

**Regulations for UG Programs in Engineering (R15UG)
(Effective from 2015-16)
and
Curriculum and Syllabus for 1st and 2nd Semesters**



**Kandula Srinivasa Reddy Memorial College of Engineering
(Autonomous)
Kadapa 516003 AP**
(Approved by AICTE, Affiliated to JNTUA, Anantapur, Accredited By NBA & NAAC)
(An ISO 9001-2008 Certified Institution)

KSRM College of Engineering (Autonomous), Kadapa-516003, AP

Regulations for UG Programs in Engineering (R15UG)
(Effective from 2015-16)

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Regulations for UG Programs in Engineering (R15UG)
(Effective from 2015-16)

1.0 Nomenclature

- 1.1 *Academic Year*: Period of academic instruction of, approximately, one year duration that usually starts in June/July and ends in April/May next
- 1.2 *Semester*: Either of two divisions of an academic year
- 1.3 *Major*: A specific field of study. Example: Civil Engineering
- 1.4 *Minor*: An area outside of, or complementary to, a Major. Example: For Civil Engineering major, Computer Science is a minor and vice versa
- 1.5 *Subject*: An area of knowledge that is studied as part of a Course
- 1.6 *Core*: A subject that is mandatory for a Major course of study
- 1.7 *Elective*: A subject that is selected for study to suit one's individual needs
- 1.8 *Audit Subject*: A subject that is studied to meet certain requirements but has no credits assigned to it
- 1.9 *Self-Study Subject*: A subject that is learnt by a student on own under the guidance of a Faculty member
- 1.10 *Humanities*: Subjects that describe and interpret human achievements, problems and historical changes at individual and societal levels covering the disciplines of literature, history, and philosophy
- 1.11 *Social Sciences*: Subjects that describe the mental and behavioural activities of individuals, groups, organizations, institutions, and nations covering the disciplines of anthropology, economics, linguistics, political science, and psychology
- 1.12 *Exam*: A test to measure one's progress, knowledge, or ability in a subject
- 1.13 *Credit*: A numerical weight given to a subject
- 1.14 *Grade*: A numerical or alphabetic designation measuring the level of achievement in an exam
- 1.15 *Attendance*: Physical presence of oneself in a classroom/laboratory for purpose of a scheduled academic instruction
- 1.16 *Course*: A series of subjects that constitute a Major field of study
- 1.17 *Branch*: Same as Course
- 1.18 *Program*: Same as Course
- 1.19 *Degree*: An academic title conferred to honour distinguished achievement

2.0 Short Title and Application

- 2.1 These rules and regulations may be called as R15UG and come into force from Academic Year 2015-16 and exist until superseded by new regulations. These rules are applicable for students who join the institute from academic year 2015-16 onwards. Students who have joined in earlier regulations will continue in their respective regulations
- 2.2 These rules and regulations are applicable to all under graduate courses in engineering and technology leading to Bachelor's Degree in Technology (B. Tech)
- 2.3 The Major courses offered, at present, are:
 - 2.3.1 Civil Engineering
 - 2.3.2 Electrical and Electronics Engineering
 - 2.3.3 Mechanical Engineering
 - 2.3.4 Electronics and Communications Engineering
 - 2.3.5 Computer Science and Engineering
- 2.4 The Institute may offer new Majors in future to which these rules and regulations will be applicable

3.0 Suspension and Amendment of Rules

- 3.1 Academic Council has the authority to suspend a rule temporarily
- 3.2 Academic Council has the authority to amend a rule
- 3.3 For affirmative action on any suspension or amendment of a rule, an affirmative vote of three-fifths of the members present and voting shall be required in Academic Council

4.0 Requirements for Admission

- 4.1 At present, admissions into first-year class of various Majors are governed by Government and the Affiliating University. The eligibility criteria and procedure for admission are prescribed by Government and Affiliating University
- 4.2 A student is not allowed change of Major after admission into first-year
- 4.3 A student must fulfil medical standards required for admission
- 4.4 The selected students are admitted into first-year class after payment of the prescribed fees

5.0 Structure of the B. Tech course

- 5.1 Duration: The duration of B. Tech degree course is eight semesters spread over four academic years. Semesters are named sequentially from First Semester to Eighth Semester
- 5.2 Working Days: Calendar for any semester shall be announced at least four weeks before its commencement. Minimum number of working days are 90 for a semester
- 5.3 Curriculum: Each Major shall have core, elective and audit subjects drawn from five categories of subject areas - i) Basic Sciences (BS), ii) Humanities

and Social Sciences (HS), iii) Basic Engineering and Design (ED), iv) Professional Major (PJ), and v) Professional Minor (PN). The curriculum for each Major shall be approved by its corresponding Board of Studies and then by the Academic Council

- 5.4 Credits: All subjects that are assessed for marks have credits assigned to them. The credits assigned to subjects shall be given in curriculum. The total number of credits for entire course is 180 for all Majors. The distribution of total credits semester-wise is given in Table 1

Table 1 Semester-wise Total Credits

Semester	Total Credits
First Semester	22
Second Semester	22
Third Semester	22
Fourth Semester	22
Fifth Semester	22
Sixth Semester	22
Seventh Semester	22
Eighth Semester	26
Total for entire course	180

- 5.5 The curriculum and syllabus for first and second semesters is given in Annexure-1 and Annexure-2 respectively
- 5.6 Responsibility and Advising: It is the responsibility of the student to understand and know the regulations and requirements to earn the degree. Each student admitted in to the degree programs is assigned to a Faculty Advisor who assists the student in designing an effective program of study. Students should consult their Faculty Advisors for selection of electives and for general advice on academic program

6.0 Registration and Enrolment

- 6.1 Prior to start of each semester, every student shall register for all the credit-bearing and audit subjects listed in curriculum of the semester. Excepting first semester, the registration for a semester shall be done during a specified week after end examinations of previous semester. In first semester, the registration shall be done within six working days from date of joining. Recommendation of Faculty Advisor is needed for registration
- 6.2 A student can also register optionally for one self-study subject per semester that does not carry any credits. A student can take any subject of any Major as self-study subject, satisfying the prerequisites if any, on the recommendation of concerned Faculty Advisor

- 6.3 Late registration will be permitted with a fine, decided from time to time, up to six working days from the last date specified for registration
- 6.4 A student will be eligible for registration for a semester if she or he i) is promoted to that semester, ii) has cleared all fees to the Institute, library and hostel of previous semester, and iii) is not disqualified for registration by a disciplinary action of the Institute
- 6.5 A student will be enrolled and allowed to attend the classes on successful registration and payment of necessary fees to Institution, library, and hostel
- 6.6 Registration and enrolment will be controlled by the Office of the Controller of Examinations

7.0 Assessment Procedure – Internal Tests and End Examinations

- 7.1 Performance of students in all subjects is assessed continuously through internal assessment tests and an End examination
- 7.2 Allocation of internal assessment and End examination marks
 - 7.2.1 For theory subjects, the allocation is 30 marks for internal assessment and 70 marks for End examination totalling 100 marks
 - 7.2.2 For laboratory/drawing/project work subjects, the allocation is 50 marks for internal assessment and 50 marks for End examination totalling 100 marks
 - 7.2.3 For seminar/viva voce/industrial training subjects, the allocation is 100 marks for internal assessment. There is no end examination for these subjects
 - 7.2.4 For audit subjects the allocation is 30 marks for internal assessment and no allocation for End examination. These marks are specified for purpose of clause 9.3, and do not account for any credits
- 7.3 Internal Assessment Examinations
 - 7.3.1 Internal assessment means performance evaluation of students by faculty members who teach the subjects
 - 7.3.2 For theory subjects, including audit subjects, the internal assessment shall be done by two midterm tests. The faculty member of the concerned subject will assess the marks in midterm tests

Each midterm test will be of one and half hour duration and evaluated for 30 marks. Internal assessment marks in a subject will be calculated as weighted sum of the two midterm test marks in that subject. The weights are: 20% for the minimum midterm marks and 80% for the maximum midterm marks. Any fractional mark after adding all contributions is rounded up to next integer mark

If any student abstains for any midterm test, she or he will be awarded zero marks for that midterm test

- 7.3.3 For laboratory/practical/drawing subjects, the internal assessment will be based on regular laboratory work over full semester. The assessment

will be done by the faculty concerned. The students shall be informed sufficiently early of the procedure to be followed for internal assessment

7.3.4 For self-study subjects, the assessment is through assignments, quizzes, seminars and/or viva-voce. The students shall be informed sufficiently early of the procedure to be followed for assessment

