystal field theory of transition metal ions. Band theory of solids. Molecular properties: Dipole moment and Polarizability. Intermolecular interactions: dipolar and van der Waal's interactions.

Module – 3:Analytical methods (10 lectures): Theoretical background of UV-Visible Spectroscopy, Infrared and Raman spectroscopy, Microwave spectroscopy, NMR spectroscopy and magnetic resonance imaging.Introduction to surface analytical techniques: X-ray photoelectron Spectroscopy, Atomic force microscopy.

Module – 4: Structure determination using spectroscopic methods (6 lectures): Introduction to chemical analysis of organic molecules. Elemental analysis and Mass spectrometry. Structural elucidation of simple organic molecules using combination of different spectroscopic data.

1.1.1.2.

Text / Reference Books

- Atkin's Physical Chemistry; 10th edition; Peter Atkins and Julio DePaula; ISBN 978-0-19-954337-3
- Fundamentals of Molecular Spectroscopy; 4th edition; Colin N. Banwell and Elaine M. McCash; ISBN-13: 978-9352601738
- Organic Spectroscopy; 3rd Edition; William Kemp; ISBN 978-1-4039-0684-7

Course Code: **ES 101**

Course Name: **Introduction to Electrical Engineering**

Credits: **4 (2-1-2)**

Course Position: **Semester 1**

Module 1: Electrical Quantities and Circuit Elements; Circuit Analysis: nodal and mesh analyses, superposition and linearity, network simplification;

Module 2: Network Graphs: nodal analysis using reduced incidence matrix, mesh analysis using fundamental circuit matrix, Tellegen's theorem;

Module 3: Sinusoidal Steady-State Analysis: nodal and mesh analyses using phasor method, Thevenin's theorem, maximum-power conditions; Response to Simple Networks: forced, natural and total responses in RLC networks;

Module 4: State Equations: zero-state, zero-input and total responses in RLC networks; Network Functions: poles, zeros and their properties;

Module 5: Resonant Circuits; Two-Port Networks: impedance, admittance and hybrid parameters; Magnetic Circuits and Transformers.

Textbooks:

1. E. Fitzgerald, D. E. Higginbotham, A. Grabel; Basic Electrical Engineering; Fifth Edition, McGraw-Hill, 2009.
2. A. Desoer, E. S. Kuh; Basic Circuit Theory; Tata McGraw-Hill, 2009.
3. M. E. Van Valkenburg; Network Analysis; Third Edition, PHI Learning, 1980.

Course Code: **ES 102**
Course Name: **Engineering Drawing**
Credits: **1.5 (0-0-3)**
Course Position: **Semester 1**

Module-1 : General principles, projection systems and multiview drawing

Sizes of drawing sheets, layouts, scales, lines, and lettering. The multiview projection method: orthographic representations including first and third angle projections. Projection symbols.

Module -2: Pictorial drawing

Isometric projection.Isometric drawing / isometric view. Oblique projections: cavalier view, and cabinet view.

Module-3 : Sectioning

The cutting plane and its line type.The viewing direction.Naming the sectional view.Hatching of internal surfaces contacting the cutting plane.Convention for hidden features below the cutting plane.Half sections. Offset sections. Revolved sections, removed sections, local sections, and successive sections.Conventions on not hatching shafts, ribs, keys, fasteners, and spokes of wheels.

Module-4 : Computer aided drafting

Practical training on the basics of computer aided drafting using commercial software.

Module-5 : Dimensioning, tolerancing, annotations, and conventions

Distinction between functional, non-functional, and auxiliary dimensions.

Elements of dimensioning: projection lines (extension lines), dimension lines, and leader lines. Types of termination of dimension lines, and origin indication.

Placing of dimensions: the aligned and the unidirectional systems. Shape indication, e.g., diameters, radii, etc.

Special indications: chords, arcs, and angles.

Arrangement of dimensions: Chain dimensioning, and dimensioning from a common feature. Tolerance stack-up in chain dimensioning.Simplified representations of intersections.Representations of square ends.Views of symmetrical parts.Simplified views of repetitive features.

Reference Text Book:

1. Engineering Drawing by N. D. Bhatt, Charotar Publishing House Pvt. Ltd., Anand, 2012 Reprint.

Course Code: **ES 103**

Course Name: **Earth and Environmental Sciences**

Credits: **2 (2-0-0)**

Course Position: **Semester 1**

Module 1: The earth system: Earth in the solar system. Atmosphere and oceans: Origin and evolution; Atmosphere-ocean interaction; Air pollution, Greenhouse effect, Ozone layer; Ocean currents and waves. Lithosphere, Hydrosphere, Cryosphere and atmosphere and their Interactions.

Module 2: Environment and Environmental Studies:

Definition and Components of Environment, Relationship between the different components of Environment, Man and Environment relationship, Impact of technology on Environment, Environmental Degradation, Multidisciplinary nature of the Environment studies, its scope and importance in the present day Education System

Module 3: Ecology and Ecosystems:

Introduction: Ecology- Objectives and Classification, Concept of an ecosystem- structure and functions of ecosystem, Components of ecosystem- Producers, Consumers, Decomposers. Bio-Geo- Chemical Cycles- Hydrologic Cycle, Ocean currents and waves. Lithosphere, Hydrosphere, Cryosphere and atmosphere and their Interactions, Carbon cycle, Energy Flow in Ecosystem, Food Chains, Food webs, Ecological Pyramids Major Ecosystems: Forest Ecosystem, Grassland Ecosystem, Desert Ecosystem, Aquatic Ecosystem, Estuarine Ecosystem.

Module 4: Population and Economic Growth:The nature of human population growth, population parameters, industrialisation, urbanisation, sustainable development, sustainable consumption, health and the environmental impacts.
Environmental pollution: Types of Environmental Pollution: Water Pollution: Introduction – Water Quality Standards, Sources of Water Pollution: Industrial Agricultural, Municipal; Classification of water pollutants, Effects of water pollutants, Eutrophication Marine pollution-Air Pollution: Composition of air, Structure of atmosphere, Ambient Air Quality Standards, Classification of air pollutants, Sources of common air pollutants like PM, SO_2, NO_X, Natural & Anthropogenic Sources, Effects of common air pollutants Land Pollution: Land uses Land degradation: causes, effects and control, soil erosion
Noise Pollution: Introduction, Sound and Noise, Noise measurements, Causes and Effects Thermal Pollution: Causes and effects, Role of individual in the prevention of pollution

Module 5: Social Issues and the Environment: From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization. Environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, and ozone layer depletion, nuclear accidents and holocaust, case studies. Wasteland reclamation – consumerism and waste products.

Environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

Text Book:

- The Good Earth: Introduction to Earth Science. 2nd Edition, McConnell, Steer, Knight, Owens & Park (2010), McGraw-Hill, New York, USA.
- Geology for Geotechnical Engineers, J.C. Harvey, Cambridge University Press
- Basics of Environmental Studies, Varandani, LAP -Lambert Academic Publishing , Germany.
- Basics of Environmental Studies U K Khare, 2011 ,Tata McGraw Hill
- Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

References:

- Dharmendra S. Sengar, 'Environmental law', Prentice hall of India Pvt Ltd, New Delhi, 2007.
- ErachBharucha, "Textbook of Environmental Studies", Universities Press(I) Pvt, Ltd, Hydrabad, 2015.
- G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
- The Good Earth: Introduction to Earth Science. 2nd Edition, McConnell, Steer, Knight, Owens & Park (2010), McGraw-Hill, New York, USA.

Course Code: **ES 104**

Course Name: **Thermodynamics**

Credits: **3 (2-1-0)**

Course Position: **Semester 1**

Course Content:

Module 1: Introductory Concepts and Definitions

System and Surroundings, Macroscopic and Microscopic approaches, Intensive and Extensive Properties, Path and Process, Thermodynamic Equilibrium, Zeroth Law.

Module 2: First Law of Thermodynamics

Closed and Open Systems, Energy, Heat and Work, First law for closed system and flow process, Applications of First law.

Module 3: Properties of Pure Substances

Properties of gases Pure substance, Liquid, Solid, and Vapour Phase Properties, Triple Point, Critical Point, Dryness Fraction, use of Vapour Tables, Mollier Chart.

Module 4: Second Law of Thermodynamics

Clausius and Kelvin-Planck Statements, Heat Engines and Heat Pumps, Reversibility, Carnot Efficiency, Entropy, Availability and Irreversibility

Module 5: Basics of Energy Conversion Cycles

Carnot Cycle, Air-Standard Cycles, Mean Effective Pressure, Vapour Power Cycles, Refrigeration Cycle, Vapour Compression Cycle

Reference text books:

- P.K. Nag, “Engineering Thermodynamics”, McGraw Hill, New Delhi
- Van Wylen, “Engineering Thermodynamics”, Wiley
- Cengel, “Thermodynamics - An Engineering Approach”, Tata McGraw Hill, New Delhi
- Moran and Shapiro, Principles of Engineering Thermodynamics”, John Wiley & Sons

Course Code: **SE 101**

Course Name: **Media Project**

Credits: **1.5 (0-0-3)**

Course Position: **Semester 1**

Module-1 (2 weeks) : Introduction to Image : properties ,elements , technology of imaging.

LAB: sketching images, 5 hand drawn images leading to a comic strip, uses of color for the images, INSTAGRAM usage for capturing images.

Module -2 (4 weeks): Visual Design, Visual and Aural Story telling

LAB: Introduction to Camera, Microphones, Report writing, Editing software

Module-3 (2 weeks): Introduction to moving images ,building up a narrative .

LAB: Advance training in camera handling, sound recording, dealing with real life situations, editing to form a narrative with actual footage and writing scripts.

Module-4 (4 weeks) : Production of a 30 to 45 second narrative, using various images set to a pre-recorded audio track in real life situations, dealing with challenges, start of postproduction of documentaries.

Module-5 (4 weeks): Post Production: Editing of the raw footage to form a structured narrative, dealing with sound and music to enhance the narrative and finalizing the project.

Discussing the learning outcomes from the project.

Course Code: **HS 101**

Course Name: **English and Humanities - I**

Credits: **4 (1-2-2)**

Course Position: **Semester 1**

Theory Component:

Module I

1. The Bet- Anton Chekhov
2. Seven Ages of Man/ To be or not to be/ Mark Antony's Speech in Julius Caesar- William Shakespeare
3. London- William Wordsworth; Ode on a Grecian Urn- John Keats

Skills: Paragraph Writing: types, structure, features; Topic, supporting and concluding sentences; Definition, Description, Illustration; Concord.

