P R E F A C E

Indian Institute of Technology, Gandhinagar (IITGN) is one of the Institutes of Technology in the country, set up with the objective of making available facilities for higher education, research and training in various fields of Science and Technology. The institute has recently been established and the first batch of the B.Tech. programme has been inducted through JEE-2008. IIT Bombay has been identified as the mentoring institute for IIT Gandhinagar. IIT Bombay's vision to be the fountainhead of new ideas and innovators in technology and science is inherently available to IITGN also. IITGandhinagar look forward to create an ambiance in which new ideas, research and scholarship flourish and from which the leaders and innovators of tomorrow emerge.

To begin with three disciplines viz. Chemical Engineering, Electrical Engineering and Mechanical Engineering has been started w.e.f. academic year 2008-09. IIT GN also follows the specialized semester based academic system for imparting education as is prevalent in other IITs. There are two Semesters in an academic year (*Autumn* – July-Nov; and *Spring* – January-April). The students are required to follow the laid down procedures and meet the academic requirements of each semester to progress in their respective study programme. The courses of study bulletin contain the curricula and syllabi for the 4year B.Tech. degree of IIT Gandhinagar. The curricula for the firs two semesters are common to all disciplines. However, the remaining curricula are discipline / department oriented.

The academic programmes of the institute is governed by Rules and Regulations approved by the Academic Council from time to time. The Academic Council is a statutory and supreme body that governs all academic matter and rulings of Chairman, Academic Council are final in regard to all academic matters. The Academic Council continuously monitors the academic programmes and makes appropriate modifications / improvements as and when required in the courses of study.

We are looking forward to make IIT Gandhinagar, a student-oriented place and our endeavor is to ensure that the students get the best of every thing that is needed to create outstanding scientists and engineers.

We wish our students a very bright and successful career.

Dean (AP/SA)

July, 2009

INTRODUCTION

Bachelor of Technology (B.Tech.) programmes consists of courses in basic sciences, humanities and social sciences, engineering and technology and other related topics. The sequence of studies broadly consists of three phases.

The first phase is an intense study of sciences, mathematics and humanities for deeper understanding of concepts than what was done in school. This is common for all UG Programmes.

The second phase is the study of engineering sciences and technical arts (*such as workshop, engineering graphics, etc.*). This emphasizes a broad based knowledge in general engineering, and engineering methodologies, and enables the students to appreciate the links between science and engineering. This phase is also, by and large, common for all UG programmes, and overlaps with the first phase.

In the third phase, the students are exposed to subjects in their chosen areas of study, designed to train them in the methodologies of analysis of problems and synthesis of solutions. The courses dwell on the principles governing systems and processes, and develop in them the ability for physical and analytical modeling, design and development. They are also introduced to engineering practice through laboratory courses, works visits, practical training, projects etc., and these may vary from discipline to discipline.

In parallel with the third phase, students can strive to broaden their perspectives through two open electives where s/he can take courses drawn from across the Institute.

At various stages of the programme, students are initiated into research methodologies, library reference work, use of engineering and scientific equipments / instruments, learning of modern computational techniques, writing of technical and scientific reports and effective communication.

Apart from the minimum credit requirements for the award of the degree, opportunities exists for supplementing the learning experience by crediting additional courses, in diverse areas. These additional credits when they are in focused areas can earn the students credentials like Minor / Honors.

At present creation of the infrastructural facilities and processes for recruitment of various faculty positions are under progress, hence, it may not be possible to offer Minor courses immediately w.e.f. 2nd year. However, Minor / Honors courses will be offered to the students at the earliest possible opportunity.

The requirements for degree programmes run by the Institute are broadly classified as:

- **Institute Requirements** (*further divided into Compulsory courses, Elective courses and other requirements.*)
- **Departmental Requirements (***further divided into Compulsory courses, Elective courses and other requirements***).**

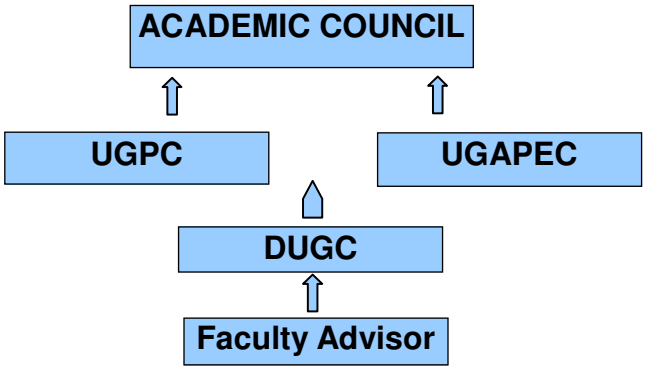
Syllabuses of various programmes are given in the this courses of study Bulletin.

Organizational Structure for Academic Administration

The academic programmes of the Institute are governed by Rules and Regulations approved by the Academic Council from time to time. The Academic Council is the supreme body that governs all academic matters of the Institute, and the rulings of Chairman, Academic Council (i.e. the

Director of the Institute) are final in regard to all academic issues. A definite time schedule is set by the Council for various academic activities, through an Academic Calendar issued in the beginning of each academic year. The Council continuously assesses the academic programmes and makes appropriate revisions / modifications / improvements as and when required through the Institute level committee known as the Under-Graduate Programmes Committee (UGPC). Dean of Academic Programmes (Dean, AP) is the Convener of the UGPC. Similarly, performance of each student is monitored by another committee known as Under-Graduate Performance Evaluation Committee (UGAPEC). These two committees make recommendations to the Academic Council, and, in turn seek / receive opinions / recommendations, as and when required, from the Department level committees known as Department Under-Graduate Committee (DUGC) in each department. The DUGCs handle all academic matters, related to both academic programmes as well as performance of individual students. The Head of the Department is the Convener for DUGC. Administrative back-up for all academic matters is provided by the Academic Office, with a Deputy / Asstt. Registrar (Academic) as in-charge.