7.3.5 For subjects like seminar, project-work, industrial training, and comprehensive viva-voce, the internal assessment will be done by a Department Committee consisting of two senior faculty members and faculty guide of concerned student. The assessment procedure will be informed sufficiently early to the students

7.4 End examinations

7.4.1 End examinations shall be conducted after completion of coursework in each semester

7.4.2 The question papers for theory subjects shall be set by faculty members outside of the Institute. The external faculty members for question paper setting shall be appointed by the Principal

7.4.3 Evaluation of answer scripts shall be done by examiners appointed by the Principal

7.4.4 For laboratory subjects, end examination shall be conducted by a committee consisting of two internal examiners. One examiner shall be appointed by Head of Department of concerned Major, and the other examiner shall be appointed by the Principal

7.4.5 For project work viva-voce, end examination shall be conducted by a committee consisting of one internal examiner, one external examiner, and the concerned guide of the student. Internal examiner shall be appointed by Head of Department of concerned Major, and the external examiner shall be appointed by the Principal

7.4.6 If a student abstains from End examination of any subject, for any reason, she or he shall be awarded zero marks in that subject

7.4.7 There is no end examination for self-study and audit subjects

8.0 Method of Assigning Letter Grades and Grade Points

8.1 For all credit-bearing subjects, performance of a student in a subject is indicated by a letter grade that corresponds to absolute marks earned in that subject. Each letter grade is assigned a numeric Grade Point that is used to compute Grade Point Average on a scale of 0 to 10

8.2 Performance of a student in both internal assessment and End examination will be considered for awarding grades for credit bearing subjects. Total marks earned in a subject is the sum of marks obtained in internal and End examinations in that subject

8.3 Pass grade A+ to D- is assigned to a subject based on total marks earned in that subject provided that a student earns at least i) 35% of marks in End examination marks and ii) 40% of marks in internal and End examination marks put together; otherwise fail grade F will be assigned to that subject

- 8.4 Grade I will be assigned to a subject if a disciplinary action is pending and is not resolved before publication of results. Office of Controller of Examinations shall resolve the pending disciplinary action within six working days from the date of publication of results and change the grade to any of A+ to D- or F
- 8.5 Grade X will be assigned to a subject if a student abstains for End examination of that subject
- 8.6 The absolute marks and corresponding letter grade and grade points are given in Table2

Table 2 Letter Grades and Grade Points

Absolute Marks	Letter Grade	Grade Points	Remark
95-100	A+	10.0	Pass
90-94	A	9.5	Pass
85-89	A-	9.0	Pass
80-84	B+	8.5	Pass
75-79	B	8.0	Pass
70-74	B-	7.5	Pass
65-69	C+	7.0	Pass
60-64	C	6.5	Pass
55-59	C-	6.0	Pass
50-54	D+	5.5	Pass
45-49	D	5.0	Pass
40-44	D-	4.5	Pass
0-39	F	0.0	Fail
-	I	0.0	Result Withheld
-	X	0.0	Absent for End Exam

- 8.7 SGPA: Semester Grade Point Average indicates the performance of a student in all credit-bearing subjects of a semester. SGPA is calculated as the weighted average of Grade Points of all subjects of the semester with corresponding credits of subjects as weights. Audit and self-study subjects are not considered for SGPA calculation
- 8.8 CGPA: Cumulative Grade Point Average indicates the performance of a student in all semesters up to and including the current semester under consideration. CGPA is calculated as the weighted average of SGPAs with total credits in each semester as the weights
- 8.9 Grade Card: All students shall be issued Grade Cards after the publication of results of a semester. Grade Card is a statement of performance of a student

in a semester. It contains information about each registered subject: type of subject, allocated credits, and letter grade earned. SGPA and CGPA will also be indicated

9.0 Requirements for Completing Subjects

- 9.1 A student shall complete all credit-bearing and audit subjects successfully to be eligible for award of degree
- 9.2 Credit-bearing subjects: A student is considered to have completed a credit-bearing subject successfully and earned credits if she or he obtains a pass grade from A+ to D- in that subject. If a student receives fail grade F or X in any subject, she or he must register for supplementary End examination for that subject as and when opportunity arises and improve grade to pass grade
- 9.3 Audit subjects: A student is considered to have successfully completed an audit subject if she or he earns at least 40% of marks in internal assessment marks. A student may request for makeup tests to satisfy this requirement by paying requisite fee
- 9.4 Self-study subjects: Based on internal assessment, the faculty guide concerned will certify whether a student has successfully completed the subject or not. Grade card will list successfully completed self-study subjects

10.0 Requirements for taking End Examinations and Promotion

- 10.1 A student is eligible to take regular End Examinations of current semester if she or he full fills the attendance requirement
- 10.2 A student shall be promoted from current semester to succeeding semester on satisfying the attendance and total credits-earned requirements
- 10.3 Attendance Requirement
 - 10.3.1 Attendance of students shall be recorded for credit-bearing and audit subjects as per the workload indicated in curriculum
 - 10.3.2 Total class-periods conducted shall be reckoned from beginning to end of a semester as published in academic calendar
 - 10.3.3 Aggregate Percentage of Attendance is calculated using total number of class-periods attended as numerator and total number of class-periods conducted for the concerned class as the denominator
 - 10.3.4 A minimum aggregate attendance of 75% is required for promotion to succeeding semester and be eligible to take End examinations of current semester
 - 10.3.5 A student can appeal to the Principal for condoning deficiency in aggregate attendance if she or he gets 65% or more aggregate attendance presenting a valid reason for deficiency. Such a student will be granted promotion if the Principal pardons the deficiency. Principal has the right to reject the appeal if he/she is not satisfied with the performance of the student or the reason cited for deficiency of the attendance

10.3.6 A student earning less than 65% aggregate attendance will be denied promotion. A student who is not promoted on basis of attendance shall be removed from the rolls and shall register for the same semester when opportunity arises. The current semester record of the student is cancelled automatically

10.4 Credits-Earned Requirement

10.4.1 This rule is applicable for promotion of a student from fourth semester to fifth semester, and from sixth semester to seventh semester

10.4.2 A student who is denied promotion for want of requisite credits shall take supplementary examinations, as and when offered, and earn credits to be eligible for promotion

10.4.3 For promotion from fourth semester to fifth semester, a student must earn at least 26 credits from first semester to third semester subjects

10.4.4 For promotion from sixth semester to seventh semester, a student must earn at least 44 credits from first semester to fifth semester subjects

10.5 A student can forego promotion and opt to repeat the current semester on written request. Recommendation of the concerned Faculty Advisor is required for cancellation of promotion. This option shall be exercised before the commencement of the End examinations of the current semester

11.0 Revaluation of End Examination Scripts

11.1 Revaluation of End Examination scripts is allowed for theory subjects only by paying requisite fee

11.2 Procedure for Revaluation: The script will be revaluated by an examiner appointed by the Principal. The maximum of revaluation and regular end examination marks will be awarded for that subject

11.3 A student can apply for revaluation in a subject only once

12.0 Supplementary End Examinations

12.1 Students are eligible to take Supplementary examinations in subjects with fail grade F or X only

12.2 Supplementary examinations for even semester subjects will be conducted along with regular examinations of odd semester subjects

12.3 Supplementary examinations for odd semester subjects will be conducted along with regular examinations of even semester subjects

12.4 For eighth semester, special supplementary examinations will be conducted in second week following the results publication date of regular examination of eighth semester

12.5 A student will be allowed to improve grade in any theory subject provided she or he has completed coursework of all semesters but before award of provisional/final degree

13.0 Requirements for Award of B. Tech degree

- 13.1 Time Limit for completion of requirements for award of degree is eight academic years from the date of admission. A student who could not complete all the requirements in this time limit shall forego admission and will be removed from the rolls of the Institute
- 13.2 A student shall be eligible for award of B. Tech degree provided she or he has:
- 13.2.1 Registered and successfully completed all required credit-bearing and audit subjects with a total of 180 credits
 - 13.2.2 Secured a CGPA of 4.5 or more
 - 13.2.3 Cleared all dues to the Institute, library and hostel
 - 13.2.4 No disciplinary action is pending against her or him
 - 13.2.5 Satisfied any other stipulation of the affiliating University
- 13.3 Award of Class: Each student will be given class in degree based on CGPA as follows:

Table 3 Class of Degree

Class of Degree	Range of CGPA
Pass Class	≥ 4.5 but < 5.5
Second Class	≥ 5.5 but < 6.5
First Class	≥ 6.5 but < 7.5
First Class with Distinction	≥ 7.5