Module II

1. Ulysses- Tennyson
2. The Second Coming- W. B. Yeats
3. Destructors- Graham Greene

Skills: Expository and Argumentative writing, Fact versus Opinion, Connectors, Noun and Adverbial clauses

Module III

1. A Homemade Education: Malcom X
2. I have a Dream: Martin Luther King OR "The Meaning of July Fourth for the Negro" by Frederick Douglas
3. The Danger of a Single Story- ChimamandaAdichie

Skills: Essay – Structure, organisation, unity, coherence, cohesion; Developing the thesis; Narrative essay; Active/Passive voice

Module IV

1. Wife's Letter- Rabindranath Tagore
2. Toba Tek Singh- Sadat Hassan Manto
3. Imaginary Homelands- Salman Rushdie

Skills: Close reading and Comprehension; Compare/Contrast and Cause and Effect Essays; Conditionals

Module V

1. Where I live- ArundhathiSubramaniam
2. Dance Like a Man- Mahesh Dattani

Skills: Process Analysis Essay; Summarizing; Translation (from Indian language to English)

Lab Component: Phonetics & Communication Skills practice cycles (14 weeks):

I. Introduction to Phonetics: Phonetics- a branch of Linguistics, International Phonetic Alphabet (IPA), Phonetic Symbols, English as an international language.

Introduction: Introduction to effective communication, verbal/non-verbal aspects of communication, components of communication,introducing oneself and others

II.Sounds of English: Classification of English phonic sounds into Vowels and Consonants, Description and Characteristic features

Situational Dialogues: Role plays, greeting, making requests, seeking permissions, asking for and giving instructions/directions, turn taking, telephone etiquette.

III. Vowels: Classification, Description, Articulation, Acoustics, Prosody and Transcription·

Debates: Stating points of view,agreeing/disagreeing, asking for and giving information, negotiation and persuasion, making suggestions.

IV. Consonants: Classification, Description, Articulation, Acoustics, Prosody and Transcription

Presentation Skills: Individual/group presentations, poster presentations, PowerPoint presentations, describing and interpreting non-verbal data, project reports/proposals.

V. Stress Patterns: Syllable, Word Stress, Stress Patterns

Group Discussion: Team dynamics, techniques for group discussions, intervention, turn taking, summarizing, body language, tone, relevance, fluency and coherence.

VI. Intonation: Rising intonation, Falling intonation and Rise- Fall intonation

Panel Discussion: Initiating and coordinating discussion, asking for and expressing opinions, providing clarification, coordinating, conducting and participating in meetings.

VII. Rhythm: Stressed-time language, Connected speech, Pitch

Public Speaking: Structure, organizing thoughts/ideas, effective transitions, summarizing and concluding, body language, tone, JAM sessions.

Course Code: **FL 101**

Course Name: **French language & Culture - I**

Credits: **0 (0-2-0)**

Course Position: **Semester 1**

Objectives:

To develop basic LSRW skills in French Language, from learning how to pronounce and write French alphabet to picking up phrases and words in written, spoken communication through listening and reading exercises.

Course Content:

A) Topics

- Alphabet
- Numbers
- Nationality
- Profession
- Country and Cities
- Self-introduction and introducing others

B) Grammar

- Present tense only with 1st group regular and irregular verbs
- Negations
- Prepositions in front of countries and cities
- Likes and dislikes with simple notions

C) Types of writing

- Very short essay on introduce oneself

Course Code: MA 102
Course Name: MATHEMATICS- II
Branch: Common to All Branches (CSE, ME, EEE and CE)
Course Credit: 4 (3-1-0)
Course Content:

1. **Linear Algebra:** Real and complex vector spaces, Linear dependence, Matrix of a vector system, changeof coordinates, Linear transformation, addition and composition; kernel and image, rank;one to one and onto maps, matrix of a linear map, Inner product, Cauchy-Schwarz,Norm, triangle inequality. Euclidean spaces, Orthogonal and orthonormal family andbasis, Gram-Schmidt orthonormalization and **Fourier Series.**
2. **Matrices:**Matrix addition and multiplication, singular matrix, determinant, rank, inverse, adjoint,Linear system: abstract study, Gaussian Elimination, Transpose and conjugate matrix;similar matrix, Eigenvalues and eigenvectors of a linear map. Characteristic polynomialof a matrix,diagonalizability, Symmetric and orthogonal matrices, diagonalization of asymmetric matrix.

3. **Complex Analysis: Complex numbers, Polar form, De Moivre's formula, complex differentiation. Cauchy- Riemann equations. Analytic functions, Elementary functions, Contour and contour integral. Cauchy's theorem and integral formula. Taylor's theorem, zeros of analytic functions. Maximum modulus principle, Laurent series, Cauchy residue theorem, poles and residue.**

4. **Integral Transform:**Laplace Transform: Functions of exponential order and examples. Transforms of elementary, transcendental and special functions. Transforms of derivatives and integralsand periodic function, unit step function and impulse function. The inverse transform,Convolution theorem, solution of ordinary differential equations (IVP and BVP). Z-Transform, FourierTransform.

Text and Reference Books

- H. Anton, Elementary linear algebra with applications (8th Edition), John Wiley (1995).
- S. Kumaresan, Linear algebra - A Geometric approach, Prentice Hall of India (2000).
- E. Kreyszig, Advanced engineering mathematics, John Wiley (1999).
- J. W. Brown and R. V. Churchill, Complex Variables and Applications, McGraw Hill,2008.
- D.G. Zill, P.D. Shanahan, A first course in complex analysis with applications.
- J. W. Brown and R. V. Churchill, Complex Variables and Applications, McGraw Hill, 2008.

- JL Schiff, The Laplace transform, Springer

- G. Strang, Linear Algebra and its Applications, Fourth Edition, Books/Cole.

Course Code: **PH 101**

Course Name: **Physics - I**

Credits: **4 (2-1-2)**

Course Position: **Semester 2**

Objectives:

Mechanics: The objective of this course is to present the basic definitions and theorems of kinematics and dynamics and their application to systems of particles. The course will cover: coordinate systems, kinematics in Galilean and non-Galilean reference frames, Newton's laws, friction, conservative forces, work-energy theorem, angular momentum, central forces, gravitation, Keplerian motion, dynamics of rigid bodies, oscillators, waves.

On completion of the course, students should be able to

- Analyse the forces in systems of point particles and the resulting motion
- Apply the calculations to common mechanical problems of pulleys, sliding and rolling wheels, etc
- Continue the physics with PH202 and elective courses

Course Content:

Classical mechanics

Module 1 (Coordinate systems and Vector Calculus)

Vectors, Algebra of Vectors, Multiplying Vectors , Components of a Vector, Base Vectors, The Position Vector r and Displacement, Velocity and Acceleration, Formal Solution of Kinematical Equations, More about the Time Derivative of a Vector, Motion in Plane Polar Coordinates.

Module 2 (Newton's laws, Types of Forces and Application of Newton's laws)

Newton’s Laws and Inertial Systems, Base Units and Physical Standards, Algebra of Dimensions, Applying Newton’s Laws, Dynamics Using Polar Coordinates.
Fundamental Forces of Physics, Gravity, Some Phenomenological Forces, A Digression on Differential Equations, Viscosity, Hooke’s Law and Simple Harmonic Motion.
Dynamics of a System of Particles, Center of Mass Coordinates, Conservation of Momentum, Impulse and a Restatement of the Momentum Relation, Momentum and the Flow of Mass, Rocket Motion.

Module 3 (Work-energy theorems, conservative forces and angular momentum)

Integrating Equations of Motion in One Dimension, Work and Energy, Conservation of Mechanical Energy, Potential Energy, What Potential Energy Tells Us about Force, Energy Diagrams, Non-conservative Forces, Conservation Laws and World Energy Usage.

Small Oscillations in a Bound System, Stability Normal Modes Collisions and Conservation Laws.

Angular Momentum of a Particle, Fixed Axis Rotation, Torque and Angular Momentum, Dynamics of Fixed Axis Rotation, Motion Involving Translation and Rotation, Work–Energy Theorem and Rotational Motion, Vector Nature of Angular Velocity and Angular Momentum, Gyroscope.

Module 4 (Central forces, gravitation, Kepler's law dynamics of rigid bodies (2D))

Central Force Motion as a One-body Problem, Universal Features of Central Force Motion, Energy Equation and Energy Diagrams, Planetary Motion, Some Concluding Comments on Planetary motion, Integrating the Orbit Integral and Properties of the Ellipse.

Module 5 (Harmonic oscillators and waves)

Simple Harmonic Motion: Review, Damped Harmonic Oscillator, Driven Harmonic Oscillator, Transient Behavior, Response in Time and Response in Frequency.
Types of waves, Energy and Power of a Wave travelling along String, Wave Equation, Standing waves and Resonance, Travelling Sound waves, Doppler Effect and Supersonic speed and Shock waves.

Text Book:

An Introduction to Mechanics by Daniel Kleppner and Robert Kolenkow, Cambridge University Press

References:

Berkely Physics Mechanics Vol. 1 by Charles Kittel, Walter D. Knight, Malvin A. Ruderman

Physics for Scientists and Engineers, Fishbane, Gasiorowicz, Thornton, Prentice Hall

LABORATORY WORK

Objectives:

The objective of the course is to let the students understand practically what basic laws and their effects are. They will practice mechanical, thermodynamical, optical and electromagnetical experiments and will be able to develop their intuitive understanding of natural effects. In parallel with the theoretical lectures they will face reality and will be in position to make links with its mathematical expressions.

Course Content:

Mechanics (Semester 1)

1- Maxwell's wheel: free fall, inertia momentum
2- Pendulum: Eigen frequency of an oscillator, momentum, gravity force
3- Collisions of projectiles: 1D motion, elastic and inelastic collisions
4- Vibrating string: standing waves, eigenmodes, influence of boundary conditions
5- Acoustic Doppler effect: analogic mixing of electric signal to detect a change in the frequency
6- Kundt's tube: to determine velocity of sound in air
7- Lee's disk method: to measure thermal conductivity of various insulators
8- Force and momentum: to validate Newton's laws of motion

Course Code: CH 102
Course Name: Chemistry II (Organic, polymer and applied chemistry)
Credits: 3 (2-0-2)
Course Position: Semester 2

Objectives:

The objective of the course is to let the students understand basic organic and polymer chemistry and applied topics related to engineering and to illustrate, through experiments, theprinciples of chemistry taught in this and earliersemester. Apart from learning safe working practices in a chemical laboratory, students will learn to perform experiments both on measurement of physical and chemical properties as well as synthesize and characterize simple organic molecules and polymers.

Module – 1: Chemical Kinetics: Rate Law and order of reactions; extent of reaction, Determination of reaction rates; Effect of temperature; Theories of chemical kinetics; Introduction to Catalysis (air pollution, catalytic converter).