On joining the Institute, a student or a group of students is/are assigned to a Faculty Advisor from his/her Department. Students are expected to consult the Faculty Advisor on any matter relating to their academic performance and the courses they may take in various semesters / summer terms. The idea of a Faculty Advisor has been evolved to extend guidance to the students enabling them to complete their courses of study for the required degree in a smooth and satisfactory manner. If on any academic matter a student would like to approach this administrative structure, it is always through the DUGC with advice and recommendations from her /his Faculty Advisor.



Organizational structure for academic matters

CURRICULUM / PROGRAMME OF STUDY

Curriculum

Every Department has a prescribed course structure which in general terms is known as the Curriculum or the Courses of Study (CoS). It prescribes all the courses / labs. / other requirements for the degree and sets out the nominal sequence semester-wise. It also gives the syllabus and a list of text / reference books for each course. This booklet contains the courses of study approved recently by the Academic Council of IIT Gandhinagar.

Semester – autumn, spring, summer

As mentioned earlier, IIT Gandhinagar follows a specialized credit-based semester system. There are two regular semesters in a year. The semester that begins in July (*July to Nov.*) is known as the *Autumn Semester* or *Semester 1* and the semester that begins in January (*Jan. to April)* is known as the *Spring Semester* or *Semester 2.* During the summer vacation, i.e., (May-June), there is one additional semester for summer courses known as the *summer term. A* few numbers of courses may be offered during the summer terr, allowing students to clear failed/dropped courses, or courses towards the requirement of Minor/Honors etc.

Course Credit Structure

In general a certain quantum of academic work measured in terms of credits is laid down as the requirements for a particular degree. A student earns credits by satisfactorily clearing courses/other academic activities every semester. The amount of credit associated with a course is dependent upon the number of hours of instruction per week in that course. Similarly the credits associated with any of the other activities are dependent upon the quantum of work expected to be put in for each of the other activity per week.

Theory and Laboratory Courses

Courses are broadly classified as *Theory courses* and *Laboratory Courses.* Theory courses consist of lecture (**L**) and tutorial (**T**) hours, but may have attached practical (**P**) hours in special cases. Laboratory courses consist of practical hours, but may have attached tutorial hours in special cases. Credit (**C**) for a course is dependent on the number of hours of instruction per week in that course, and is obtained by using a multiplier of two (**2**) for lecture and tutorial hours, and a multiplier of one (**1**) for laboratory hours. Thus, for example, a theory course having two lectures and one tutorial per week throughout the semester carries a credit of 6. Similarly, a laboratory course having one tutorial and three laboratory hours per week throughout semester carries a credit of 5. For example -

Theory course

L	T	P	C
2	1	0	6

Laboratory course

L	T	P	C
0	1	3	5

In the Courses of Study bulletin, if a course is shown as, say, ***CE304 Soil Mechanics II: 2 1 0 6***, it indicates the following:

Theory course

Course detail	***Indicates the following***
CE	Alphabetic code for Civil Engineering Department course.
3	Year / Level code (This indicates that the course is offered in the Third year)
04	Serial Number and the Semester indicator (*last digit indicates even or odd semester. Even = Spring Semester; Odd = Autumn Semester*)
Soil Mechanics II	Title of the course
2 1 0 6	L T P C (credit structure)

Laboratory Course - **(CE218: Hydraulic Design Lab.: 0 1 3 5**)

Course detail	***Indicates the following***
CE	Alphabetic code for Civil Engineering Department course.
2	Year / Level code (This indicates that the course is offered in the Second year)
18	Serial Number and the Semester indicator (*last digit indicates even or odd semester. Even = Spring Semester; Odd = Autumn Semester*)
Hydraulic Design Lab	Title of the course
0 1 3 5	L T P C (credit structure)

Lab courses usually have either a 1 or a 6 as the middle digit in the course number.

Other academic activities consist of Seminar and Projects, Practical Training, Works Visit and

NSO/NSS/NCC. These are credit as well as non-credit requirements. Seminars, Projects are credit requirements, whereas NSO / NSS / NCC, Practical Training (PT), Works Visit etc. are non-credit requirements.

Minimum credit requirements and planning of individual academic programme

Depending on the discipline, the minimum credit required for award of a B.Tech. degree is between **252** and **264**. This is nominally divided into 108 credits as Institute requirements and 144 -156 credits as Departmental requirements. The credits are distributed semester-wise as shown in the Courses of Study bulletin for each department. Courses generally progress in sequences, building competencies and their positioning indicates certain academic maturity on the part of the students. Some courses do, in addition, specify passing in courses offered earlier in the programmes as pre-requisites. Students are expected to follow the semester-wise schedule of courses given in the Courses of Study bulletin; they do, however, have a freedom to follow alternative schedules to optimize their academic profile with additional learning, keeping the requirements for each course in mind. For students with backlog courses, such rescheduling may even become necessary. Such departures from suggested schedules need to be done very carefully, and always with advice from the Faculty Advisor.

Opportunities for Additional Learning: Minor and Honors etc.

(will be offered as soon as the infrastructural facilities and faculty requirement is met.)