- 13.4 Degree will issued under the seal of affiliating University

14.0 Transitory Regulations

- 14.1 A student who initially joins the Institute in a previous Regulation and has to re-join in a semester of the present Regulations, due to any reason, shall be bound by the rules of the current Regulations. Board of Studies of the concerned Major will specify, extra or otherwise, academic coursework to be undertaken by such students who re-join the current Regulations

Annexure-1 Curriculum
For B. Tech (Civil Engineering and Mechanical Engineering)

First Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1521101	BS	Mathematics-1	3	1	0	30	70	3
1522102	BS	Engineering Physics	3	1	0	30	70	3
1523103	BS	Engineering Chemistry	3	1	0	30	70	3
1524104	HS	English-1	4	0	0	30	70	3
1503105	ED	Engineering Drawing-1	1	0	3	30	70	3
1525106	HS	Human Values and Professional Ethics	4	0	0	30	70	3
1599107	BS	Physics and Chemistry Lab	0	0	3	50	50	2
1524108	HS	English Language and Communication Skills Lab	0	0	3	50	50	2
		Total	18	3	9	280	520	22

Second Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1521201	BS	Mathematics-2	3	1	0	30	70	3
1521202	BS	Mathematics-3	3	1	0	30	70	3
1505203	ED	Programming in C	3	1	0	30	70	3
1524204	HS	English-2	4	0	0	30	70	3
1503205	ED	Engineering Drawing-2	1	0	3	30	70	3
1501206	HS	Environmental Studies	4	0	0	30	70	3
1599207	ED	Engineering Workshop	0	0	3	50	50	2
1505208	ED	Programming in C Lab	0	0	3	50	50	2
		Total	18	3	9	280	520	22

For B. Tech (Electrical & Electronics Engineering and Electronics & Communications Engineering)

First Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1521101	BS	Mathematics-1	3	1	0	30	70	3
1521102	BS	Mathematics-2	3	1	0	30	70	3
1503103	ED	Engineering Graphics	1	0	3	30	70	3
1524104	HS	English-1	4	0	0	30	70	3
1505105	ED	Programming in C	3	1	0	30	70	3
1501106	HS	Environmental Studies	4	0	0	30	70	3
1505107	ED	Programming in C Lab	0	0	3	50	50	2
1599108	ED	Engineering Workshop	0	0	3	50	50	2
		Total	18	3	9	280	520	22

Second Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1522201	BS	Engineering Physics	3	1	0	30	70	3
1521202	BS	Mathematics-3	3	1	0	30	70	3
1523203	BS	Engineering Chemistry	3	1	0	30	70	3
1524204	HS	English-2	4	0	0	30	70	3
1502205	PJ	Electrical Circuits	3	1	3	30	70	3
1525206	HS	Human Values and Professional Ethics	4	0	0	30	70	3
1524207	HS	English Language and Communication Skills Lab	0	0	3	50	50	2
1599208	BS	Physics and Chemistry Lab	0	0	3	50	50	2
		Total	18	3	9	280	520	22

For B. Tech (Computer Science and Engineering)

First Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1521101	BS	Mathematics-1	3	1	0	30	70	3
1521102	BS	Mathematics-2	3	1	0	30	70	3
1503103	ED	Engineering Graphics	1	0	3	30	70	3
1524104	HS	English-1	4	0	0	30	70	3
1505105	ED	Programming in C	3	1	0	30	70	3
1501106	HS	Environmental Studies	4	0	0	30	70	3
1505107	ED	Programming in C Lab	0	0	3	50	50	2
1599108	ED	Engineering Workshop	0	0	3	50	50	2
		Total	18	3	9	280	520	22

Second Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1522201	BS	Engineering Physics	3	1	0	30	70	3
1521202	BS	Mathematics-3	3	1	0	30	70	3
1523203	BS	Engineering Chemistry	3	1	0	30	70	3
1524204	HS	English-2	4	0	0	30	70	3
1505205	PJ	Introduction to Data Structures	3	1	3	30	70	3
1525206	HS	Human Values and Professional Ethics	4	0	0	30	70	3
1524207	HS	English Language and Communication Skills Lab	0	0	3	50	50	2
1599208	BS	Physics and Chemistry Lab	0	0	3	50	50	2
		Total	18	3	9	280	520	22

Annexure-2 Syllabus

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1521101	BS	Mathematics-1	3	1	0	30	70	3

Objectives:

* To make the students to understand differential equations and to make use these equations not only in mathematics but also in solving engineering problems.

* To make the students to understand the importance of differential calculus double integrals and triple integrals.

Unit I: Differential equations of first order and first degree: Exact, Non exact, Linear and Bernoulli equations. Applications: Orthogonal trajectories, Newton's law of cooling, Law of natural growth and decay.

Unit II: Linear differential equations of second and higher order with constant coefficients and R.H.S term of the type e^{ax} , $\sin ax$, $\cos ax$, polynomials in x , $e^{ax} V(x)$, $xV(x)$ - Method of variation of parameters.

Unit III: Simple examples of Taylor's and Maclaurin's series – Functions of two or more variables Jacobians – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

Unit IV: Curvature: Curvature of a curve – Curvature of a circle – Radius of a curvature – Centre of Curvature – Equation to the circle of curvature. Curve tracing – Cartesian, polar and parametric curves.

Unit V: Multiple Integrals: Evaluation of double integrals in Cartesian coordinates, and polar coordinates - Change of variables in double integrals - Change the order of integration in double integrals - Evaluation of triple integrals in Cartesian and polar coordinates - Change of variables in triple integrals.

Text Books:

1. Higher Engineering Mathematics, Dr. B.S. Grewal, Khanna Publishers-42 edition.
2. Higher Engineering Mathematics, B.V. Ramana, Mc. Graw Hill Education (India) Pvt. Ltd

Reference Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, Willey Publications, 9th edition- 2013
2. Engineering Mathematics Volume-1, Dr. D.S Chandra Sekharaiah, Prism Books Pvt. Ltd.
3. Advanced Engineering Mathematics by N. Bali, M Goyal, Firewall Media 7th edition.
4. Engineering Mathematics, Volume – I & II, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher Ist Edition (2010).

Outcomes:

Students are able to understand and apply differential equations in solving hydro dynamics and fluid mechanics problems

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1521102 / 1521201	BS	Mathematics-2	3	1	0	30	70	3

Objectives:

- * To make the students to understand Fourier series and apply them in solving problems.
- * To inculcate the concept of partial differential equations and its application to solve wave equation and heat equations.
- * To make the students to understand Laplace transforms and inverse Laplace transforms.
- * The students gain the knowledge about vector differentiation and vector integration.

Unit I: Vector calculus - Vector differentiation: Scalar point function - Vector point function -Vector operator Del – Gradient – Divergence - Curl . Vector integration: Line, Surface and Volume integrals .Green’s theorem in a plane, Stoke’s theorem and Gauss-divergence theorems (Statements only). Applications of Green’s , Stoke’s and Gauss divergence theorems.

Unit II: Laplace transforms of standard functions – Properties of Laplace Transforms - Transforms of derivatives and integrals- Evaluation of integrals by Laplace transforms – Unit step function – Second shifting theorem – Dirac’s delta function. Laplace transform of periodic functions.

Unit III: Convolution theorem. Inverse Laplace Transforms – Applications of Laplace transforms to ordinary differential equations.

Unit IV: Fourier series: Determination of Fourier coefficients - Fourier series - Even and odd functions - Fourier series in an arbitrary interval - Functions having points of discontinuity- Half range Fourier sine and cosine expansions.

Unit V: Partial Differential Equations: Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions - Method of separation of variables. Solution of one dimensional wave equation - Solution of one dimensional heat equation.

Text Books:

- 1..Higher Engineering Mathematics, Dr. B.SGrewal, Khanna Publishers-42 edition.
- 2.Higher Engineering Mathematics, B.V.Ramana, Mc. Graw Hill Education (India) Pvt. Ltd.

Reference Books:

5. Advanced Engineering Mathematics, Erwin Kreyszig, Willey Publications, 9th edition- 2013
6. Engineering Mathematics Volume -1, Dr. D.S Chandra Sekharaiah, Prism Books Pvt. Ltd.
7. Advanced Engineering Mathematics by N. Bali, M Goyal, Firewall Media 7th edition.
8. Engineering Mathematics, Volume – I & II , E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher Ist Edition (2010).
9. Fourier Series and Integral Transforms by Prof. S. Sreenadh, S. Ranganatham, Dr. M.V.S.S.N. Prasad, Dr. V. Ramesh Babu – S. Chand & Company Pvt. Ltd.