Module – 2:Organic chemistry: Structural isomers and stereoisomers, optical activity, absolute configurations and conformational analysis. Introduction to organic reactions involving substitution, addition, elimination, oxidation and reduction. Reaction mechanisms and reactive intermediates. Chromatographic techniques. Synthesis of some commonly used drug molecules.

Module – 3: Polymers: Synthetic and natural polymers. Methods of polymerization, Molecular weight and determination, Glass transition temperature. Structure-property correlations.
Examples of some specific polymers.

Module – 4:Electrochemistry: Electrochemical Cell, Half-cell reactions and electrodes, Standard electrode potential, Electrochemical Series, Nernst equation. Electrochemistry of corrosion and preventive methods. Batteries: different types of batteries and applications.

Module – 5: Nanoscience: Basics of nanomaterials, Synthesis- Bottom-up and Top-down approach, Characterization- Electron microscopy techniques, Applications- electronics, medicinal.

List of laboratory experiments:

1. Determination of total hardness of water by complexometric titration.
2. Determination of surface tension of a liquid by drop count method and the effect of additives.
3. Study of kinetics of hydrolysis of ester.
4. Determination of equilibrium constant of $KI + I_2 = KI_3$ by solubility method.
5. Simultaneous determination of concentrations of strong and weak acid in a mixture using conductometric titrations.

6. Preparation of phosphate/citrate buffers and evaluating their pH resistance.
7. Estimation of amount of Cu^{2+} or Ni^{2+} present in a solution using UV-Visiblespectrophotometer and Beer-Lambert's law.
8. Synthesis of silver nanoparticles by reduction of $AgNO_3$ and the evaluation of the optical properties by UV-Vis spectrophotometry.
9. Synthesis of benzillic acid from benzil using solid phasesynthesis (Green chemistry).
10. Synthesis and FT-IR spectroscopic characterization of dibenzalacetone.
11. Determination of critical micellar concentration (CMC) of a surfactant.
12. Synthesis of an organometallic complex and spectroscopic characterization.
13. Synthesis of a polymer such as Bakelite.
14. Paper chromatography and separation of natural pigments.
15. Synthesis of Aspirin.

Text books:

- Atkin's Physical Chemistry; 10^{th} edition; Peter Atkins and Julio DePaula; ISBN 978-0-19-954337-3
- Organic Chemistry; Jonathan Clayden, Nick Greeves and Stuart Warren; ISBN: 978-0-19-927029-3

Course Code: **ES 105**

Course Name: **Electronics**

Credits: **4 (2-1-2)**

Course Position: **Semester 2**

Course Content:

Module 1: Signals and signal processing: Analog, Discrete and Digital signals and their characterization; Electronic circuits for implementing mathematical operations; Need for active devices; Transistors: characteristic, load line and biasing techniques; Small signal transistor amplifiers and its incremental equivalent circuit;

Module 2: Differential amplifier: its characteristics and operation; Mathematical operations performed using Operational Amplifier (OPAMP); CMRR, slew rate and gain-bandwidth product; OPAMP based amplifiers and applications: spectral analysis and active filters;

Module 3: Feedback: various topologies of feedback network; Nonlinear applications of OPAMP, sinusoidal oscillators and negative resistance circuits;

Module 4: Power amplifiers: Class A, AB, B, C, D: their operations and efficiency; Rectifier circuits, voltage regulators and power supplies;

Module 5: Introduction to digital circuits: ADC/DAC and their implementations; Digital Logic Gates, representing boolean functions: expression, truth table, circuit; boolean minimization using Karnaugh maps; Adders; Comparators; Multiplexers; Encoders / Decoders; Latches – SR Latch, D Latch; Flip Flops – D, JK, T Flip-flops; Synthesizing sequential state machines.

Textbooks:

1. A. Malvino, D. J. Bates; Electronics Principles; Seventh Edition, McGraw-Hill, 2007.
2. R. A. Gayakwad; Op-amps and Linear Integrated Circuits; Fourth Edition, Prentice Hall, 2000.
3. M. M. Mano; Digital Logic and Computer Design; First Edition, Pearson Education, 2004.

Course Code: **ES 106**

Course Name: **Introduction to Computer Science**

Credits: **4 (2-1-2)**

Course Position: **Semester 2**

Module 1
Representation of data: Number systems; Conversion from one base to the other; Binary number system; Representation of Binary numbers using Physical devices; Basic logic gates and binary logic; Short, Int, Long types; Integer arithmetic using logic gates; Float point representation; Float, Double, long Double data types; Characters - ascii codes; Boolean variables; IEEE standards and history.
Module 2
Von Neumann architecture of modern computing system; Low level languages vs High level Languages; Compilation and byte code; Introduction to C programming language; Variables, type declaration and operations.
Control structures and manipulation of data: Conditional Constructs if, ifelse, while, for, do-while, switch, break, continue.
Functions: Implementation of functions in C, recursion, Iteration vs recursion.
Module 3
Pointers and Arrays
The pointer datatype; Declaring pointer variables; Passing a reference using pointers; Null pointers.
Arrays; Declaring and using arrays; Arrays as parameters; Strings in C;
Relation between arrays and pointers; N-dimensional arrays; What is an algorithm?;
Algorithms: Sorting examples - Insertion sort, Bubble sort, mergesort.
Searching examples - linear search, Binary search.
Structures; Dynamic Memory Allocation; Malloc - Free functions; Dynamically Sized arrays; Implementation of Linked lists.
File handling: Reading and writing files; Writing header files; Make and Installation Packages.
Module 4
Introduction to interpreted languages; Introduction to Python3; Dynamic typing; inbuilt data types - Strings, Lists, Tuples, Sets, Dictionaries, and methods. Subcriptables and Iterables; the while and for loops; Functions - Polymorphism in Python functions; Introduction to Python classes; Brief introduction to Object Oriented Programming.

Module 5
Standard modules in Python for scientific computing and plotting; Handling files; Implementation of various algorithms (search, sort etc) in Python; Speed comparison with C; Integration of C programs into Python scripts.
References
1. Introduction to Computing Systems: From Bits & Gates to C & Beyond; Yale Patt& Sanjay Patel

2. C: How to Program; Paul Deitel, Harvey Deitel
3. Dive into Python; Mark Pilgrim
4. Beginning Python: Novice to Professional; Magnus Lie Heitland
5. Python Algorithms; Magnus Lie Heitland

Course Code: **ES 107**

Course Name: **Workshop Practice**

Credits: **0 (0-0-2)**

Course Position: **Semester 2**

List of Experiments:

1. Introduction to Workshop: Overview and Safety Practices (1 week)
2. Hand Tools & Machining Demonstration (1 week)
3. Benchwork and Fitting (2 weeks)
4. Woodwork and Carpentry (2 weeks)
5. Welding Demonstration (1 week)
6. Introduction to Machine Tools (1 week)
7. Lathe and Milling: Basic Operations (2 weeks)

Textbook: Workshop Practice by B. L. Juneja, 2016, Cengage Learning.

Course Code: **SE 102**

Course Name: **Introduction to Enterprises & Economy**

Credits: **3 (2-1-0)**

Course Position: **Semester 2**

Objectives:

The course provides students with a structured understanding of how companies operate and can be managed. After the class, students should be familiar with concepts such as governance, strategy, partnering, organizing, etc.

Course Content:

- Introduction: objectives, stakeholders, operations and product life cycles
- Marketing of products and services
- Corporate strategy
- Growth process and strategic plan
- Structure and processes, informal organization
- Performance driving and operations management
- Management of innovation and technology

Text Books/ References:

Course reader in English + copy of the slides presented in class

- The structuring of organizations, H. Mintzberg
- Principles of ecomomy, N. Gregory Mankiw
- Economics, Organization and Management, Paul Milgrom and John Roberts

Course Code: **HS 102**

Course Name: **Professional Ethics**

Credits: **1 (0-1-0)**

Course Position: **Semester 2**

Course Content:

Module 1: Why be moral? Introduction to ethical theories. Is and Ought. What is and what ought to be? Fact-value distinction

Module 2: End and Means. Classical dilemma, Debates and theories. Gandhian Ethics. The concept of shreyas and preyas.

Module 3: Justice. Classical theories of justice. Crime and punishment. Malpractices.

Module 3: Rights, Duties and Responsibilities. Natural rights, Fundamental rights and Human dignity. Freedom and autonomy. Duties and responsibilities. Legal rights. Patents and intellectual rights

Module 4: Good Life. Happiness. Harmony. Care and Compassion

Module 5: Case studies of professionals, institutions and organizations

Textbooks / References:

1. Handouts of classical texts by various philosophers will be provided to students. (Socrates, Kant, Hume, Locke, Mills, Bentham, Rawls, Gandhi, etc.)
2. Practical Ethics by Peter Singer
3. Applied Ethics by Peter Singer
4. What We Owe Each Other by T. M Scanlon
5. Fundamental Ethics – for Scientists and Engineers by Edmund Seebauer and Robert Barry

Course Code: **FL 102**

Course Name: **French language & Culture - II**

Credits: **0 (0-2-0)**

Course Position: **Semester 2**

Objectives:

To develop basic LSRW skills in French Language, from learning how to pronounce and write French alphabet to picking up phrases and words in written, spoken communication through listening and reading exercises.

Contents:

A) Topics

- Family
- Hobbies and pastimes
- Leisure activities
- Describing habit and routines
- Weather description

B) Grammar

- Possessive adjective
- Near future
- Past tense
- Negation
- Spatial location : - venir de / aller à + ville ou pays
- Adverb of time: now, this week, tomorrow, last month etc…
- Fixed preposition with some verbs(aller, venir, faire, jouer)

C) Types of writing

- Post card writing
- Family tree
- Likes and dislikes with advanced notions

Course Code: MA 203
Course Name: MATHEMATICS- III
Branch: Common to All Branches (CSE, ME, EEE and CE)
Course Credit: 4 (3-1-0)
Course Content:

1. Probability and Random Variables
Axiomatic definition of probability, Sample Space, Events, Conditional Probability, Independence ofEvents, Theorem of Total Probability, Bayes' Theorem, Discrete and Continuous Random Variables,Probability Mass Function, Probability Density Function, Cumulative Distribution Function, Moments,Mathematical Expectation, Variance, Standard Deviation, Moment Generating Function.

2. Discrete and Continuous Distributions
Binomial Distribution, Poisson Distribution, Uniform Distribution, Exponential Distribution, Normal(Gaussian) Distribution, Markov's Inequality, Chebyshev's Inequality.