The B.Tech. Programme recognizes the fact that students' aspirations, on one hand, and the demands of the work place, on the other, have become highly diverse. Every student has specific abilities, interests and career goals. Employers too look for people with different combinations of competencies and flavors.

Each department prescribes a minimum of credits, and courses that would qualify a candidate for the award of the B.Tech. degree. As mentioned earlier, the total credits for the B.Tech. programme for example varies between **252-264** depending on the discipline. This approximately converts itself into about four theory courses and one or two laboratory courses or other activities like seminar, project, etc., every semester. All the students in that discipline require undergoing this programme. This minimum content may not have much flexibility.

It is expected that all students with reasonably good academic standing, utilize this surplus time for enhancing their academic learning experience, though the initiative is left entirely to them. They can use it to credit an assortment of courses / projects anywhere in the Institute, (subject to requirements of each of these courses being met), to gain a wide exposure. These additional academic accomplishments will find a separate mention in the transcript. They can also credit focused activities which can qualify as a Minor / Honors (details below). They may alternatively devote part or all of the additional time for extra-curricular activities (including social work) if they so desire, and gain hands-on administrative / managerial / aesthetic skills or sensitivity towards social issues.

Since seats available in such courses will always be limited and competition severe, students aspiring to do these additional courses have to maintain high academic standing to register in these courses. Sustained hard work and diligence throughout the duration of the programme is necessary to maintain the academic standing and gain entry to courses of one's choice.

This additional time will be used by students with backlogs (failed or dropped courses) to clear them with proper classroom learning. They may not be able to take the courses towards additional accomplishments mentioned above, if any of her/his backlog courses is running in a particular semester, or s/he does not have adequate academic standing.

MINOR

Minor is an additional credential a student will earn if s/he does 30 credits worth of additional learning in a discipline other than her/his major discipline of B.Tech. degree. All academic units in the Institute will offer minors in their disciplines, and will prescribe what set of courses and/or other activities like projects is necessary for earning a minor in that discipline.

A student **does not pre-register** for a Minor. S/he accumulates credits by registering for the required courses, and if the requirement for a particular Minor is met within the prescribed minimum time limit for the course, the Minor will be awarded. This will be mentioned in the Degree Certificate as "***Bachelor of Technology in xxx with Minor in yyy.***" The fact will also be reflected in the transcript, along with the list of courses taken.

Since the number of seats available for each of the courses will always be limited, one has to compete for a place in every course. Maintaining a high academic standing therefore is essential for completing all the requirements for a Minor as mentioned earlier. Even if one specified course cannot be earned during the course of the programme, that Minor will not be awarded. The individual course credits earned however will be reflected in the respective grade card / transcript.

For the award of the Minor, all requirements towards the basic degree and the Minor have to be completed within the stipulated period of the programme one is registered for.

HONORS

Honors is an additional credential a student will earn if s/he opts for and earns the extra 30 credits in her/his **own discipline**. The concerned department specifies the credit requirements for earning the Honors. Honors are not indicative of class.

As in the case of Minors, a student **does not register for Honors**. S/he accumulates credits by registering for the required courses. On successful accumulation of credits at the end of the programme, honors will be awarded and mentioned in the Degree Certificate as "Bachelor ***of Technology in xxx, with Honors.***" The fact will also be reflected in the transcript, along with the list of courses etc. taken.

For the award of the honors, all requirements towards the basic degree and the honors have to be completed within the stipulated period of the programme one is registered for.

Two Minors etc. for Students with Excellent Academic Standing

Students with excellent standing (Category I, CPI ≥ 8.0, no backlogs) can opt for earning two Minors and / or an Honors and a Minor, if time table permits, by overloading courses as per rule. Students should however, take due care to see that they are not over stretching themselves by opting for such overloads over extended periods.

Semester-wise registration

IIT Gandhinagar follows a specialized credit based semester system, therefore registration at the beginning of each semester on the prescribed dates announced in the Academic Calendar, is mandatory for every student till s/he completes her/his programme. If a student do not register in a particular semester without prior permission of the UGAPEC, her/his studentship is liable to be canceled. Students are not permitted to re-register for course/(s), which they have already passed. Any academic activity (course / seminar / project etc) undergone by a student without registration will not be counted towards the requirements of her/his degree.

A separate booklet containing the rules and regulations for governing B.Tech. programme as approved by the Academic Council is also available. It would be desirable for all the students to through the rules and regulations booklet and get fully acquainted with the academic system of the Institute.

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Course Curriculum for B.Tech. Programme : Chemical Engineering Department

Semester I					
Course code	Course Name	Credit structure			
		L	T	P	C
CH 101	Chemistry	2	1	0	6
CS 101	Computer Programming & Utilization	2	0	2	6
HS 101 HS 103	English Language Course * Introduction to Philosophy	3	0	0	6
MA 101	Calculus	3	1	0	8
PH 101	Electricity and Magnetism	2	1	0	6
PH 111	Physics Lab.	0	0	3	3
ME 101	Engineering Graphics & Drawing	0	1	3	5
NC 101#	National Cadet Corps (NCC)	0	0	0	P/NP
NO 101#	National Sports Organization (NSO)	0	0	0	P/NP
NS 101#	National Service Scheme (NSS)	0	0	0	P/NP
					40