Outcomes:

- Students are able to apply Fourier series in harmonic analysis.
- Students are able to understand wave equation and heat equations and solve them by the method of separation of variables.
- Students are able to understand Laplace transforms and vector calculus concepts and their applications.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1521202	BS	Mathematics-3	3	1	0	30	70	3

Objectives:

* This course aims at providing the students with the concepts of matrices and basics of linear algebra which will be useful in solving simultaneous linear equations.

* Our emphasis will be more on logical and problem solving development in Numerical methods and their applications in solving Engineering problems when analytical methods fails.

Unit I : Matrices: – Rank – Echelon form – Normal form – Solution of linear system of equations: Consistency and inconsistency - Gauss elimination method – Eigen values, eigen vectors for real matrices – Cayley- Hamilton theorem – Inverse and powers of a matrix. Linear transformations – Orthogonal transformations.

Unit II: Solution of algebraic and transcendental equations – Bisection method - False - position method - Newton - Raphson method. Solution of System of equations: Crout's method- Gauss Seidel iteration method.

Unit III: Interpolation – Finite differences - Forward differences - Backward differences - Newton's forward and backward difference formulae for interpolation - Lagrange's formula for unequal intervals- Inverse interpolation. Curve fitting: Method of least squares- Fitting of a straight line, second degree and exponential curves.

Unit IV: Numerical differentiation: Finding first and second order derivatives using Newton's formulae. Numerical integration: Newton - Cote's quadrature formulae - Trapezoidal rule – Simpson's 1/3 rule – Simpson's 3/8 rule.

Unit V: Numerical solution of ordinary differential equations - Solution by Taylor's series –Picard's method of successive approximations –Euler's modified method - Runge - Kutta methods of second and fourth order – Milne's predictor - corrector method.

Textbooks:

1. Higher Engineering Mathematics, Dr. B.S.Grewal, Khanna Publishers-42 edition.
2. Introductory methods of Numerical Analysis, S.SSastry, 5th edition.

References:

1. Engineering Mathematics – III B, Dr. M.KVenkata Raman, 13th edition.
2. Higher Engineering Mathematics, B.VRamana, Mc. Graw Hill Education(India) Pvt. Limited.
3. Numerical Methods, S. Arumugam, A.Thangapandi Isaac, A. Soma Sundaram, Second edition, Scitech Publications (India) Pvt. Limited.
4. Advanced Engineering Mathematics, Erwin Kreyszig, Willey Publications, 9th edition- 2013.

Outcomes:

- Students are able to understand and Applied Matrix theory in solving Engineering Problems.
- Students are able to understand and applied numerical methods in solving simultaneous equations and transcendental equations

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1522102 / 1522201	BS	Engineering Physics	3	1	0	30	70	3

Course Objective:

- To evoke interest on applications of superposition effects like interference and diffraction, the mechanisms of emission of light, achieving amplification of electromagnetic radiation through stimulated emission, study of propagation of light through transparent dielectric waveguides along with engineering applications.
- To enlighten the periodic arrangement of atoms in crystals, direction of Bragg planes, crystal structure determination by X-rays and also to know the role of ultrasonic's in non-destructive testing..
- To get an insight into the microscopic meaning of conductivity , classical and quantum free electron model, the effect of periodic potential on electron motion, evolution of band theory to distinguish materials and to understand electron transport mechanism in solids.
- To open new avenues of knowledge and understanding on semiconductor based electronic devices, basic concepts and applications of semiconductor and magnetic materials have been introduced which find potential in the emerging micro device applications.
- To give an impetus on the subtle mechanism of superconductors in terms of conduction of electron pairs using BCS theory, different properties exhibited by them and their fascinating applications. Considering the significance of microminiaturization of electronic devices and significance of low dimensional materials, the basic concepts of nanomaterials, their synthesis, properties and applications in modern emerging technologies are elicited.

UNIT – 1: PHYSICAL OPTICS, LASERS AND FIBRE OPTICS

PHYSICAL OPTICS :- Interference, Interference in thin films by reflection – Newton's Rings-Fraunhofer diffraction due to single slit, double slit and diffraction grating.

LASERS:- Introduction –characteristics of laser-Spontaneous and stimulated emission of radiation-Einstein's coefficients-population inversion – Excitation mechanisms and optical resonator-NDYAG laser – He-Ne laser- Application of lasers.

FIBER OPTICS:- Introduction-Construction and working principle of optical fiber-Numerical aperture and acceptance angle- Types of optical fibers- Black diagram of Optical fiber communication system- Applications of optical fibers.

UNIT – 2: CRYSTALLOGRAPHY AND ULTRASONICS

CRYSTALLOGRAPHY:- Introduction –Space lattice –unit Cell lattice parameters- Bravis lattice – Crystal systems- Packing fractions of SC, BCC and FCC – Directions and planes in Crystals – Miller indices – InterPlanar spacing in cubic crystal – X-ray diffraction – Bragg's law powder method.

ULTRASONICS:- introduction- production of ultrasonic's by piezoelectric method- properties and detection- applications in non –destructive testing.

UNIT-3: QUANTUM MECHANICS AND ELECTRON THEORY

QUANTUM MECHANICS: Introduction to matter waves – de'Broglie hypothesis – Schrodinger's time independent wave equation – Physical Significance of wave function – Particle in one dimensional infinite potential well .

ELECTRON THEORY: Classical free electron theory – Sources of electrical resistance – Equation for electrical conductivity – Quantum free electron theory – Fermi-Dirac distribution - Kronig-Penny model (qualitative) – Origin of bands in solids – Classification of solids in to conductors, semiconductors and insulators .

UNIT- 4: ENGINEERING MATERIALS

MAGNETIC MATERIALS:- Introduction and basic definitions- Origin of Magnetic moments- Bohr magneton- Classification of magnetic materials into dia, para, ferro, antiferro and ferri magnetic materials- Hysteresis- Soft and hard magnetic materials and applications of magnetic materials.

SUPERCONDUCTORS: Introduction- effect of magnetic field-Meissner effect- Type I and Type II Superconductors- Flux quantization- London penetration depth- ac and dc Josephson effects- BCS theory(Qualitative)- Applications of superconductors.

UNIT- 5: PHYSICS OF SEMICONDUCTORS AND NANO MATERIALS

SEMICONDUCTOR PHYSICS: Introduction- Intrinsic and extrinsic semiconductors- Drift and diffusion currents and Einstein's equation- Hall effect- Direct and Indirect band gap semiconductors- Formation of P-n junction.

PHYSICS OF NANO-MATERIALS:- Introduction- Significance of Nano-scale and types of nano-materials- physical properties: optical, thermal, mechanical and magnetic properties- Synthesis of nano-materials: ball mill, chemical vapour deposition and sol-gel-Applications of nano-materials.

Text Books:

1. Engineering Physics by K. Thygarajan, Mac Graw – Hill Publishing Co. New Delhi.
2. Engineering Physics by P.K. Palanisamy, Scitech Publications.
3. Engineering Physics by S. Mani Naidu, Pearson edition.

Reference Books:

1. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish University Press, I Edition, 2009.
2. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning, I Edition, 2012
3. Engineering physics – M.N. Avadhanulu and P.G. KshirSagar, Chand and Co, Revised Edition, 2013.
4. Solid State Physics – A.J. Dekkar, McMillan Publishers, Latest edition, 2012.
5. Engineering Physics – Gaur and Gupta Dhanapati, Rai Publishers , 7th Edition, 1992.
6. Text book of Nanoscience and Nanotechnology: B S Murthy, P.Shankar, Baldev Raj B B Rath, James Murday, University Press, I Edition, 2012.

Outcome:

- The different realms of physics and their applications in both scientific and technological systems are achieved through the study of physical optics, lasers and fibre optics.
- The important properties of crystals like the presence of long-range order and periodicity, structure determination using X-ray diffraction are focused along with ultrasonic non-destructive technique.
- The discrepancies between the classical estimates and laboratory observations of physical properties exhibited by materials would be lifted through the understanding of quantum picture of subatomic world.
- The electronic and magnetic properties of materials were successfully explained by free electron theory and focused on the basis for the band theory.
- The properties and device applications of semiconducting and magnetic materials are illustrated.
- The importance of superconducting materials and nanomaterials along with their engineering applications are well elucidated.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1523103 / 1523203	BS	Engineering Chemistry	3	1	0	30	70	3

Objectives:

- Knowledge in Chemistry serves as basic nutrient for the understanding and thereby design of materials of importance in life. Thus the advancement in Engineering depend on the outcome of basic sciences.
- The Engineering Chemistry course for undergraduate students is framed to strengthen the fundamentals of chemistry and then build an interface of theoretical concepts with their industrial! Engineering applications.
- The course main aim is to impart in-depth knowledge of the subject and highlight the role of chemistry principles (or) applications in the field of engineering.
- An attempt has been made to logically correlate the topic with its application.