3. Random Vectors
Joint Probability Distribution of Functions of Random Variables, Independence of Random Variables,Covariance, Variance, Expectation, Correlation, Multinomial Distribution, Transformations of RandomVariables, The Law of Large Numbers, The Central Limit Theorem.

4. Random Processes
Continuous and Discrete Random Processes, Autocorrelation Function, Auto covariance Function, Correlation Coefficient, The Bernoulli Process, The Poisson Process, The Wiener Process, The Markov Chain,Stationarity: Strict-Sense Stationary (SSS) and Wide-Sense Stationary (WSS) Processes.

5. Statistics
Descriptive Statistics: Sample Mean, Sample Variance, Sample Standard Deviation and Sample Correlation Coefficient; Confidence Intervals, Parameter Estimation: Unbiasedness, Consistency, Point Estimator, Maximum Likelihood Estimators.

Text and Reference Books

- Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists,Elsevier, Fifth Edition 2016.
- Sheldon M. Ross, Introduction to Probability Models: 11th Edition, Academic Press Elsevier, 2015.
- Jean Jacod and Philip Protter, Probability Essentials, Springer, 2004.
- Hogg, Tanis and Rao, Probability and Statistical Inference: 7th Edition, Pearson, 2006.
- Alberto Leon-Garcia, Probability, Statistics, and Random Processes for Electrical Engineering, Pearson, 2008.

Course Code: **PH 202**

Course Name: **Physics - II**

Credits: **5 (3-1-2)**

Course Position: **Semester 3**

Prerequisites: PH101
The objective of this course is to introduce and present the basics of Fields and Waves in the context of Electromagnetism and Optics

Course Contents

Electrostatics

Physical definitions of Gradient, divergence and curl operators, curvilinear coordinates, Dirac Delta function, Theory of vector fields, Coulomb's law and principle of superposition, Gauss's law and its applications, Electric potential and electrostatic energy, Poisson's and Laplace's equations with simple examples, uniqueness theorem, boundary value problems, Properties of conductors, Multipole expansion, Electric fields in matter, Dielectrics and polarization

Magnetostatics

Biot& Savart's law, Amperes law, Divergence and curl of magnetic field, Vector potential, Vector potential, Magnetic field in matter, Bound currents, Field H, Classification of magnetic materials, Faraday's law in integral and differential forms, Motional EMF, Displacement current

Electromagnetism

Maxwell's equations, Electromagnetic waves, wave equation, e.m. waves in vacuum and media, refractive index, Energy and momentum of e.m.w., Poynting vector, Polarization of e.m. waves, Reflection and refraction, skin depth, standing electromagnetic waves, Electric dipole radiation, Waveguides with rectangular metallic boundaries, TE, TM and TEM mode.

Optics

Some discussions on geometrical optics, Wave optics: Interference between two coherent waves, Fresnel and Fraunhoffer diffraction, Diffraction grating, polarization, Fiber Optics

Labs

- Geometrical optics with lenses
- Newton's rings
- Single-and double-slit diffraction
- Spectrometry of a glass prism
- Polarization study with half and quarter wave plates
- Helmholtz coils
- Faraday's law
- B-H loop
- Hall effect

Course Code: **ES 208**

Course Name: **Mechanics**

Credits: **3 (2-1-0)**

Course Position: **Semester 3**

Contents:

Module 1: Introduction to mechanics: Fundamental concepts and definitions – Systems of units – Force vectors – Equilibrium of a particle – Resultants of force systems – Moment of a force – Moment of a couple – Simplification of force and couple systems – Reduction of simple distributed loading.

Module 2: Analysis of structures: Equilibrium of a rigid body – Conditions for rigid-body equilibrium – Free-body diagrams – Equilibrium in two dimensions – Equations of equilibrium – Simple trusses – The method of joints – The method of sections – Analysis of frames – Analysis of cables – Cables subjected to concentrated loads – Cables subjected to distributed loads.

Module 3: Friction, center of gravity and moment of inertia: Characteristics of dry friction – Problems involving dry friction – Wedges – Frictional forces on screws and flat belts – Rolling resistance – Center of gravity, center of mass and centroid – Composite bodies – Theorems of Pappus and Guldinus – Resultant of general distributed loading – Definition of moments of inertia for areas – Parallel-axis theorem for an area – Radius of gyration of an area – Moments of inertia for composite areas.

Module 4: Virtual work: Definition of work – Principle of virtual work – Principle of virtual work for a system of connected rigid bodies – Conservative forces – Potential energy – Potential energy criterion for equilibrium.

Module 5: Selected topics in engineering dynamics: Brief review of kinematics and kinetics of particles: Rectilinear kinematics, Curvilinear motion, Motion of a projectile – Newton's laws of motion – Central-force motion and space mechanics – Principle of work and energy – Conservation of energy – Principle of impulse and momentum – Conservation of linear momentum for a system of particles – Angular momentum – Planar rigid-body motion – Translation – Rotation about a fixed axis – Instantaneous centre of rotation.

Textbook:

1. F. Beer, E. Johnston, D. Mazurek, P. Cornwell, B. Self, S. Sanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Hill India, 2017.

References:

1. R.C. Hibbeler, Engineering Mechanics: Statics and Dynamics, 11th edition, Pearson, 2009.

2. A.P. Boresi, R.J. Schmidt, Engineering Mechanics: Statics and Dynamics, 1st edition, Cengage Learning, 2008.

Course Code: **ES 209**

Course Name: **Signals & Systems**

Credits: **4 (2-1-2)**

Course Position: **Semester 3**

Course Content:

Module 1: Characterization and classes of signals; Representation of signals: orthonormal expansion; Analytic signal; Hilbert Transform; Transforms on signals: Fourier Transform; Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT);

Module 2: Analytic signals, Hilbert Transform, Real part sufficiency; Laplace transform; Random signals: Characterization and representation of discrete and continuous random processes, Orthogonal expansion and KahrunenLoeve series; Discrete signals: Sampling, sampling function and error in sampling; Z-transform, Properties of z-transform, inverse z transform;

Module 3: Discrete LTI systems: Linear Difference Equations and z-transform; State variable representation of discrete systems; Continuous LTI systems - impulse response, Transfer Function, pole zero concepts; state variable representation of continuous systems; Eigen value and Eigen functions of LTI systems, their significance;

Module 4: Stability, controllability, Observability and their significance, state estimation and state control; Feedback: stability, RH criterion, root locus, Nyquist criterion; Output feedback Control: P.PI.PD.PID;

Module 5: Transmission of random processes through LTI systems; Generation of WSS signals, spectral factorization; Estimation of random signals in noise; Linear Time Varying Systems: Time varying impulse response; Digital Filters: FIR and IIR filters, and their synthesis.

Textbooks:

1. Oppenheim, Wilsky, Nawab; “Signals and Systems”; Second Edition, PHI.
2. J. G. Proakis and Manolakis; “Digital Signal Processing”; Fourth Edition, PHI.
3. K. Ogata; “Modern Control Systems”; Fifth Edition, PHI.

Course Code: **ES 210**

Course Name: **Data Structures**

Credits: **5 (2-2-2)**

Course Position: **Semester 3**

Module 1

Introduction to Data Structures: Single and Multi-dimensional Arrays, Sparse Matrices (Array and Linked Representation)
Introduction to Algorithms: Algorithm Development, Complexity analysis, Recursion. Growth of Functions &Asymptotic Notations. Rates of Growth: O(n), Ω(n), Θ(n), o(n), ω(n), Run-Time Complexity, Space Complexity, NP-Completeness (Time Permitting). Complexity Class - P, NP, NP Complete, NP Hard, Is P=NP? and Reductions.

Module 2
Linear Data Structures- Stacks: Operations and Applications, Implementing single / multiple stack/s in an Array; Prefix, Infix and Postfix expressions, Applications of stack; Limitations of Array representation of stack.
Links Lists: Operation – Creations, insertion, Deletion, Circular Lists, Doubly Linked List. (Approaches, Implementation Issues, Complexity & Efficiency), Amortized Analysis.

Module 3
Array and Linked representation of Queue, De-queue, Priority Queues, Circular Queues: Operations and Applications
Sorting Algorithms& Searching: Bubble sort, Quick Sort, Insertion Sort, Merge Sort, Selection sort, Heap Sort, Radix sort and Bucket sort. Lower bound for comparison based sorting algorithms. Linear Search, Binary Search.

Module 4
Introduction to Hashing, Deleting from Hash Table, Efficiency of Rehash Methods, Hash Table Reordering, Resolving collusion by Open Addressing, Coalesced Hashing, Separate Chaining, Dynamic and Extendible Hashing, Choosing a Hash Function, Perfect Hashing Function
Introduction to Tree as a data structure; Binary Trees (Insertion, Deletion , Recursive and Iterative Traversals on Binary Search Trees); Threaded Binary Trees (Insertion, Deletion, Traversals); Height-Balanced Trees (Various operations on AVL Trees).

Module 5
Graphs I: Representation and Traversal (Preorder, Inorder, Postorder)

- Representation: Matrix, Adjacency list
- Traversal: Depth First Search, Breadth First Search

Graphs II: Basic Algorithms

- Minimum Spanning Tree

- Shortest Path
- All pairs Shortest Path, Transitive Closure

Reference Books

R1. Aaron M. Tenenbaum, Moshe J. Augenstein, YedidyahLangsam, "Data Structures Using C and C++:, Second edition, PHI, 2009.
R2. Micheal T. Goodrich and Roberto Tamassia: Algorithm Design: Foundations, Analysis and Internet examples (John Wiley &Sons, Inc., 2002)
R3. Cormen T.H., Leiserson, C.E., Rivest, R.L., and C. Stein. Introduction to Algorithms, MIT Press, Second Edition (Indian reprint: Prentice-Hall).
R4. Sanjoy Das Gupta, Christos Papadimitriou, UmeshVazirani, AlgorithmsTata McGraw-Hill Publishers
R5. Alfred V. Aho, John E. Hopcroft, Jeffery D.Ulman. Data Structures and Algorithms
R6. Ellis Horowitz, SartajSahni, SanguthevarRajasekaran. Computer Algorithms
R7. Robert L. Kruse, "Data Structures and Program Design in C++", Pearson,1999.

Course Code: **CS 201**

Course Name: **Discrete Mathematical Structures**

Credits: **2 (2-0-0)**

Course Position: **Semester 3**

1. Logic and Proofs

Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Rules of Inference, Methods of Proofs, Normal Forms, Program Correctness, Resolution Principle.

2. Set Theory and Functions

Inductive Definition of Sets and Proof by Induction, Relations, Representation of Relations by Graphs, Properties of Relations, Equivalence Relations and Partitions, Partial Orderings.