* For students deficient in English Language

Semester II					
Course Code	Course Name	Credit Structure			
		L	T	P	C
PH 102	Modern Physics	3	1	0	8
HS 102	Economics	3	0	0	6
CL 102 EE 102	Introduction to Chemical Engg (**for CL**) Intro. to Electrical and Electronic Circuits* **(for EE and ME)**	3	0	0	6
MA 102 MA 104	Linear Algebra Ordinary Differential Equation - I	3 3	1 1	0 0	4 4
ME 102	Workshop Practice	0	1	3	5
CH 112	Chemistry Lab	0	0	3	3
NC 102#	National Cadet Corps (NCC)	0	0	0	P/NP
NO 102#	National Sports Organization (NSO)	0	0	0	P/NP
NS 102#	National Service Scheme (NSS)	0	0	0	P/NP
					36

Any one of these courses to be taken

Semester III					
Course code	Course Name	Credit structure			
		L	**T**	**P**	**C**
CL 201	Solid Mechanics	2	1	0	6
MA 201	Complex Analysis	3	1	0	4
MA 203	Differential Equations - II	3	1	0	4
CL 203	Chemical Engineering Thermodynamics	3	1	0	8
CL 205	Introduction to Transport Phenomena	2	1	0	6
CL 211	Introductory Chemical Lab	0	0.5	3	4
					32

Semester IV					
Course code	Course Name	Credit structure			
		L	T	P	C
ES 202	Environmental Studies (half semester)	2	1	0	3
HS 202	Environmental Studies (half semester	2	1	0	3
CL 202	Fundamentals of Heat and Mass Transfer	2	1	0	6
CL 204	Process Fluid Mechanics	2	1	0	6
CL 206	Introduction to Numerical Analysis	3	1	0	8
CL 212	Chemical Engineering Lab – I	0	0	6	6
					32
HONORS					
CL xxx	Honors Elective	2	1	0	**6**

Semester V					
Course code	Course Name	Credit structure			
		L	T	P	C
EE 102	Introduction to Electrical and Electronics Circuits	3	1	0	8
BT 301	Molecular Cell Biology	2	1	0	6
HS 3xx	HSS elective	3	0	0	6
CL301	Mass Transfer Operations	2	1	0	6
CL 311	Chemical Engineering Lab-II	0	0	6	6
EE 313	Basic Electric Circuits Lab.	0	0	3	3
					35
HONORS					
CL xxx	Honors Elective	3	0	0	**6**

Semester VI					
Course code	Course Name	Credit structure			
		L	T	P	C
CL 302	Chemical Reaction Engineering	3	1	0	8
CL 304	Material Science	3	0	0	6
XX xxx	Institute Elective – I	3	0	0	6
EE xxx	Department Elective – I	3	0	0	6
CL 312	Chemical Engineering Lab. -III	0	0	6	6
					32
HONORS					
CL xxx	Honors Elective	2	1	0	**6**

Semester VII					
Course code	Course Name	Credit structure			
		L	T	P	C
CL 401	Process Equipment Design and Economics	3	0	0	6
CL 403	Process Control	3	1	0	8
CL xxx	Department Elective – II	3	0	0	6
XX xxx	Institute Elective – II	3	0	0	6
CL 411	Chemical Engineering Lab.-IV	0	0	6	6
					32
HONORS					
CL xxx	Honors Elective	3	0	0	**6**

Semester VIII					
Course code	Course Name	Credit structure			
		L	T	P	C
CL402	Chemical Processes	3	0	0	6
CL404	Chemical Process Design	3	0	0	6
CL411	Design Lab. - I	0	0	3	3
CL413	Design Lab. - II	0	0	3	3
CL xxx	Department Elective - III	3	0	0	6
CL xxx	Department Elective - III	3	0	0	6
					30
HONORS					
CL xxx	Honors Elective	3	0	0	**6**

i	Title of the Course	Chemistry	Course Code	CH 101
ii	Credit structure	L T P C 1 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Schrodinger equation (origin of quantization), Born interpretation of wave function, Hydrogen atom: solution to Φ-part, MO theory: atomic and molecular orbitals, Structure, bonding and energy levels of diatomic molecules. Examples N2, O2, CO and HF, Configuration, molecular chirality and isomerism, Conformation of alkanes and cycloalkanes, Reactivity of carbonyl group (addition reactions, reactions due to acidic proton, addition-elimination reactions and reactivity of acid halide, ester and amide), Functional group interconversions involving oxidation and reduction, Periodic properties: trends in size, electron affinity, ionization potential and electronegativity, Use of Ellingham diagram and thermodynamics in the extraction of elements, Transition metal chemistry: inorganic complexes, bonding theories, magnetism, bonding aspects and structural distortion, Bioinorganic chemistry: storage and transport proteins, Catalysis: hydrogenation, hydroformylation and olefin metathesis			
v	Texts/References P.W.Atkins, Physical Chemistry, Oxford University Press, 7th Edition, 2006. G.M.Barrow, Physical Chemistry, 5th Edition, Tata McGraw-Hill, New Delhi, 1992. D.A.McQuarrie and J.D. Simon, Physical Chemistry - a molecular approach, Viva Books Pvt. Ltd. (1998). R.T.Morrison and R.N. Boyd, Organic Chemistry, Prentice Hall of India Pvt. Ltd., 5th Ed, 1990 L. G. Wade, Organic Chemistry, Pearson Education 6th Ed, 2006. G. Solomons and C. Fryhle, Organic Chemistry, John Wiley & Sons (Asia) Pte Ltd. M.J.Sienko and R.A.Plane, Chemical Principles and Applications, McGraw Hill, 1980. J.D.Lee, Concise Inorganic Chemistry, 4th Edition, ELBS, 1991. D.D.Ebbing, General Chemistry, Houghton Miffin Co., 1984.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All departments		