UNIT-I:

Water: Sources of water, types of impurities in water. Hardness of water: Causes, expression of hardness - units - Types of hardness-Temporary & permanent hardness of water. Disadvantages of hard water, Methods of treatment of water for domestic purpose Analysis of water : Hardness of water by EDTA method, Estimation of Dissolved oxygen by Winkler's method Numerical problems.

Boiler troubles - Scale & Sludge formation, caustic embrittlement, Boiler corrosion, priming & foaming. Softening of water -Internal Treatment: phosphate,colloidal,calgon,carbonate and sodium aluminate treatment, External treatment : Zeolite, Ion exchange process. Reverse osmosis, electro dialysis.

UNIT -II:

Polymers: Introduction, Types of Polymerization, Mechanism (chain growth & Step growth). Plastics: Thermoplastic resins & Thermo set resins. Compounding of plastics, Preparation, properties, engineering applications of polyethylene, Bakelite, Nylon, Teflon. Elastomers-Natural rubber, vulcanization, Compounding of rubber,

Synthetic Rubbers :Buna-S, Butyl rubber and Thiokol Rubbers.

Inorganic Polymers : Basic introduction, Preparation, properties and engineering applications of Silicones, Polyphosphazins(-(R)₂-P=N-)

UNIT-III:

Electrochemistry: Basic concepts for construction of Electrochemical cells, Types of cells: Concentration cells, Galvanic cells. Electrochemical Series. Batteries- Primary (Laclanche cell) and Secondary Batteries (Lead acid cell) .Fuel cells-H₂-O₂,fuel cell and methanol- oxygen fuel cells.

Corrosion- Introduction, Types and Mechanism of Corrosion(Wet and Dry corrosion), factors influence corrosion, Control of Corrosion- Cathodic Protection(Sacrificial anodic protection & impressed current cathodic protection). Basic principles of Electroplating, Electroless plating.

UNIT-IV:

Fuel technology:

Fuels: Classification, Characteristics of good fuel. Solid fuels: Manufacture of Metallurgical coke by Otto Hoffmann's by product oven process. Liquid fuels – petroleum crude - refining of petroleum. Synthetic petrol: Bergius and Fischer Tropsch's process, Calorific value of fuels: HCV, LCV, determination of Calorific value of solid fuels(Bomb calorimetry).

Lubricants: Functions of lubricant, mechanism of lubrication(thick film, thin film& extreme pressure lubrication). Properties of lubricants: Viscosity, Flash & fire point,Cloud and pour point, Aniline point.

UNIT- V:

Advanced Chemistry:

Green Chemistry: Introduction , Significance of green chemistry, 12 principles of Green chemistry. .

Photo Chemistry: Introduction, Fluorescence, Phosphorescence, Luminiscent compounds, Solar cells
 Catalysis: Introduction, Types of Catalysis(Homogenous& Heterogenous catalysis) Action of catalyst
 (Catalytic promoters, Catalytic inhibitor and catalytic poisons) and applications of catalyst.

TEXTBOOKS

- 1 Text Book of Engineering Chemistry, Jain and Jain, DhanapathRai Publishing Company, New Delhi, 15th Edition, 2010.
- 2 Engineering Chemistry by Jayaveera, G.V. Subba Reddy, Tata McGraHill Publications, Edition 2013.
- 3 Text Book of Engineering Chemistry, Shashichawla, DhanapathRai Publications, New Delhi, 4th Edition, 2011.
- 4 Text Book of Engineering Chemistry by S.S. Dara&Mukkati S. Chand & Co Publishers, New Delhi, 2006.

REFERENCES

1. Text Book of Engineering Chemistry - C. Parameswara Murthy, C.V. Agarwal and Andra Naidu, BS Publications, Hyderabad, 3rd Edition, 2008.
2. Engineering Chemistry by K.B. Chandra Sekhar, UN. Das and Sujatha Mishra, SCITECH, Publications India Pvt. Limited, Chennai, 2nd Edition, 2012.
3. Chemistry of Engineering Materials by C.V. Agarwal, A. Naidu, BS publications.

EXPECTED OUTCOMES(EO) : The Student is expected to :

- Differentiate between hard and soft water.Understand the disadvantages of using hard water domestically and industrially. Select and apply suitable treatments domestically and industrially.
- Understand the electrochemical sources of energy
- Understand industrially based polymers,various engineering materials.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1524104	HS	English-1	4	0	0	30	70	3

Objectives:

- To improve the language, proficiency of the students in English with an emphasis on LSRW Skills.
- To develop an awareness in the students about the significance of silent reading and comprehension.
- To equip the students to study academic subjects with greater facility through theoretical and practical components of the syllabus.
- To develop study skills as well as communication in formal and informal situations.
- To enable students to express themselves fluently and appropriately in social and professional contexts.
- To develop an awareness in the students about writing as an exact and formal skill.

UNIT – I

An Astrologer's day – R.K. Narayan
 My struggle for an education – Booker T. Washington
 Grammar – Identification and Interchange of parts of speech.

UNIT – II

Building A New State – Dr. A.P.J. Abdul Kalam
 The Happy Prince – Oscar Wilde
 Grammar – Reading comprehension

UNIT – III

The woodrose – Abburi Chayadevi

Mokshagundam Visveswaraiyah – A Biography
Grammar – Vocabulary

UNIT – IV

Homi Jehangir Baba – A Biography
If – Rudyard Kipling
Grammar – Transformation sentences

UNIT – V

Remedial Grammar

Reference Books

1. Glossary of Grammatical Terms – Geogrey Leech
2. Practical English Usage – Michal Swan
3. English Grammar and Composition - Wren and Martin
4. Advanced English Grammar & Composition – M.P. Bhatia
5. English Improvement Course – Dhillon

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1524204	HS	English-2	4	0	0	30	70	3

Objectives:

- To improve the language, proficiency of the students in English with an emphasis on LSRW Skills.
- To develop an awareness in the students about the significance of silent reading and comprehension.
- To equip the students to study academic subjects with greater facility through theoretical and practical components of the syllabus.
- To develop study skills as well as communication in formal and informal situations.
- To enable students to express themselves fluently and appropriately in social and professional contexts.
- To develop an awareness in the students about writing as an exact and formal skill.

UNIT – I

Phonetics & Transcription
Resume & Emails

UNIT – II

Dialogue Writing
Speech Making

UNIT – III

Paragraph Writing
Precis Writing

UNIT – IV

Group Discussion
Interviews

UNIT – V

Letter Writing
Technical Report Writing

Reference Books

1. Effective Technical Communication – M. Ashraf Rizvi, Tata McGraw-Hill
2. Speaking English Effectively – Krishna Mohan & N.P. Sing, Macmillan Publication

3. A Text Book of English Phonetics for Indian Students – T. Bala Subramanian, Trinity Press.
4. Communication with Confidence – Puspalatha, Oxford Publication
5. An approach to Communication Skills – Dhan Rajan
6. Business Correspondence and Report Writing – R.C. Sharma & Krishnamohan

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1503105	ED	Engineering Drawing-1	1	0	3	30	70	3

COURSE OBJECTIVE:

By studying the engineering drawing, a student becomes aware of how industry communicates technical information. Engineering drawing teaches the principles of accuracy and clarity in presenting the information necessary about objects.

- This course develops the engineering imagination i.e., so essential to a successful design. Learning techniques of engineering drawing changes the way one thinks about technical images.
- It is ideal to master the fundamentals of engineering drawing first and to later use these fundamentals for a particular application, such as computer aided drafting. Engineering Drawing is the language of engineers and by studying this course, engineering students will eventually be able to prepare drawings of various objects being used in technology.

UNIT-1:

INTRODUCTION TO ENGINEERING DRAWING

Principles of Engineering Graphics and their significance- Drawing instruments and their use- Conventions in Drawing- Lettering- BIS Conventions.

Curves used in Engineering Practice: (a) Conic sections –General method only, (b) Cycloid, Epicycloids and Hypocycloid, (c) Involute

UNIT- II:

PROJECTION OF POINTS AND LINES: Principles of orthographic projection- conventions- First and Third angle projections. Projections of points, Lines inclined to one or both planes, Problems on projections, Finding True lengths & traces.