3. Graph Theory

Elements of graph theory, Euler graph, Hamiltonian path, Shortest-Path problems, Trees, Tree traversals, Spanning Trees, Minimum Spanning Trees.

4. Algebraic Structures

Definition and Elementary Properties of Groups, Semigroups, Monoids, Rings, Integral Domains and Fields, Lattices.

5. Counting

Elementary Combinatorics, The Pigeonhole Principle, Counting Techniques, Recurrence Relations, Generating Functions.

Text Book

K. H.Rosen, "Discrete Mathematics and Applications", Fifth edition 2003, TataMcGraw Hill publishing Company

Reference Books

J. P. Tremblay and R Manohar, "Discrete Mathematical structures with applications to Computer Science", McGraw Hill publications.

C.L.Liu and D P Mohapatra, "Elements of Discrete Mathematics", 4 th edition, McGraw-Hill Education (India).

J .L. Mott, A.Kandel, T.P .Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", second edition 1986, Prentice Hall of India.

Course Code: **FL 203**

Course Name: **French language & Culture - III**

Credits: **0 (0-2-0)**

Course Position: **Semester 3**

Objectives:

The aim of this course is to understand very short, simple information in the spoken and written language and to express oneself simply and briefly in speech and in writing for practical purposes in everyday situations requiring a direct exchange of information. It is expected that productive skills will be limited and fragmented and that language will be mostly or completely formulaic at this level; receptive skills will be more developed than productive skills.

Course Content:

General themes

- People: Family, Physical description
- Places: Cafe, Restaurant, Shops, Bank, Post office, Hotel, Road
- Hobbies: Sports, Going out, Shows, Holiday trips
- Daily Life: Work, Shopping,
- Daily activities

Grammar topics

- Pronominal verbs: verbesreflechis and pronominal verbs
  Past Simple - events in the past
- Past participles
  Imperfect tense - descriptions in the past (it was, there was)
  Imperative - Affirmative and Negative - for instructions and commands
- Near Future Tense
  Future simple tense
- Conditional tense

Course Code: ES 211
Course Name: Numerical Methods
Branch: Common toAll Branches (CSE, ME, EEE and CE)
Course Credit:4 (3-0-2)
Course Content:

1. **Algebraic and Transcendental equations:**Computation of floating point numbers and round-off errors and machine representation of numbers. Solutions of non-linear and transcendental equations: order and convergence analysis.

2. **Interpolation, numerical differentiation and Integration:**interpolation; Numerical differentiation, Richardson's extrapolation; Numerical integration: Newton-Cotes formulae, Romberg integration, quadrature formulae.

3. **System of Algebraic Equations:**Norms of vectors and matrices, Linear systems: direct and iterative schemes, ill conditioning, convergence analysis and finding dominant eigenvalues; Numerical schemes for nonlinear systems (Newton's method); Regression.

4. **Ordinary differential equations:**Difference equations; Numerical solution of differential equations: Single step and multi-step methods, order consistency, stability and convergence analysis, stiff equations; Solving two-point boundary value problems by shooting methods and finite difference methods.

Text and Reference Books

- David Kincaid and Ward Cheney, Numerical Analysis and mathematics of scientific computing, Books/Cole, 1999.
- Samuel D. Conte and Boor, Elementary Numerical Analysis: Algorithmic Approach, Tata McGraw-Hill, 1980.
- K. Atkinson, Elementary Numerical Analysis, John Wiley, 1978.
- Richard L Burden and J Douglas Faires, Numerical Analysis, Thomson Books Cole, Seventh edition 2009.

Course Code: **CS 202**
Course Name: **Digital Logic Design and Computer Architecture**
Credits: **4 (3-1-0)**
Course Position: **Semester 4**

Module1

Digital Logic Circuits - The fundamental knowledge needed for the design of combinatorial logic circuits constructed with individual gates. Flip-Flops and sequential circuits – state table and design procedure. Digital Components - The logical operation of the most common standard digital components (Decoders, Multiplexers, Registers, Counters, and Memories).

Module2

Basic Computer Organization and Design - Register Transfer Language and Microoperations to describe the internal operation of the computer. Design the processor logic using RTL Microprogrammed Control – Principles and designing processor using micro programmed controller

Module3

Central Progressing Unit (CPU) - General register organization, the operation of memory stack, variety of addressing modes, instruction format. Pipeline Processing - The concept of pipelining, arithmetic and instruction pipeline. cache memories organization as associative /direct mapping and set associative mapping

Modlue4

Risc architecture and superscalar architecture.examples of processors employing risc and superscalar architecture.

Module5

Input-Output Organization - Computer communication with input and output devices.
I/O interface units are presented to show the way that the processor interacts with external peripherals. 4 modes of transfer : Programmed I/O, Interrupt initiated transfer, direct memory access, and IOP.
Memory Organization - The concept of memory hierarchy : cache memory, main memory, auxiliary memory. Virtual memory Memory Management Unit : physical address and logical address mapping

Reference:

Morris Mano, Computer Architecture, Pearson Education; 3 edition (2007)
William Stallings, Computer Organization & Architecture, Pearson Education Asia, 9th Edition, 2012

Course Code: **CS 203**

Course Name: **Design and Analysis of Algorithms**

Credits: **4 (2-1-2)**

Course Position: **Semester 4**

Introduction: Characteristics of algorithms. Analysis of algorithms: Asymptotic analysis of complexity bounds – best, average and worst-case behaviour; Performance measurements of algorithms, time and space trade-offs, analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Linear Programming, Branch and-Bound and Backtracking methodologies for the design of algorithms; examples of these techniques for problem-solving , bin packing, Knap Sack TSP. Heuristics – characteristics and their application domains.

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.

Approximation algorithms, Randomized algorithms, Class of problems, beyond NP – P SPACE

Suggested books:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.
3. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
4. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.

Course Code: **CS 204**

Course Name: **Object Oriented Programming**

Credits: **3 (2-0-2)**

Course Position: **Semester 4**

Module 1

Object Oriented Programming Basics: Properties, Object (s), Class(s), Pillars of OOP, Attribute(s), Operation(s), Class. Introduction to Encapsulation, Abstraction, Inheritance, Polymorphism.

Java Programming Basics: Java Programming Syntax, Compilation and Execution of Java Applications and Introduction to Java Type System, Introduction to Java API Classes and Packages

Primitive Type(s), Java Type vs Java Value, Differences in C and Java, Sample Java Application (Reading input in Java).

Module 2

Class definition: Defining Class(s) in Java, Adding Attribute(s) and Operations, Access Modifier(s), Object Creation (Role of constructors), Introduction to Strings.

Polymorphism: Method Overloading vs Method Overriding [Also Constructor overloading], Object as Parameters. final and static keywords in Java: Learning the use of final and static keywords in Java , static block in Java.

Module 3

Learning Arrays and Strings in Java: Arrays and Multi-dimensional arrays, Strings, StringBuffer, String Builder, StringTokenizer

Inheritance: Inheritance, Abstract classes, Instance variable hiding, Method overriding. Generic classes, Wrapper Classes.

Interfaces in Java: interfaces, Comparator and Comparable interfaces, Inner classes,Anonymous classes

Module 4

Collection Framework: Collection Class(s) & Interfaces, ArrayLists, Vectors, LinkedLists, Iterators and ListIterators.

Exception Handling: Exception classes , Checked vs Unchecked Exceptions, Throw vs Throws clauses

Java Multithreading: Thread Scheduler, Life cycle of Thread, Runnable interface & Class level/ Object level Synchronization.

Object Model: Shallow and Deep Copy, Object Class, Type Inquiry

Module 5

Event Handling Programming: Understanding Java's Delegation Event Model, Event Classes, Listener Interfaces . GUI Programming, Learning User Interface Components, AWT Hierarchy of classes, Introduction to Swing Package, Frames , Panels, Layout Managers.

Design Patterns :Pattern Basics, Iterator Pattern, Model View Controller Architecture, Singleton Pattern, Command Pattern, Adapter.

Reference Books

R1.Object Oriented Design & Patterns, Cay Horstmann, John Wiley & Sons, 2004

R2.The complete Reference Java 2, 8th Edition, Herbert Schildt, Tata McGraw Hill Publishing

R3.Introduction to Java Programming, By: Y. Daniel Liang.

Course Code: **CS 205**

Course Name: **Theory of Computation**

Credits: **3 (3-0-0)**

Course Position: **Semester 4**

Module 1

Motivation; Mathematical notations and terminology; Definitions, Theorem and Proof; Types of Proofs; Alphabet and Formal languages.

Module 2

Regular Languages: Finite Automata (DFA); Nondeterminism (NFA); Equivalence of DFA and NFA; Regular Expressions - properties, applications (UNIX, Arithmetic etc); Nonregularlagnuages; Pumping lemma for regular languages.

Context-Free Languages: Context free grammars; Pushdown Automata; Non-context free languages; Pumping lemma for context-free languages; Properties and Applications of context-free grammars.

Module 3

The Church-Turing Thesis: Turing Machines; Programming on a Turing Machine, Variations of Turing machines;

Module 4

Decidability: Decidable languages; The Halting problem; Proofs of undecidability - Diagonalization and Reduction;

Reducibility: Undecidable Problems from Language Theory; Mapping Reducibility; Computable functions.

Module 5

Time Complexity: Big-O and small-o notation; Analyzing algorithms; The class P; The Class NP; The P vs NP problems; NP-Completeness; Cook-Levin Theorem;

References

1. Introduction to the Theory of Computation; Michael Sipser.
1. Introduction to Languages and The Theory of Computation; John Martin.
2. Introduction to Automata Theory, Languages, and Computation; John E. Hopcroft et al.

Course Code: **SE 203**

Course Name: **Design Thinking**

Credits: **2 (1-0-2)**

Course Position: **Semester 4**

1st week:

Exercise 1**:** Drawing practice using subconscious mind with the help of music…. Al Di Meola (Race with Devil on Spanish Highway), Beethoven Symphony No.9, Hans Zimmer - Kings of the Past, Pink Floyd - Terminal Frost etc. Another exercise was to create a story from subconscious mind.

Exercise 2:2D drawing from conscious mind and create a story.

Exercise 3: 2D Story making following story board & comic strips type.

2nd week:

Introduction 3D, where 'D' stands for dimension, which means an object has three dimensions. X-axis, Y-axis and extra dimension are the Z-axis which gives height/width/depth to an object.

Exercise 1**:** Composition exercise 3D, Create a new 3d compound structure using any one symmetrical and asymmetricalpattern with the help of colour paper

3rd week:

3d exploratory prototyping/ connection of variety objects….Bangles, Rubber band, Scooby sticks, Marbles, Paper cups. This is a brain storming activity. Where they will learn how to build a product with the help of very limited object and also they need to calculate the mathematical way to function this game.