<table>
<tr><td>i</td><td>Title of the Course</td><td>Computer Programming and Utilization</td><td>Course code</td><td>CS 101</td></tr>
<tr><td>ii</td><td>Credit structure</td><td colspan="3">L T P C
2 0 2 6</td></tr>
<tr><td>iii</td><td>Prerequisite, if any(for the students)</td><td colspan="3">High School Mathematics</td></tr>
<tr><td>iv</td><td colspan="4">Course Content
<u>Description:</u> This course provides provides an introduction to problem solving with computers using a modern language such as Java or C/C++. Topics covered will include:

A. Utilization: Developer fundamentals such as editor, integrated programming environment, Unix shell, modules, libraries.
B. Programming features: Machine representation, primitive types, arrays and records, objects, expressions, control statements, iteration, procedures, functions, and basic i/o.
C. Sample problems in engineering, science, text processing, and numerical methods.</td></tr>
<tr><td>v</td><td colspan="4">Texts/References
1. G. Dromey, How to Solve It by Computer, Prentice-Hall, Inc., Upper Saddle River, NJ, 1982
2. Polya, G., How to solve It (2nd ed.), Doubleday and co. (1957).
3. C++ Program Design: An introduction to Programming and Object-Oriented Design. Tata McGraw Hill. Coohoon and Davidson. 3rd edition. 2003.
4. Let`s C. Yashwant Kanetkar. Allied Publishers, 1998.
5. The Java Tutorial, Sun Microsystems. Addison-Wesley, 1999.</td></tr>
<tr><td>vi</td><td>Instructor(s)name</td><td colspan="3"></td></tr>
<tr><td>vii</td><td>Name of other departments to whom the course is relevant</td><td colspan="3">All Department</td></tr>
</table>

i	Title of the Course	Economics	Course Code	HS 102
ii	Credit structure	L T P C 3 0 0 6		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Basic economic problems. Resource constraints and Welfare maximizations. Nature of Economics: Positive and normative economics; Micro and macroeconomics, Basic concepts in economics. The role of the State in economic activity; market and government failures; New Economic Policy in India. Theory of utility and consumer's choice. Theories of demand, supply and market equilibrium. Theories of firm, production and costs. Market structures. Perfect and imperfect competition, oligopoly, monopoly. An overview of macroeconomics, measurement and determination of national income. Consumption, savings, and investments. Commercial and central banking. Relationship between money, output and prices. Inflation - causes, consequences and remedies. International trade, foreign exchange and balance payments, stabilization policies : Monetary, Fiscal and Exchange rate policies.			
v	Texts/References 1. P. A. Samuelson & W. D. nordhaus, Economics, McGraw Hill, NY, 1995. 2. A. Koutsoyiannis, Modern Microeconomics, Macmillan, 1975. R. Pindyck and D. L. Rubinfeld, Microeconomics, Macmillan publishing company, NY, 1989. 3. R. J. Gordon, Macroeconomics 4th edition, Little Brown and Co., Boston, 1987. William F. Shughart II, 4. The Organization of Industry, Richard D. Irwin, Illinois, 1990.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All Departments		

i	Title of the Course	Calculus	Course code	MA 101
ii	Credit structure	L T P C 3 1 0 8		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Review of Limits, continuity, differentiability. Mean value theorem, Taylors Theorem, Maxima and Minima. Riemann integrals, Fundamental theorem of Calculus, Improper integrals, applications to area, volume Convergence of sequences and series, power series. Partial Derivatives, gradient and directional direvatives, chain rule, maxima and minima, Lagrange multipliers. Double and Triple integration, Jacobians and change of variables formula. Parametrization of curves and surfaces, vector Fields, Line and surface integrals. Divergence and curl, Theorems of Green, Gauss, and Stokes.			
v	Texts/References 1. Hughes-Hallett et al, *Calculus – Single and Multivariable* (3rd Edition), John-Wiley and Sons (2003) 2. James Stewart, *Calculus* (5th Edition), Thomson (2003) 3. T.M. Apostol, *Calculus*, Volumes 1 and 2 (2nd Edition), Wiley Eastern 1980 4. G.B.Thomas and R.L.Finney, *Calculus and Analytic Geometry* (9th Edition), ISE Reprint, Addison-Wesley, 1998.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All Departments		

i	Title of the Course	Electricity and Magnetism	Course code	PH 101
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Electrostatics : Coulomb's law, Gauss theorem, electric potential, Laplace's equation, Poisson's equation, electrostatics with conductors, capacitors, dielectrics. Magnetostatics : Biot Savart's law, Ampere's law, Lorentz force. Magnetic Induction : Faraday's law, Lenz's law, self and mutual inductance, energy in a magnetic field, LCR circuit, resonance. Maxwell's equations : displacement current, electromagnetic waves, plane wave solutions of Maxwell's equations, Poynting vector, wave propagation through a boundary, reflection, refraction, absorption and skin depth.			
v	Texts/References 1. A.S. Mahajan and A. Rangawala, Electricity and Magnetism, Tata McGraw Hill, 1989. 2. D. Griffiths, Introduction to Electrodynamics, 2nd ed., Prentice Hall, 1989.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All departments		

i	Title of the Course	Chemistry Lab	Course code	CH 112
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content	Experiments illustrating the concepts of 1) galvanic cells, (2) thermochemistry, (3) chemical kinetics, (4) equilibrium constant, (5) analysis by oxidation reduction titration.		
v	Texts/References	--		
vi	Instructor(s)name	--		
vii	Name of other departments to whom the course is relevant	All departments		