UNIT- III:

PROJECTION OF PLANES: Projections of regular plane surfaces/figures, Projection of planes using auxiliary planes.

UNIT-IV:

PROJECTIONS OF SOLIDS: Projections of regular solids inclined to one or both planes..

UNIT- V

SECTIONS OF SOLIDS: Section planes and sectional views of right regular solids- Prism, Cylinder, Pyramid and Cone. True shape of sections

TEXT BOOKS:

1. Engineering Drawing, N.D.Bhat, Charotar Publishers
2. Engineering Drawing, K.L. Narayana,P.Khanniah, Scitech Pub.
3. Engineering Drawing, Basant Agrawal,C.M.Agrawal, Tata McGraw-Hill

REFERENCES:

1. Engineering Drawing, Shah and Rana, 2/e,Pearson Education
2. Engineering Drawing,B.V.R. Guptha,J.K.Publishers
3. Engineering Drawing and Graphics, Venugopal, New age Publishers
4. Engineering Drawing, Johle, Tata McGraw-Hill

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1503205	ED	Engineering Drawing-2	1	0	3	30	70	3

COURSE OBJECTIVE:

By studying the engineering drawing, a student becomes aware of how industry communicates technical information. Engineering drawing teaches the principles of accuracy and clarity in presenting the information necessary about objects.

- This course develops the engineering imagination i.e., so essential to a successful design. Learning techniques of engineering drawing changes the way one thinks about technical images.
- It is ideal to master the fundamentals of engineering drawing first and to later use these fundamentals for a particular application, such as computer aided drafting. Engineering Drawing is the language of engineers and by studying this course, engineering students will eventually be able to prepare drawings of various objects being used in technology

UNIT- I:

DEVELOPMENT OF SURFACES: Development of surfaces of Right regular solids- Prisms, Cylinder, Pyramid, Cone and their sectional parts.

UNIT- II:

ORTHOGRAPHIC PROJECTIONS: Conversion of isometric projections/ views to Orthographic Views- Conventions.

UNIT- III:

ISOMETRIC PROJECTIONS: Principles of isometric projection -isometric views-Conventions- isometric views of Lines, Plane figures, Simple and Compound Solids- Isometric projection of objects having non isometric lines.

UNIT- IV

INTERSECTION OF SURFACES: Intersection of cylinder & cylinder, intersection of cylinder & cone, and intersection of square prism into square prism.

UNIT- V

INTRODUCTION TO AUTOCAD: Co-ordinate systems, Setting of Drawing space, Preparatory commands-limits, Snap, Grid and Ortho, Viewing commands -Zoom, Pan & Osnap; Geometry commands (Only Line, Circle and Arc) and editing commands.

TEXT BOOKS:

1. Engineering Drawing, N.D.Bhat, Charotar Publishers
2. Engineering Drawing, K.L. Narayana,P.Khanniah, Scitech Pub.
3. Engineering Drawing, Basant Agrawal,C.M.Agrawal, Tata McGraw-Hill

REFERENCES:

1. Engineering Drawing, Shah and Rana, 2/e,Pearson Education
2. Engineering Drawing,B.V.R. Guptha,J.K.Publishers
3. Engineering Drawing and Graphics, Venugopal, New age Publishers
4. Engineering Drawing, Johle, Tata McGraw-Hill

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1503103	ED	Engineering Graphics	1	0	3	30	70	3

COURSE OBJECTIVE:

By studying the engineering drawing, a student becomes aware of how industry communicates technical information. Engineering drawing teaches the principles of accuracy and clarity in presenting the information necessary about objects.

- This course develops the engineering imagination i.e., so essential to a successful design. Learning techniques of engineering drawing changes the way one thinks about technical images.
- It is ideal to master the fundamentals of engineering drawing first and to later use these fundamentals for a particular application, such as computer aided drafting. Engineering Drawing is the language of engineers and by studying this course, engineering students will eventually be able to prepare drawings of various objects being used in technology.

UNIT-1:

INTRODUCTION TO ENGINEERING DRAWING

Principles of Engineering Graphics and their significance- Drawing instruments and their use- Conventions in Drawing- Lettering- BIS Conventions.

Curves used in Engineering Practice: (a) Conic sections –General methods only
(b) Cycloid, Epicycloids and Hypocycloid
(c) Involute

UNIT- II: PROJECTION OF POINTS AND LINES: Principles of orthographic projection- conventions- First and Third angle projections. Projections of points, Lines inclined to one or both planes, Problems on projections, Finding True lengths & traces.

UNIT- III: PROJECTION OF PLANES: Projections of regular plane surfaces/figures, Projection of planes using auxiliary planes.

PROJECTIONS OF SOLIDS: Projections of regular solids inclined to one or both planes..

UNIT- IV SECTIONS OF SOLIDS: Section planes and sectional views of right regular solids- Prism, Cylinder, Pyramid and Cone. True shape of sections

UNIT- V ORTHOGRAPHIC PROJECTIONS: Conversion of isometric projections/views to Orthographic Views- Conventions.

TEXT BOOKS:

1. Engineering Drawing, N.D.Bhat, Charotar Publishers
2. Engineering Drawing, K.L. Narayana,P.Khannah, Scitech Pub.
3. Engineering Drawing, Basant Agrawal,C.M.Agrawal, Tata McGraw-Hill

REFERENCES:

1. Engineering Drawing, Shah and Rana, 2/e,Pearson Education
2. Engineering Drawing,B.V.R. Guptha,J.K.Publishers
3. Engineering Drawing and Graphics, Venugopal, New age Publishers
4. Engineering Drawing, Johle, Tata McGraw-Hill

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1505105 / 1505203	ED	Programming in C	3	1	0	30	70	3

Course Objectives:

- To understand the syntax and semantics of C programming language and other features of the language
- To learn logical skills for solving problems, implement them using C language

UNIT I

Introduction to Computers: Computer Systems, Computing Environment, Computer Languages, Creating and Running Programs, System Developments, Algorithms, Flowcharts.

Introduction to the C Language: Introduction, C programs, Identifiers, Types, Variables, Constants, Input and Output, Programming Examples.

UNIT II

Structure of C program: Expressions, Precedence and Associativity, Evaluating Expressions, Type Conversion, Statements, Sample Programs.

Selections and Making Decisions: Logical Data and Operators, Two-way Selection, Multiway Selection.

UNIT III

Repetition: Concept of Loop, Pretest and Post-test Loops, Initialization and Updation, Event and Counter Controller Loop, Loops in C, Looping Applications

Functions: Introduction, User Defined Functions, Inter-Function Communication, Standard Functions, Scope, Programming Examples.

UNIT IV

Arrays: Introduction, Two Dimensional Arrays, Multi-Dimensional Arrays, Inter Function Communication, Array Applications, Exchange(Bubble) Sort, Binary Search, Linear Search.

Strings: String Concepts, C Strings, Sting Input/output Functions, Arrays of Strings, String Manipulation Functions, String/Data Conversion.

UNIT V

Enumerated, Structure, and Union Types: The Type Definition, Enumerated Types, Structure, Unions, Programming Applications.

Bitwise Operators: Exact Size Integer Types, Logical Bitwise Operators, Shift Operators, Mask, Introduction to Pointers and File management.

TEXT BOOKS:

1. Computer Science, A Structured Programming Approach Using C, Behrouz A. Forouzan & Richard F. Gilberg, Third Edition, Cengage Learning
2. Programming in ANSI C, E. Balagurusamy, Fifth Edition, McGraw Hill.

REFERENCE BOOKS:

1. How to solve it by Computer by R.G. Dromey, Pearson
2. Computer Fundamentals and C Programming, Second Edition, Dr. P. Chenna Reddy.
3. Programming in C: A Practical Approach, Ajay Mittal, Pearson.

4. The C programming Language, B. W. Kernighan and Dennis M. Ritchi, Pearson Education.
5. Problem Solving and Programming Designs in C, J. R. Hanly and E.B. Koffman.,
6. Programming with C Rema Theraja, Oxford
7. Problem Solving with C, M.T.Somashekara, PHI
8. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
9. Programming with C, R.S.Bickar, Universities Press

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1505205	PJ	Introduction to Data Structures	3	1	0	30	70	3

Course Objectives:

- To understand the concept of pointers and files
- To understand dynamic memory allocation concepts
- To implement operations on linked lists
- To understand and implement various sorting and searching methods

UNIT-I

Pointers: Introduction, Understanding pointers, Accessing the address of a variable, Declaring pointer variable, Initialization of pointer variables, Accessing a variable through its pointer, Chain of pointers, Pointer Expressions, Pointers and Arrays, Array of pointers, Pointers to functions.