4th week:

2D form exploration Tangram

5th& 6th weeks:

Screening short films.

Exercise 1: First write down the basic theme.

Exercise 2: To identify and write down the visual and audio components of this design/narrative and also to state alongside as to what could be its motivation.

7th week:

Context-Concept- We are providing some objects (Syringe, Nail Cutter, and Stapler). Brain storms the following using object which is given them. Note the idea, possibilities and connection as possible.

1. **In what contexts do you see a use for this product?**
2. **How did this product evolve? What are the alternatives before the product for the same need? What the problem did this product solve?**
3. **Think of 5 important "WHAT IF CONTEXTS" for this product?**
4. **Describe a PERSONA of the product.**
5. **Sketch your 10 new concepts based on this product.**
6. **What can be made it simpler, pleasurable and more meaningful?**

(8th week)

Typography & Photo montage (collage)– History of typography/ Calligraphy and Photomontage. Typography plays a *critical* role in strengthening the brand, creating interest to the product, and highlighting a central message. The core purpose of a design is communication. Whether we're talking about an online ecommerce store or a corporate brochure, typography is a vital component. Typography is the art and technique of selecting and arranging type styles/fonts for texts.

Exercise 1: To write their name in two different styles (Serif and Calligraphy).

Exercise 2:Making a collage art using magazine and newspaper.

9th week

Book Cover Design:History and evolution of book. History of book covers designing.

Exercise 1:Create a book coverby using typography or any kind of creative image which can describe the book visually.

10th week

Ideating objects & Mechanical transformation-

Problem review

1. Identify the object.
2. User profile of the product.
3. Function of the product.
4. How many parts is the product made of?
5. How is each part manufactured?
6. What manufacturing processes are applied?
7. What are the alternatives uses the product?
8. What are the irritants present in this product?

9. If the product had to be redesigned, what would be your approach? Sketch the design.

$11^{th\ t}$ to 15^{th} weeks

'Final Project and Prototype.

Course Code: **FL 204**

Course Name: **French Language & Culture - IV**

Credits: **0 (0-2-0)**

Course Position: **Semester 4**

Objectives:

The aim of this course is to understand very short, simple information in the spoken and written language and to express oneself simply and briefly in speech and in writing for practical purposes in everyday situations requiring a direct exchange of information. It is expected that productive skills will be limited and fragmented and that language will be mostly or completely formulaic at this level; receptive skills will be more developed than productive skills.

Course Content:

General themes

- Accommodation: Units in the house, interior decor
- Everyday objects
- Countries & Cities
- Actions in daily life
- Events: Meetings, Evening out, Family events, Visits, Excursions, Accidents, TV news
- Money and payments

Grammar topics

- Transitive and Intransitive verbs - Direct and Indirect object
- Relative pronoun 'there' - place
- Relative pronouns - who, that/which
- Prepositions of place: go to, be at, come from + a place
- Connectors: but, because

Course Code: MA 304
Course Name: MATHEMATICS- IV
Branch: Common toAll Branches (CSE, ME, EEE and CE)
Course Credit: 4(3-1-0)
Course Position: Semester 5

Course Content:

1. **Series solutions of ordinary differential equations and Special functions.**

2. **Partial Differential Equations: Formation and solutions of partial differential equations. Method of separation of variables, Solution of wave equation, Heat equation, Laplace's equation. Fourier transform method for solving PDEs.**

3. **Finite Difference methods for second order linear PDEs.**

4. **Variational principles and introduction to Finite Element method Galerkin method.**

Text and Reference Books

- LC Evans, Partial differential equations.
- W. E. Boyce and R. DiPrima, Elementary Differential Equations (8th Edition), John Wiley (2005).
- Ronald N. Bracewell, The Fourier Transform and its Applications, Mc-Graw Hill, 1965
- T. Amaranath, An Elementary Course in Partial Differential Equations, Jones & BartlettPublishers.
- L. Elsgolts, Differential equations and Calculus of variations.
- **G. D. Smith, Numerical solution of partial differential equations: Finite Difference methods, Oxford University press.**
- **Cook, Robert D;Malkus, David S;Plesha, Michael E; Witt, Robert J. Concepts and Applications of Finite Element Analysis, Wiley, 2001.**
- K. Shankara Rao, Introduction to Partial Differential Equations, PHI Learning Private Limited.
- **J. N. Reddy, An Introduction to Finite Element Method.**
- **J. N. Reddy, Applied Functional Analysis and Variational Methods in Engineering**

E. Kreyszig, Introductory functional analysis with applications, Wiley, New-York.

Course Code: **ES 312**

Course Name: **Introduction to Materials Sciences**

Credits: **3 (2-0-2)**

Course Position: **Semester 5**

Course Content

Classification of Materials: Crystal and atomic structure/property correlation. Criteria for selection of materials for engineering applications.Structure-Property-Performance correlations.Lennard- Jones potential and understanding intrinsic behavior of materials.

Short-range/long-range order, Amorphous Materials, Glasses. Basic Crystallography, Bravais lattices, packing fraction, crystal structures of metallic elements.Crystal directions and planes, Miller indices, inter-planar spacings.Crystal structure determination, Polymorphism or Allotropy.

Imperfections in crystals and their importance. Types of imperfections: point, line, surface, volume. Deformation by slip, Mechanism of slip, Slip systems.Dislocations and Stacking faults.Applications of diffusion, Mechanisms of Diffusion, Fick's first law, Factors affecting Diffusion, Fick's second Law. Diffusion and Materials Processing-Case studies: Applications

Alloy formation and Hume-Rothery rules. Gibb's free energy for thermodynamic stability of phases and Gibb's phase rule. Cooling curves and Equilibrium diagrams: Unary/Binary Phase diagram, Lever rule; Invariant reactions: Eutectic, Eutectoid, Peritectic and, Peritectoid; Non-equilibrium cooling, Avrami kinetics, Phase transformation, Time-Temperature-Transformation and Continuous Cooling Transformation Diagrams. Analysis of specific alloy systems.

Steel: Fundamentals and applications. Mechanical Behaviour of Ferrous/Non-ferrous alloys: Fatigue, Creep and Failure.

Functional/ Adaptive materials: Smart Metals/Engineered alloys, sensors and actuators, Ceramic Materials, properties, processing and applications. Dielectrics, Ferroelectrics, Piezoelectrics, Multiferroics, Semiconductors and advanced functional materials.

Composite materials: Types of composites, Properties and applications.

Text:

Callister's Materials Science and Engineering, (2ed) R. Balasubramaniam, Wiley, ISBN: 9788126541607

Reference:

Materials Engineering: Bonding, Structure, and Structure-Property Relationships (1st Ed) by Susan Trolier-McKinstry, Robert E. Newnham; Cambridge University Press, ISBN-13: 978-1107103788ISBN-10: 1107103789.

Introduction To Solids by Leonid Azaroff (2017) McGraw Hill Education, ISBN-10: 0070992193ISBN-13: 978-0070992191

Course Code: **CS 306**

Course Name: **Principles of Programming Languages**

Credits: **2 (2-0-0)**

Course Position: **Semester 5**

Preliminary Concepts - Reasons for studying, concepts of programming languages, Programming domains, Language Evaluation Criteria, influences on Language design, Language categories, Programming Paradigms – Imperative, Object Oriented, functional Programming , Logic Programming. Programming Language Implementation – Compilation and Virtual Machines, programming environments.

Imperative Languages: block structure, scope rules, parameter passing, constructs like co-routines, tasks, exceptions etc.

Functional programming: functions, recursion, macros, user-defined control constructs, higher order constructs, types, data abstraction, lazy evaluation, polymorphism, semantics, type inference, and implementation issues.

Declarative programming: declarative programming, Horn clauses, procedural interpretation of Horn clauses, resolution and unification.

Declarative Concurrency: Data-driven concurrent model, basic thread programming techniques, streams, lazy execution, soft real time programming, the message passing concurrent model.

Suggested References:

1. Programming Language Design Concepts, D. A. Watt, Wiley Dreamtech, rp-2007
2. Michael L Scott, Programming Language Pragmatics, 3rd Ed., Morgan Kaufmann, 2009
3. P. van Roy and S. Haridi, Concepts, Techniques and Models of Computer Programming, Prentice-Hall Of India, 2004.
4. M Hennessey, The Semantics of Programming Languages, John Wiley, 1990.
5. Concepts of Programming Languages Robert .W. Sebesta 8/e, Pearson Education, 2008.
6. J. LLoyd, Foundations of Logic Programming, Springer Verlag, 1984.
7. L. C. Paulson, ML for the Working Programmer, 2nd Ed., Cambridge University Press, 1996.
8. C. Reade, Elements of Functional Programming, Addison Wesley, 1989.

Course Code: **CS 307**

Course Name: **Operating Systems**

Credits: **4 (3-0-2)**

Course Position: **Semester 5**

Module-1
Processes, Process API, Direct Execution, CPU Scheduling, Multi-level Feedback, Lottery Scheduling, Multi-CPU Scheduling, Inter process communication, Process Synchronization, Deadlocks.

Module-2
Address Spaces, Memory API, Address Translation, Segmentation,
Free Space Management, Introduction to Paging, Translation Lookaside Buffers, Advanced Page Tables, Swapping

Module-3
Concurrency and Threads, Thread API, Locks, Locked Data Structures, Condition Variables, Semaphores, Concurrency Bugs, Event-based Concurrency

Module-4
I/O Devices, Hard Disk Drives, Redundant Disk Arrays (RAID), Files and Directories, File System Implementation

Module-5
Fast File System (FFS), FSCK and Journaling, Log-structured File System, Data Integrity and Protection
Text Book:

1. Operating Systems: Three Easy Pieces by Remzi H. Arpaci—Dusseau and Andrea C. Arpaci—Dusseau
   Freely available at: http://pages.cs.wisc.edu/~remzi/OSTEP/
2. Operating System Concepts, Abraham Silberschatz, PeterB Galvin, Gerg Gagne.
3. XV6 Website: https://pdos.csail.mit.edu/6.828/2012/xv6.html
4. Advanced Programming in the UNIX Environment by Richard Stevens and Stephen Argo
5. Unix Network Programming: Interprocess Communication, Volume 2, W. Richard Stevens.

Course Code: **CS 308**

Course Name: **Database Management Systems**

Credits: **4 (3-0-2)**

Course Position: **Semester 5**

Basic Concepts
Introduction to File and Database systems- Database system structure – concepts and architecture, date models, schemas & instances, DBMS architecture & data independence, database languages & interfaces, Data Model, ER model.