i	Title of the Course	Engineering Graphics and Drawing	Course code	ME 101
ii	Credit structure	L T P C 0 1 3 5		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Introduction to engineering drawing and orthographic projections; Projection of points and straight line; Projection of planes and solids; Projection of simple machine elements; Development of surfaces, Intersection of surfaces; Construction of isometric views from orthographic projections. v			
v	Texts/References Bhatt N. D. and Panchal V. M., Engineering Drawing, Charotar Publishers, Anand, 2007. Luzadder Warren J. and Duff Jon M., Fundamentals of Engineering Drawing, Prentice Hall of India, 2001. French Thomas E. and Vierck Charles J., Engineering Drawing and Graphic Technology, McGraw Hill, 1993. Jolhe Dhananjay A., Engineering Drawing, Tata McGraw Hill, 2007. Shah M. B. and Rana B. C., Engineering Drawing, Dorling Kindersley (India) Pvt. Ltd, Pearson Education,			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Modern Physics	Course Code	PH 102
ii	Credit structure	L T P C 3 1 0 8		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Special theory of relativity: Galilean and Lorentz transformation, space time viewpoints, Minkowski space and four vectors, energy momentum conservation. Review of quantum concepts, Black body radiation, particle nature of light, photoelectric effect, Compton effect, matter waves, wave packets, phase and group velocity, Davisson Germer experiment, Franck-Hertz experiment, Heisenberg uncertainty principle. Schrödinger equation, probabilistic interpretation of wave function. One dimensional problems-particle in a box, potential well, potential barrier and tunneling, harmonic oscillator. Hydrogen atom. Elements of statistical Physics: Maxwellian distribution, Bose-Einstein and Fermi-Dirac distributions.			
v	Texts/References 1. H.S. Mani and G.K. Mehta, Introduction to Modern Physics. 2. S.H. Patil, Elements of Modern Physics. 3. K.S. Kane, Modern Physics 4. A. Beiser, Concepts of Modern Physics			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All Departments		

i	Title of the Course	**Introduction to Philosophy**	Course Code	HS 103
ii	Credit structure	L T P C 3 0 0 6		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content The course will acquaint the students of science and engineering with some issues on the nature and methods of science and mathematics, and the ethical issues arising out of the application of science and technology. The objective is to develop a critical, reflective and historical awareness on the issues relating to the following topics: Philosophy and History of Science: Growth of scientific knowledge: factors leading to the emergence of modern science. Conceptual evolution: internal and external history. Methodology of science: induction, falsificationism, confirmation and probability. Nature of scientific laws and theories: realism, instrumentalism and under determination. Relationship between scientific observation, experiment and scientific theory. Nature of scientific explanation: teleological explanations and the covering law model. Selected case studies on scientific theories.Logic and the nature of mathematical reasoning: Inductive and deductive forms of reasoning. Nature of axioms: formal axiomatic systems. Concept of consistency, independence and completeness. Nature of rules of inference and proof. Selected examples of axiomatic systems and proof procedures. Cognition: Current approaches to the understanding of mind and mental processes: empiricist, rationalist, behaviourist and cognitivist. Ethics: Impact of science and technology on man and society: elements of environmental and professional ethics.			
v	Texts/References A.C. Grayling (Ed.) Philosophy; A Guide through the subject, Oxford University Press, Londown, 1995.Marx W. Wartofsky, Conceptual Foundations of Scientific Thought: An Introduction to the Philosophy of Science, Macmillan, London 1968.I.B. Cohen, The Birth of a New Physics, Penguin Books, 1985.H. Eves and C.V. Newsom, Foundations and Fundamental Concepts of Mathematics, Boston, PWS-Kart Pub. Co., 1990.K.E. Goodpaster and K.M. Sayre (Eds.) Ethics and Problems of 21st Century, Univ. of Notre Dame Press, London, 1979.S.D. Agashe, A.Gupta and K. Valicha (Eds.) Scientific Method, Science, Technology and Society: A Book of Readings, Univ. of Bombay Press 1980.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All Departments		