UNIT-II

File Management in C: Introduction, Defining and opening a file, Closing a file, Input/Output operations on files, Random access to files, Dynamic Memory Allocation: Introduction, Dynamic memory allocation, Memory allocation process, Allocating a block of memory: malloc, Allocating multiple blocks of memory: calloc, Releasing the used space: free, Altering the size of a block: realloc

UNIT-III

Concepts of ADTs: Data structures, Storage structures & File structures, Primitive & Non-primitive data structures, Linear & Non-linear data structures Linear Lists: ADT, Array & Linked representations, simulated pointers

UNIT-IV

Arrays : ADT, Mappings, Representations, Sparse Matrices, Linked Lists: : Single Linked Lists- Insertion, Deletion, Double Linked Lists- Insertion, Deletion, Circular Linked List, Garbage collection.

UNIT-V

Sorting: Selection, Insertion, Bubble, Merge, Quick, Radix Searching: Sequential & Binary Search.

TEXT BOOKS:

1. Programming ANSI C, E. Balaguruswamy, Fifth Edition, McGraw Hill (for Units I & II)
2. Fundamentals of Data Structures, Horowitz and Sahani, Galgotia publication
3. An Introduction to Data Structures with applications, Jean Paul Trembley and Paul G. Sorenson, McGraw Hill.

REFERENCE BOOKS:

1. C Programming & Data Structures, B.A. Fourouzan and R.F. Gilberg, Third Edition, Cengage Learning.

2. Data Structures using C, A.M.Tanenbaum, Y. Langsam and M.J. Augenstein, Pearson Education/PHI, Eighth Edition.
3. Data Structures Through C, G.S. Baluja, Dhanpat Rai & Co.
4. Programming in C and Data Structures, J.R. Hanly, Ashok N. Kamathane and A. Ananda Rao, Pearson Education.
5. Data Structures and Program Design in C, R. Kruse et al, Pearson Education

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
11502205	PJ	Electrical Circuits (Common for EEE & ECE)	3	1	0	30	70	3

Objectives

This course introduces the basic concepts of circuit analysis which is the foundation for all subjects of the Electrical Engineering discipline. The emphasis of this course is laid on the basic analysis of circuits which includes single phase circuits, magnetic circuits, theorems, transient analysis and network topology.

UNIT – I

Introduction to Electrical Circuits: circuit concepts, classification of network elements, voltage & current sources; independent & dependent sources, source transformation techniques, R-L-C Parameters, Voltage - Current relationship for passive elements. Kirchhoff's laws, network reduction techniques – series, parallel, series parallel, Y/ Δ - Transformations, Mesh and Nodal analysis for D.C excitation.

UNIT – II

Single Phase AC Circuits: RMS, Average values, form factor, peak factor for different periodic waveforms, phase, phase difference, phasor notation, J-notation. Concept of Reactance, Impedance, Susceptance, and Admittance, Active & Reactive power, Power factor, power triangle. Response of R, L & C elements for Sinusoidal excitation, steady state analysis of RL, RC and R-L-C (Series, parallel, series parallel) Circuits for sinusoidal excitations, phasor diagram. Steady state analysis of A.C Circuits using mesh and nodal analysis.

UNIT – III

Series and Parallel resonance: Resonant frequency, Half Power frequency, Band width, Q- Factor, Relation between them, problems.

Locus Diagrams: Impedance & admittance locus diagrams of RL & RC Series circuits and two branch parallel circuits.

UNIT – IV

Magnetic Circuits: Concept of self & mutual inductances, Dot Convention, Problems, Coefficient of coupling, Composite Magnetic circuit, analysis of Series and Parallel Magnetic Circuits, Duality and dual Circuits, problems.

Unit – V

Network Topology: Definition – Graph, tree, Co-tree, Incidence Matrix, Tie-Set & Cut – Set Matrices for Planar networks, Formulation of equilibrium equations based on graph theory, problems.

Text Books

1. Network Analysis – Van Valkenburg - 3rd edition, PHI.
2. Engineering Circuit Analysis – William H. Hayt –Jack E. Kimmerly – TMH
3. Fundamentals of Electric Circuits – Charles's, Alexander & Mathew N.O. Sadiku, TMH 3rd Edition.
4. Electrical Circuits – N. Sreenivasulu – Reem Publications

References

1. Circuits & Networks – A. Sudhakar , Shayammohan.S. Pillai, 4th Edition – TMH.
2. Theory and Problems of Electrical Circuits – Joseph A. Edminister – Schaum Series, 1st Edition – TMH.
3. Network Analysis – N C Jagan & C. Lakshmi Narayana, BSP.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1525106 / 1525206	HS	Human Values and Professional Ethics	4	0	0	30	70	3

Course Objective:

- This course deals with professional ethics which includes moral issues and virtues, social responsibilities of an engineer, right qualities of moral leadership

UNIT - I : ENGINEERING ETHICS

Senses of Engineering Ethics – Variety of Moral issues – Types of inquiry – Moral Dilemmas – Moral Autonomy – Kohlberg’s Theory – Consensus and Controversy – Professions and Professionalism – Professional ideals and virtues

UNIT – II : ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as experimentation – Engineers as Responsible Experimenters – Research Ethics – Codes of Ethics – Industrial Standards – A Balanced Outlook on Law – The Challenger Case Study

UNIT – III : ENGINEER’S RESPONSIBILITY FOR SAFETY

Safety and Risk – Assessment of Safety and Risk – Risk benefit Analysis – Reducing Risk – The Government Regulator’s Approach to Risk – Chernobyl Case and Bhopal Case studies.

UNIT – IV : RESPONSIBILITIES AND RIGHTS

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property (IPR) – Discrimination.

UNIT – V : GLOBAL ISSUES

Multinational Corporations – Business Ethics – Environmental Ethics – Computer Ethics – Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Leadership – Sample Code of conduct.

TEXT BOOKS :

1. Mike martin and Roland Schinzinger. “ Ethics in Engineering ”, McGraw Hill, New York 2005
2. Charles E Harris. Michael S Pritchard and Michael J Rabins. “ Engineering Ethics – Concepts and Cases ”, Thompson Learning 2000.

REFERENCE BOOKS :

1. Charles D Fleddermann, “ Engineering Ethics”, Prentice Hall, New Mexico, 1999.
2. John R Baatright. “Ethics and the Conduct of Business”, Pearson Education 2003.
3. Edmund G Seabauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University press 2001.
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, “ Business Ethics – An Indian Perspective”, Biztantra, New Delhi, 2004.
5. David Ermann and Michele S Shauf, “ Computers, Ethics and Society”, Oxford University Press, 2003

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1501106 / 1501206	HS	Environmental Studies	4	0	0	30	70	3

Unit I

Multidisciplinary nature of environmental studies: Definition, scope and importance – Need for public awareness; Natural Resources: Renewable and non-renewable resources – Natural resources and associated problems; (a) Forest resources – Use and over-exploitation, deforestation, case studies – Timber extraction, mining, dams and their effects on forest and tribal people; (b) Water resources – Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems; (c) Mineral resources – Use and exploitation, environmental effects of extracting and using mineral resources, case studies; (d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies; (e) Energy resources –Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies; (f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification; Role of an individual in conservation of natural resources; equitable use of resources for sustainable lifestyles

Unit II

Ecosystems: Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystems (a) Forest ecosystem, (b) Grassland ecosystem, (c) Desert ecosystem, (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit III

Biodiversity and its conservation: Introduction – Definition : genetic, species and ecosystem diversity; Bio-geographical classification of India; Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values; Biodiversity at global, National and local levels; India as a mega-diversity nation; Hot-spots of biodiversity; Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity

Unit IV

Environmental Pollution: Definition – Cause, effects and control measures of (a) Air pollution, (b) Water pollution, (c) Soil pollution, (d) Marine pollution, (e) Noise pollution, (f) Thermal pollution, (g). Nuclear hazards; Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution – Pollution case studies; Disaster management: floods, earthquake, cyclone and landslides

Unit V

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; • Environmental ethics : Issues and possible solutions; Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies; Wasteland reclamation; Consumerism and waste products; Environment Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness

Human Population and the Environment: Population growth, variation among nations – Population explosion – Family Welfare Programme; Environment and human health; Human Rights; Value

Education; HIV/AIDS; Women and Child Welfare; Role of Information Technology in Environment and human health, case studies; Field work: Visit to a local area to document environmental assets river/forest/grassland/hill/mountain - Visit to a local polluted site-Urban/Rural/Industrial/Agricultural; Study of common plants, insects, birds; Study of simple ecosystems-pond, river, hill slopes, etc.