Relational Models SQL – Data definition- Queries in SQL-relational model concepts, relational model constraints, relational algebra, SQL- a relational database language: date definition in SQL, view and queries in SQL, specifying constraints and indexes in SQL; relational database management systems-Updates, Views, Integrity and Security

Relational Database design - Functional dependences and Normalization for Relational Databases, normal forms based on primary keys, (1NF, 2NF, 3NF & BCNF), lossless join and dependency preserving decomposition, converting ER-diagrams into relations.

Data Storage and query Processing Record storage and Primary file organization- Secondary storage Devices, Operations on Files, Heap File, Sorted Files, Hashing Techniques, Index Structure for files, Different types of Indexes- B-Tree - B+Tree, Query Processing.

Transaction Management Transaction Processing, Need for Concurrency control, Desirable properties of Transaction, Schedule and Recoverability, Serializability and Schedules; Concurrency Control, Types of Locks, Two Phases locking, Deadlock, Time stamp based concurrency control , Recovery Techniques, Concepts- Immediate Update- Deferred Update, Shadow Paging.

Introduction to NoSQL databases.

Suggested Books:
1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan- “Database System Concepts”, McGraw-Hill
2. Raghu Ramakrishnan and Johannes Gehrke – “Database Management Systems”, McGraw-Hill
3. J.D.Ullman, “Principals of database systems”, Galgotia publications.
4. RamezElmasri and Shamkant B. Navathe, “Fundamental Database Systems”, Pearson Education,
5. Hector Garcia–Molina, Jeffrey D.Ullman and Jennifer Widom- “Database System Implementation”- Pearson Education

Course Code: **CS 309**

Course Name: Microprocessors and Interfacing

Credits: **3 (2-0-2)**

Course Position: **Semester 5**

Module1

Micro processor architecture -8085,Instruction set and addressing ,Assembly programming

Module2

Intel 8086-Architecture,Instruction set and addressing,Assembly programming

Module3

Programmable Peripheral Device Interfacing : 8255,8254,8259A,8279,8251 and 8257

Module4

Architecture of Intel 80286,80386 and Pentium processor

Module5

Microprocessor based applications

References

1.Fundementals of Microprocessors and Microcontrollers

B Ram Dhanpat Rai Publications

2.Advanced Microprocessors and Peripherals

K M Bhurchandi A K Ray

Course Code: **HS-E1**

Course Name: **HSS + Mgmt. - Elective - I**

Credits: **2 (2-0-0)**

Course Position: **Semester 5**

1. Selections from World Literature
2. Business Communication
3. Visual Story Telling
4. Introduction to Culture Studies
5. Literature and Visual Arts
6. Cinema and Philosophy

Course Code: **FL 305**

Course Name: **French Language & Culture - V**

Credits: **0 (0-2-0)**

Course Position: **Semester 5**

Objectives:

At this level the students work in class on understanding and expressing feelings, intentions, opinions and routine tasks in order to interact with relative facility in their specific field of activities. Students are able to discuss ideas with frequently used language and can ask for information about familiar subjects concerning everyday subjects and the news. They also work on comprehension skills and writing notes. They work on improving their grasp of everyday syntax and grammar and build a lexical base corresponding to immediate needs. They also work on targeted pronunciation to improve clarity of expression.

Course Content:

A) Topics

1. To accept or to refuse any invitation
2. Showing possession
3. Description of an object
4. Expressing comparison
5. To express an idea
6. Description of a landscape

B) Grammar

1. Revision of l'imparfait (PastContinuous), le Futur simple (Simple future) et le passé composée (Simple Past)
2. Possessive Pronouns
3. Place of Adjectives
4. Recent Past
5. Forms of negation

C) Types of writing

1. Informal letter or email
2. A short passage

Course Code: **CS 310**

Course Name: **Computer Networks**

Credits: **4 (3-0-2)**

Course Position: **Semester 6**

Module 1:
Data communication Components: Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

Module 2:
Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CSMA/CA, IEEE 802.3 and 802.11 standards.

Module 3:
Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols, Internetworking and intranetworking.

Module 4:
Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Module 5:
Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography

Suggested Books:
1. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.
2. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
3. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.
4. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
5. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley.

Course Code: **CS 311**

Course Name: **Web Programming**

Credits: **3 (2-0-2)**

Course Position: **Semester 6**

Module1
Introduction to WEB: HyperText Transfer Protocol, Java Network Programming-sockets and classes
Hypertext MarkupLanguage(HTML) CSS –cascaded style sheets

Module2
XML Technologies -DTD W3C Schema.Parsing of XML documents-DOM representation of xml documents. XPath and XSTL for transformation of xml documents

Module3
Client side programming: JavaScript language use of JS and HTML DOM regular expressions for client side scripts in HTML documents.

Module4
Server side programming: CGI scripts, servlets JSP technology . JSP action tags, use of java beans in JSP

Module5
DataBase connectivity-JDBC, AJAX and Webservices

References
1.Web Technologies Uttam K Roy Oxford University Press
2.Web Technologies A computer Science Perspctive Jeffery C Jackson

Course Code: **CS 312**

Course Name: **Software Engineering**

Credits: **3 (2-0-2)**

Course Position: **Semester 6**

Module-1 (4 weeks)
Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths.
A Generic view of process: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI), process patterns, process assessment, personal and team process models.
Process models: The waterfall model, incremental process models, evolutionary process models, the unified process.

Module -2 (3 weeks)
Software Requirements: Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document.
Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management.
System models: Context models, behavioural models, data models, object models, structured methods.

Module-3 (4 weeks)
Design Engineering: Design process and design quality, design concepts, the design model.
Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

Module-4 (3 weeks)
Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.
Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

Module-5 (2 weeks)
Metrics for Process and Products: Software measurement, metrics for software quality.
Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan.
Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

Text Book:
1. Software Engineering: Principles and Practices By Hans Van Vliet, 3rd Edition, Wiley publications.
2. Design Patterns : Elements of Reusable Object-Oriented Software- Grady Booch, Eric Gamma

3. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, Mc Graw Hill International Edition.
4. Software Engineering- Sommerville, 7th edition, Pearson Education.
5. The unified modeling language user guide-Grady Booch, James Rambaugh, Ivar Jacobson, Pearson Education.
References:
1. Software Engineering, an Engineering approach- James F. Peters, WitoldPedrycz, John Wiley.
2. Software Engineering principles and practice- Waman S Jawadekar, The Mc Graw-Hill Companies.
3. Fundamentals of object oriented design using UML Meiler page-Jones: Pearson Education.

Suggested Lab Assignments:

1. Program to calculate mean, standard deviation and median of a given data set.

2. Read a file and count the number of lines of code according to a predefined definition for lines of code (LOC).

3. Write a program to count the total program LOC, the total LOC in each proxy the program contains, and the number of methods in each proxy.

4. Write a program

o To calculate the linear regression size-estimating parameters for a set of n programs where actual and estimated LOC data are available.

o After you complete the programming assignment in Part 1, analyze the defects found in developing assignments 1, 2, 3, and 4. Document your analysis in the worksheet named "Defect Analysis Report".

5. Write a program to analyze the data provided in a worksheet, the worksheet contains a hypothetical historical development database as well as with a forecast of standard components for a hypothetical project. Using this information the program will determine the size and duration of the project.

6. Write a program to calculate the probability value of a t-distribution given the number of tails and the values of t and n (i.e., write a program to find the area under the t-distribution).

7. Write a program to calculate a linear regression prediction interval from a set of n pairs of data.

8. Write a program that informs the user if two series of numbers are correlated sufficiently for planning purposes. Specific functional program requires are described below.

Course Code: **CS 313**

Course Name: **Machine Learning**

Credits: **3 (2-0-2)**

Course Position: **Semester 6**

Course Content:

Module-1

- Evolutionary Search Algorithms
- Supervised Learning Classification techniques
- Regression methods and Logistic Regression
- Unsupervised Learning and K-means clustering
- SVM Basics

Module-2

- ANN Basics
- Back-propagation Algorithm
- Detailed practical aspects of ANN performance

Module-3

- Convolutional Neural Networks
- Image Processing Basics
- Image Classification, Detection and Localization using CNNs

Module-4

- Sequences, Time Series and Recurrent Neural Networks
- LSTMs and GRUs
- Natural Language Processing basics
- Different RNN Architectures for divergent NLP tasks
- Language Modelling and Machine Translation using RNNs

Module-5

- Markov Models and Markov Decision processes
- Bellman equation and Value & Policy Iteration Algorithms
- Reinforcement Learning and Q-Learning
- Adaptive Critic Formalisms.

Course Code: **PR 301**

Course Name: Third year team project

Credits: **3 (0-0-6)**

Course Position: **Semester 6**

The course consists of a semester-long project on a topic given by a company or a tutor. Teams of 4 or 5 students will work on the actual need of this so-called client. Each project is linked to a specific challenge: Energy, Transportation, Health and other Thrust Areas. The content is similar to CS-417 but with less number of hours.

Students will have inputs during the semester regarding their professional skills. They will work mostly in autonomy but monitored by regular project reviews.

The objective of Project work & Dissertation is to enable the student to delve deeper into a subject, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

- Review and finalization of the Approach to the Problem relating to the assigned topic;
- Preparing an Action Plan for conducting the investigation, including team work;
- Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
- Final development of product/process, testing, results, conclusions and future directions;
- Preparing a paper for Conference presentation/Publication in Journals, if possible;
- Preparing a Dissertation in the standard format for being evaluated by the Department;
- Final Seminar Presentation before a Departmental Committee.

Course Code: **E1**

Course Name: **Elective - I**

Credits: **3 (3-0-0)**

Course Position: **Semester 6**

The student can choose from a list of electives offered by the Institute.

Course Code: **HS-E2**

Course Name: **HSS + Mgmt. - Elective - II**

Credits: **2 (2-0-0)**

Course Position: **Semester 6**

1. The Humanities for a Critical Understanding of the World
2. Academic Writing
3. Urban Studies: Reading the City
4. Contemporary Shakespeare: Readings and Adaptations
5. Philosophical Arguments

Course Code: **FL 306**

Course Name: French Language & Culture - VI

Credits: **0 (0-2-0)**

Course Position: **Semester 6**

Objectives:

At this level the students work in class on understanding and expressing feelings, intentions, opinions and routine tasks in order to interact with relative facility in their specific field of activities. Students are able to discuss ideas with frequently used language and can ask for information about familiar subjects concerning everyday subjects and the news. They also work on comprehension skills and writing notes. They work on improving their grasp of everyday syntax and grammar and build a lexical base corresponding to immediate needs. They also work on targeted pronunciation to improve clarity of expression.