i	Title of the Course	Introduction to Chemical Engineering	Course code	CL102
ii	Credit structure	L T P C 3 0 0 6		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Historical overview of Chemical Engineering: Concepts of unit operations and unit processes, and more recent developments, Features of organized chemical processing - from chemistry to chemical engineering. The Chemical Industry-scope, features and characteristics and scope. Principles of balancing with examples to illustrate differential and integral balances lumped and distributed balances. Material balances in simple systems involving physical changes and chemical reactions; systems involving recycle, purge and bypass. Properties of substances: single component and multicomponent, single and multiphase systems. Use of Compressibility charts, vapor pressure correlations / charts & Psychometric charts. Ideal liquid and gaseous mixtures. Energy balance calculations in simple systems. Introduction to Computer aided calculations – steady state material and energy balances.			
v	Texts/References 1. R.M.Felder and R.W.Rousseau, Elementary Principles of Chemical Processes, 3rd ed., John Wiley, New York, 2004 2. D.M.Himmdlblau and J.B.Riggs, Basic Principles and Calculations in Chemical Engineering, 7th ed., Prentice Hall, 2003. 3. B.I.Bhatt and S.M.Vora, Stoichiometry, 4th ed.McGraw Hill, 2004			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Linear Algebra	Course Code	MA 102
ii	Credit structure	L T P C 3 1 0 4		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Vectors in R^n, notion of linear independence and dependence, linear span of a set of vectors, vector subspaces of R^n, basis of a vector subspace. • Systems of Linear equations, matrices and Gauss elimination, row space, null space, and column space, rank of a matrix. • Determinants and rank of a matrix in terms of determinants. • Abstract vector spaces, linear transformations, matrix of a linear transformation, change of basis and similarity, rank-nullity theorem. • Inner product spaces, Gram-Schmidt process, orthonormal bases, projections and least squares approximation. • Eigenvalues and eigenvectors, characteristic polynomials, eigenvalues of special matrices (orthogonal, unitary, hermitian, symmetric, skew-symmetric, normal). Algebraic and geometric multiplicity, diagonalization by similarity transformations, spectral theorem for real symmetric matrices, applications to quadratic forms.			
v	Texts/References 1. H.Anton, *Elementary linear algebra with applications* (8^{th} ed.), John Wiley (1995) 2. G.Strang, *Linear algebra and its applications* (4rh Ed.), Thomson (2006) 3. S.Kumaresan, *Linear algebra – A Geometric approach*, Prentice Hall of India (2000) 4. E.Kreyszig, *Advanced Engineering Mathematics* (8^{th} Ed.), John Wiley (1999)			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Ordinary Differential Equations - I	Course code	MA 104
ii	Credit structure	L T P C 3 1 0 4		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content • Exact equations, integrating factors and Bernoulli equations. • Orghogonal trajectories. • Lipschitz condition, Picard's theorem, examples on nonuniqueness. • Linear differential equations generalities. • Linear dependence and Wornskians. • Diamensionality of space of solutions, abel-Liouville formula. • Linear ODE's with constant coefficients, the characteristic equations. • Cauchy-Euler equations. • Method of undetermined coefficients • Method of variation of parameters. • Laplace transforms generalities. • Shifting theorems • Convolution theorem.			
v	Texts/References 1. E.Kreyszig, *Advanced engineering mathematics* (8th Ed.), John Wiley (1999) 2. W.E.Boyce and R. DiPrima, *Elementary Differential Equations* (8th Ed.) John Wiley (2005) 3. T.M.Apostol, *Calculus, Volume* 2 (2nd Ed.), Wiley Eastern, 1980.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Workshop Practice	Course Code	ME 102
ii	Credit structure	L T P C 0 1 3 5		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Introduction to wood work: hand tools & various operations. Introduction to pattern making: types of patterns, allowances, colour coding. etc. Introduction to bench work & fitting: tools & operations. Introduction to metal cutting and machine tools: Safety measures, principles of operation of basic machine tools like lathe, shaping, & drilling. Important operations on these machines. Cutting tools and their usage, selection of cutting speeds, feeds, etc. Introduction to welding. Assignments: Simple assignments in wood working, fitting, electric arc welding, lathe and shaping machine work.			
v	Texts/References 1) Elements of Workshop Technology, Vol. I by S. K. Hajrachoudhury & Others, Media Promoters and Publishers, Mumbai. 14th Edition, 2007. 2) Elements of Workshop Technology, Vol. II by S. K. Hajrachoudhury & Others, Media Promoters and Publishers, Mumbai. 12th Edition, 2007. 3) Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All Departments		

i	Title of the Course	Physics Lab.	Course code	PH 111
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)			
iv	Course content Error analysis and accuracy of measurement. Selected experiments from the following: current and voltage sensitivities of a moving coil galvanometer, measurement of self inductance using Anderson's bridge, resistivity of a thermistor, Helmholtz coil. Fresnel biprism, Newton's rings. Young's modulus using Koenig's method, physical pendulum, Kundt's Tube, Laser Diffraction, Grating Spectrometer, G.M. Counter.			
v	Texts/References • B.L. Worsnop and H.T. Flint, Advanced Practical Physics for students, Asia Publishing House, 1971. • G.L. Squires, University Press, Cambridge, 1999.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Solid Mechanics	Course Code	CL 201
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)			
iv	Course Content Rigid and deformable solids; Method of sections for evaluating internal forces in bodies – review of free body diagrams; Concept of stress – normal and shear stresses; State of stress; Concept of strain – normal and shear strains; State of strain; Hooke's Law; Constitutive relations; Axially loaded members, force and deflections; Indeterminate systems and compatibility conditions; Simple indeterminate systems and lack of fit problems; Generalized Hooks law; Stress in cylindrical and spherical shells; Thin-Walled Pressure Vessels; Torsion of circular shafts – determinate and simple determinate systems. Elastic theory of bending of beams; Sheer force and bending moment diagrams; Bending and shearing stresses in beams of symmetrical cross-section; Concept of shear flow and shear center; Principle of superposition and it limitations. Transformation of plane stress and strain; Principal stresses and strains; Mohr's circle. Bending deflection of beams by direct integration method, Application of direct integration method of to simple indeterminate systems. Elastic buckling of compression members.			
v	Texts/References 1. F.P.Beer, E.R.Johnston and J.T.DeWolf, Mechanics of Materials, 3rd Ed., Tata McGraw Hill, New Delhi, 2004 2. E.P.Popov, Engineering Mechanics of Solids, 2nd Ed., Prentice Hill, New Delhi, 1999 3. I.H.Shames and J.M.Pitarresi, Introduction to the Solid Mechanics, 3rd Ed. Prentice Hill, New Delhi, 1989.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