TEXTBOOKS:

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies by Benny Joseph, Mc. Graw Hill Publications.
3. Principles and a basic course of Environmental science for under graduate course by Kousic, KouShic.
4. Text book of Environmental Sciences and Technology by M.AnjiReddy, BS Publication.

REFERENCES:

1. Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Printice hall of India Private limited.
2. Environmental Studies by AninditaBasak – Pearson education
3. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1599107 / 1599208	BS	Physics and Chemistry Lab	0	0	3	50	50	2

PART A – ENGINEERING PHYSICS LAB

Objectives:-

- To explore the application of interference and diffraction by doing concerned experiments.
- To understand the role of laser in various applications.
- To know the significance of fiber parameters in communication application.
- To understand the concept of energy gap, Hall effect, B-H curve, X-ray diffraction and synthesis of nano material by performing the experiments.

LIST OF EXPERIMENTS

Any 7 of the following experiments has to be performed in a semester:

1. Determination of wavelengths of various colours of mercury spectrum using diffraction grating in normal incidence method.
2. Determination of dispersive power of the prism.
3. Determination of thickness of thin object by wedge method.
4. Determination of radius of curvature of lens by Newton’s Rings.
5. Laser : Determination of wavelength using diffraction grating.
6. Determination of Numerical aperture and acceptance angle of an optical fiber.
7. Energy gap of a semiconductor using p-n junction diode.
8. Hall effect: Determination of mobility of charge carriers in semiconductor
9. Hysteresis: B-H curve
10. Magnetic field along the axis of a current carrying coil – Stewart and Gee’s method.
11. Determination of crystallite size using X-ray pattern (powder) by using Debye-Scherer method.

12. Synthesis of nanomaterials by any convenient method.

Outcomes:-

- Students can aware of the application of interference, diffraction phenomena along with laser.

The basic concept of fiber parameters, energy gap, Hall effect, B-H curve, X ray diffraction technique, along with synthesis of nano-materials can be elucidated by the students

PART B – ENGINEERING CHEMISTRY LAB

OBJECTIVES

- The objective of the course is that the student will have exposure to various experimental skills which is very essential for an Engineering student.
- The experiments are selected from various areas of Chemistry like Conductometry, Polymers, Energy sources and water.
- Also the student is exposed to various tools like Analytical Balance, pH meter, Viscometer, Bomb calorimeter, etc.

LIST OF EXPERIMENTS

Introduction to Lab - Analytical Balance, Molarity, Normality, Calculations, Glass wares.

- 1 Determination of total hardness of water by EDTA method.
- 2 Estimation of Dissolved Oxygen present in given water sample by Winkler's method
- 3 Determination of viscosity of oils by Redwood viscometer I.
- 4 Determination of viscosity of oils by Redwood viscometer II.
- 5 Determination of calorific value of fuel sample using Bomb Calorimetry.
- 6 Estimation of Iron by Diphenyl amine indicator.
- 7 Determination of Copper by EDT A method.
- 8 Conductometric titrations of Strong acid Vs Strong base(NaOH).
9. Colorimetric estimation of Manganese.
10. pHmeter calibration and measurement of pH of water and various other samples.

REFERENCES

1. Vogel's Text book of Quantitative Chemical Analysis, J. Mendham et.al., Pearson Education, Sixth Edition, 2012.
2. Laboratory manual on Engineering Chemistry, Anupama Rajput, Dhanpat Rai & Co Publications.
3. Essentials of Experimental Engineering Chemistry, Shashichawla, Dhanpat Rai & Co Publications.

OUTCOME

The student is expected to learn from this laboratory course the concept of error and its analysis. It also allows the student to develop experimental skills to design new experiments in Engineering. With the exposure to these experiments the student can compare the theory and correlate with experiment

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1599108 / 1599207	ED	Engineering Workshop	0	0	3	50	50	2

PART A – Engineering Workshop

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

1. TRADES FOR EXERCISES:

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

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

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

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

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

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

REFERENCE BOOKS:

1. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
2. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas
3. Dictionary of Mechanical Engineering, GHF Nayler, Jaico Publishing House

PART B – IT Workshop

Course Objectives:

- To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations.
- To make the students know about the internal parts of a computer, assembling a computer from the parts, preparing a computer for use by installing the operating system.
- To learn about Networking of computers.

Task 1: Learn about Computer: Identify the internal parts of a computer, and its peripherals.

Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 2: Assembling a Computer: Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods available (eg: beeps). Students should record the process of assembling and trouble shooting a computer.

Task 3: Install Operating System: Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process. Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process.

Task 4: Networking: Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimping activity, logical configuration etc should be done by the student. The entire process has to be documented.

Task 5: Word Processor: Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the color, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered.

Task 6: Presentations: creating, opening, saving and running the presentations, Selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show. Students should submit a user manual of the Presentation tool considered.

REFERENCE BOOKS:

1. Introduction to Computers, Peter Norton, Mc Graw Hill.
2. MOS study guide for word, Excel, Powerpoint & Outlook Exams”, Joan Lambert, Joyce Cox, PHI.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Networking your computers and devices, Rusen, PHI.

Trouble shooting, Maintaining & Repairing PCs”, Bigelows, TMH

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1505107 / 1505208	ED	Programming in C Lab	0	0	3	50	50	2

Objectives:

- To make the student learn C Programming language.
- To make the students solve problems, implement them using C language.

The Student is expected to solve at least 12 assignments from different concepts (every year 12 different experiments).

SAMPLE LIST OF EXPERIMENTS:

1. Practice DOS/LINUX commands necessary for design of C programs.
2. Write, edit, debug, compile and execute sample C programs to understand the programming environment.
3. a) Write a C program to find the sum of the individual digits of a given number.
b) Write a C program to check whether a given number is a palindrome or not.
4. a) Write a C program to generate & print first n terms of the Fibonacci sequence.
b) Write a C program to find the roots of a quadratic equation.
5. a) Write a C program to compute the factorial of a given number.
b) Write a C program to generate all the prime numbers within a given range
6. a) Write a C program to generate PASCAL triangle.
b) Write a C program to find the GCD of two integers.
7. a) Write a C program to evaluate the function Sin(x) as defined by the infinite series expression.

$$\sin(x) = \frac{x}{1!} - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots$$

b) Write a C program to find the square root of a given number.
8. a) Write a C program to find both smallest and largest number in a list of integers.
b) Write a C program to perform multiplication of two matrices.
9. Write a C program to read a matrix and perform the following operations.
 - i) Print transpose of a matrix.
 - ii) Removal of duplicates from an ordered array.
10. a) Write a C program to perform arithmetic operations using functions.
b) Write a C program to find the factorial of a given number using recursive function.
11. a) Write a C program to count the number of vowels, constants, blank spaces, digits and special characters in a given string.
b) Write a C program to check whether a given string is palindrome or not.
12. Write a C program to read two strings and perform the following operations without using built-in string library functions.
 - i) String length determination.

- ii) Comparison of two strings.
- iii) Concentration of two strings.
- iv) String reversing.

12. Write a C program to define a structure with the following members.

Roll No., Name, marks in Sub1, Sub2, Sub3. Read the n students records and find the total marks of each student and print the result in the following format.

Roll No.	Name	Sub1	Sub2	Sub3	Total Marks	Result
1234	XXX	40	50	90	180	Distinction

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1524108 / 1524207	HS	English Language and Communication Skills Lab	0	0	3	50	50	2

Objectives:

- To improve the language, proficiency of the students in English with an emphasis on LSRW Skills.
- To develop an awareness in the students about the significance of silent reading and comprehension.
- To equip the students to study academic subjects with greater facility through theoretical and practical components of the syllabus.
- To develop study skills as well as communication in formal and informal situations.
- To enable students to express themselves fluently and appropriately in social and professional contexts.
- To develop an awareness in the students about writing as an exact and formal skill.

LANGUAGE LAB

1. Phonetics
2. Situational Dialogues
3. Telephonic Skills
4. Describing Objects / Situation / People and Places
5. Information Transfer
6. Idioms

COMMUNICATION LAB

1. Introducing oneself
2. JAM Session
3. Extempore / Elocution
4. Role-play
5. Debate
6. Group Discussion

Suggested Software: Walden & K-Van Solutions