Course content:

A) Topics

1. To Propose or to invite for a program, a party etc.
2. Writing a personal letter
3. Expressing obligation and interdiction
4. To ask for the touristic information
5. To present one's point of view and argue about it
6. To understand the difference between written and spoken language

B) Grammar

1. Adverb
2. To know how to change verbs into noun and vice-versa
3. The Subjunctive
4. Relative pronouns
5. Expression of duration
6. Direct and Indirect speech in present
7. Basic logical connective

C) Types of writing

1. A short essay
2. Informal letter or email
3. Film review

Course Code: **CS 414**

Course Name: **Distributed Systems**

Credits: **4 (3-0-2)**

Course Position: **Semester 7**

Foundations Characterization of DS, Examples of distributed systems, Resource sharing and the World Wide Web, Challenges. System Models Architectural models, Fundamental models.

Interprocess Communication The API for the Internet protocols, characteristics of interprocess communication, Sockets, UDP datagram communication, TCP stream communication, External data representation and marshalling, Client-server communication, Group communication, IP multicast.

Distributed Objects and remote Invocation Indirect Communication, Operating System Support, Distributed File Systems, Name Services. Time and Global States Clocks, events and process states, physical time and clocks, logical time and clocks, global states, distributed debugging.

Coordination and Agreement Distributed mutual exclusion, elections, multicast communication, coordination agreement, consensus and related problems.

Case Studies –

Text and Reference Books

1. G. Coulouris, J. Dollimore, and T. Kindberg, “Distributed Systems: Concepts and Design”, Pearson Education.

2.Taunenbaum, “Distributed Systems: Principles and Paradigms”, PHI.

3. M. Singhal & N. Shivaratri, “Advanced Concepts in Operating Systems”, TMH.

Course Code: **CS 415**

Course Name: Compiler Design

Credits: **3 (3-0-0)**

Course Position: **Semester 7**

CO- I

Overview of Compilation: Phases of Compilation – Lexical Analysis, Regular Grammar and regular expression for common programming language features, pass and Phases of translation, interpretation, bootstrapping, data structures in compilation – LEX lexical analyzer generator.

Top down Parsing: Context free grammars, Top down parsing – Backtracking, LL (1), recursive descent parsing, Predictive parsing, Preprocessing steps required for predictive parsing.

CO – II

Bottom up parsing : Shift Reduce parsing, LR and LALR parsing, Error recovery in parsing , handling ambiguous grammar, YACC – automatic parser generator.

CO – III

Semantic analysis : Intermediate forms of source Programs – abstract syntax tree, polish notation and three address codes. Attributed grammars, Syntax directed translation, Conversion of popular Programming languages language Constructs into Intermediate code forms, Type checker.

Symbol Tables : Symbol table format, organization for block structures languages, hashing, tree structures representation of scope information. Block structures and non block structure storage allocation: static, Runtime stack and heap storage allocation, storage allocation for arrays, strings and records.

CO – IV

Code optimization : Consideration for Optimization, Scope of Optimization, local optimization, loop optimization, frequency reduction, folding, DAG representation.

Data flow analysis : Flow graph, data flow equation, global optimization, redundant sub expression elimination, Induction variable elements, Live variable analysis, Copy propagation.

CO – V

Object code generation : Object code forms, machine dependent code optimization, register allocation and assignment generic code generation algorithms, DAG for register allocation.

TEXT BOOKS :

1. Principles of compiler design -A.V. Aho .J.D.Ullman; Pearson Education.
2. Modern Compiler Implementation in C- Andrew N. Appel, Cambridge University Press.

REFERENCES :

1. lex&yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly
2. Modern Compiler Design- Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Wileydreamtech.
3. Engineering a Compiler-Cooper & Linda, Elsevier.
4. Compiler Construction, Louden, Thomson.

Course Code: **CS 416**

Course Name: **Cryptography and Network Security**

Credits: **4 (3-0-2)**

Course Position: **Semester 7**

Introduction and application of cryptography

Polyalphabeticcipherschemes, Vigenere Cipher, Caesar cipher, Vernam cipher, one time pad, Decryption techniques.

Classical Cryptography:

Block and stream Ciphers, Feistel Ciphers, DES, Multiple Encryption using DES, **AES**, cryptanalysis attacks.

Algebra and Number Theory:

Modular arithmetic, Quadratic Residues, Euclidean Algortihm, Chineese Remainder Theorem, Euler's criterion, primality testing, Discrete logarithms.

Public Key cryptography

Diffie-Hellman problem (DHP), Discrete Log problem (DLP), Hash functions, RSA, Elliptic curve cryptography.Introduction to quantum cryptography.

Cryptographic protocols

Asymmetric key cryptography, Diffie-Hellman key agreement,Extended Euclidean Algortihm ,provably secure systems. Signature schemes (Elgammal), zero knowledge proofs.

Digital Signatures

Schemes, hashing techniques:RC4, SHA

System Security

Buffer overflow attacks, Malware analysis and detection techniques, protection mechanisms.

Network Security

Host and network Intrusion detection systems, Introduction to Wi-Fi protection mechanisms, Phishing attacks.

Information security Engineering and Modeling, Role Based Access Controls (RBAC), Digital Signatures, Website and Mobile app security, Social engineering attacks, cyber fraud, insurance and laws.

Text Books:

1. Coding Theory and Cryptography: The Essentials Monographs and Textbooks in Pure and Applied Mathematics. 2nd edition CRC publishers, D.C. Hankerson, Gary Hoffman, D.A. Leonard, Charles C. Lindner, K.T. Phelps, C.A. Rodger, J.R. Wall (Chaps 10, 11 and 12).
2. Security Engineering: A Guide to Building Dependable Distributed Systems, 2nd edition John wiley publishers, Ross Anderson

Course Code: **HS-E3**

Course Name: **HSS + Mgmt. - Elective - III**

Credits: **2 (2-0-0)**

Course Position: **Semester 7**

1. The Humanities for a Critical Understanding of the World
2. Academic Writing
3. Urban Studies: Reading the City
4. Contemporary Shakespeare: Readings and Adaptations
5. Philosophical Arguments

Course Code: **E2**

Course Name: **Elective - II**

Credits: **3 (3-0-0)**

Course Position: **Semester 7**

The student can choose from a list of electives offered by the Institute.

Course Code: **E3**

Course Name: **Elective - III**

Credits: **3 (3-0-0)**

Course Position: **Semester 7**

The student can choose from a list of electives offered by the Institute.

Course Code: **PR 402**

Course Name: **Year – 4 Project**

Credits: **3 (0-1-4)**

Course Position: **Semester 7**

The course consists of a semester-long project on a topic given by a company or a tutor. Teams of 4 or 5 students will work on the actual need of this so-called client. Each project is linked to a specific challenge: Energy, Transportation, Health and other Thrust Areas.

Students will have inputs during the semester regarding their professional skills. They will work mostly in autonomy but monitored by regular project reviews.

The objective of Project work & Dissertation is to enable the student to extend further the investigative study taken up under PR 301, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

- In depth study of the topic assigned in the light of the Report prepared under PR 301;
- Review and finalization of the Approach to the Problem relating to the assigned topic;
- Preparing an Action Plan for conducting the investigation, including team work;
- Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
- Final development of product/process, testing, results, conclusions and future directions;
- Preparing a paper for Conference presentation/Publication in Journals, if possible;
- Preparing a Dissertation in the standard format for being evaluated by the Department;
- Final Seminar Presentation before a Departmental Committee.

Course Code: **FL 407**

Course Name: **French Language & Culture -VII**

Credits: **0 (0-2-0)**

Course Position: **Semester 7**

Objectives:

The aim is to place the students in various communication situations in French that correspond to social and professional contexts. They learn to express their ideas simply and coherently and are able to understand selective authentic French texts written in everyday language. These texts usually discuss subjects of cultural nature. Radio and television documentaries about the news or subjects linked to the students' specific area of interest are used to practice extracting key information. Students acquire sufficient vocabulary and control of the main grammatical structures to be able to express most of what they want to say relatively easy.

Course Content:

A) Topics

- Intergeneration accommodation
- Internet and cellphone
- Pollution
- Love, marriage, divorce
- Carpool (Covoiturage)

The topics were studied through written articles, audio listening and television coverage. Students were also asked to do oral presentations on the above mentioned topics.

B) Grammar

- Subjunctive
- Reported speech
- Connectors

C) Types of writing

- Official letter
- Argumentative essay

Course Code: **E4**

Course Name: **Elective - IV**

Credits: **3 (3-0-0)**

Course Position: **Semester 8**

The student can choose from a list of electives offered by the Institute.

Course Code: **E5**

Course Name: **Elective - V**

Credits: **3 (3-0-0)**

Course Position: **Semester 8**

The student can choose from a list of electives offered by the Institute.

Course Code: **PR 403**

Course Name: **Year – 4 Project**

Credits: **9 (0-5-8)**

Course Position: **Semester 8**

The course consists of a semester-long project on a topic given by a company or a tutor. Teams of 4 or 5 students will work on the actual need of this so-called client. Each project is linked to a specific challenge: Energy, Transportation, Health and other Thrust Areas.

Students will have inputs during the semester regarding their professional skills. They will work mostly in autonomy but monitored by regular project reviews.

The objective of Project work & Dissertation is to enable the student to extend further the investigative study taken up under PR 401, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

- In depth study of the topic assigned in the light of the Report prepared under PR 401;
- Review and finalization of the Approach to the Problem relating to the assigned topic;
- Preparing an Action Plan for conducting the investigation, including team work;
- Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
- Final development of product/process, testing, results, conclusions and future directions;
- Preparing a paper for Conference presentation/Publication in Journals, if possible;
- Preparing a Dissertation in the standard format for being evaluated by the Department;
- Final Seminar Presentation before a Departmental Committee.

Course Code: **FL 408**

Course Name: **French Language & Culture - VIII**

Credits: **0(0-2-0)**

Course Position: **Semester 8**

Objectives:

The aim is to place the students in various communication situations in French that correspond to social and professional contexts. They learn to express their ideas simply and coherently and are able to understand selective authentic French texts written in everyday language. These texts usually discuss subjects of cultural nature. Radio and television documentaries about the news or subjects linked to the students' specific area of interest are used to practice extracting key information. Students acquire sufficient vocabulary and control of the main grammatical structures to be able to express most of what they want to say relatively easy.

Course Content:

A. Topics

- French education system
- Employment/Unemployment
- House exchange

The topics were studied through written articles, audio listening and television coverage. Students were also asked to do oral presentations on the above mentioned topics.

B. Grammar

- Future perfect
- Nominalization

C. Types of writing

- Article for magazine
- Writing/ Responding to queries on forum discussion platforms