<table>
<tr><td>i</td><td>Title of the Course</td><td colspan="2">Complex Analysis</td><td>Course Code</td><td>MA 201</td></tr>
<tr><td>ii</td><td>Credit structure</td><td colspan="4">L T P C
3 1 0 4</td></tr>
<tr><td>iii</td><td>Prerequisite, if any(for the students)</td><td colspan="4">Nil</td></tr>
<tr><td>iv</td><td colspan="5">Course Content
Definition and properties of analytics functions.
Cauchy-Riemann equations, harmonic functions.
Power series and their properties
Elementary functions
Gauchy’s theorem and its applications.
Taylor series and Laurent expansions.
Residues and the Cauchy residue formula
Evaluation of improper integrals
Conformal mappings
Inversion of Laplace transforms</td></tr>
<tr><td>v</td><td colspan="5">Texts/References
R.V.Churchill and J.W.Brown, Complex variables and applications (7th Edition), McGraw-Hill (2003)
J.M.Howie, Complex analysis, Springer-Verlag (2004)
M.J.Ablowitz and A.S.Fokas, Complex Variables 0 Introduction and Applications, Cambridge University Press, 1998 (Indian Edition)
E.Kreyszig, Advanced Engineering Mathematics (8th Edition), John Wiley (1999)</td></tr>
<tr><td>vi</td><td>Instructor(s)name</td><td colspan="4"></td></tr>
<tr><td>vii</td><td>Name of other departments to whom the course is relevant</td><td colspan="4"></td></tr>
</table>

i	Title of the Course	Differential Equations - II	Course Code	MA 203
ii	Credit structure	L T P C 3 1 0 4		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content • Review of power series and series solutions of ODE's • Legendre's equation and Legendre polynomials • Regular and irregular singular points, method of Frobenius • Bessel's equation and Bessel's functions • Strum-Liouville problems • Fourier series • D'Alembert solution to the Wave equation. • Classification of linear second order PDE in two variables • Vibration of a circular membrane • Heat equation in the half space.			
v	Texts/References 1. E.Kreyszig, Advanced Engineering Mathematics (8^{th} Edition), John Wiley (1999). 2. W.E.Boyce and R.Diprima, Elementary Differential Equations (8^{th} Edition), John Wiley (2005). 3. R.V.Churchill and J.W.Brown, Fourier series and boundary value problems (7^{th} Edition), McGraw-Hill (2006)			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Chemical Engineering Thermodynamics	Course Code	CL 203
ii	Credit structure	L T P C 3 1 0 8		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Single-Phase Systems; Introductory concepts; Work, Heat, Reversible and Irreversible Processes; Equations of State and Generalized Correlations; First Law : Closed and Open Systems, Steady and Transient Processes. Second law and Entropy: Reversible Heat Engines; Availability and Exergy Analyses, Maxwell Relations and Fluid Properties Estimation; Pure Component Phase Equilibria, Power and Refrigeration Cycles; Flow Processes; Statistical Mechanics Basics: quantum states and degeneracy of energy levels. Louisville's theorem, micro canonical, canonical, grand canonical and the other ensembles, partition function and thermodynamic properties; mono atomic and diatomic gases, lattice statistics, ideal gas mixtures, imperfect gases; liquid state and solution theories. Single Phase Mixtures and Solutions; Ideal Solutions; Partial molar quantities; Gibbs-Duhem Equation; Phase-Rule; Phase equilibrium criteria, non ideal solutions, residual and Excess properties; Fugacity and Activity Coefficient models; vapor-liquid equilibria (VLE) at low to moderate pressures; Raoult's Law, Henry's law High-Pressure VLE Availability Analysis of processes LLE, Triangular diagrams. Langmuir and BET isotherms; Chemical Reaction Equilibrium: Homogeneous and Heterogeneous reactions; Multi reaction Equilibria; Combined Phase and Reactions Equilibria; Analytical Instrumentation; Calorimeters, Osmometers and their Principles.			
v	Texts/References 1. J.M.Smith,H.C. Van Ness and M.M.Abbott. Introduction to Chemical Engineering Thermodynamics, 6th ed., McGraw-Hill,2001 2. S.I.Sandler, Chemical, Biochemical and Engineering thermodynamics, 4th Ediction, Wiley India, 2006. 3. J.M.Prausnitz, R.N.Lichtenthaler and E.G.Azevedo, Molecular Thermodynamics of Fluid-Phase Equilibria, 3rd Ed. Prentice Hall, 1998. 4. J.W.Tester and M.Modell, thermodynamics and its Applications, 3rd ed. Prentice Hall, 1999. 5. R.C.Reid., J.M.Prausnitz and B.E.Poling, Properties of Gases and Liquids, 4th ed., Mc-Graw-Hill, 1987. 6. R.Balzheiser, M.Samuels and J.Eliassen, Chemical Engineering Thermodynamics, Prentice Hall, 1972. 7. K.Denbigh, Principles of Chemical Equilibrium, 4th ed., CPU, 1081.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Introduction to Transport Phenomena	Course Code	CL 205
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Introduction: Vectors/Tensors, Viscosity, Shell balance: Falling film, Circular tube; Equations of Change for isothermal systems: Continuity, Motion, Energy, Substantial derivatives; Unidirectional flows: Pipe flow, Variable viscosity falling film, Couette viscometer, Rotating Sphere; Unsteady flows: Startup Plate flow, Parallel plates, Oscillating plate; Thermal conductivity and mechanism of energy transport; Shell energy balances and temperature distributions in solids and laminar flow; The equations of change for nonisothermal systems; Diffusivity and the mechanisms of mass transport; Concentration distributions in solids and laminar flow; Equations of change for multicomponent systems; Introduction to the concept of heat and mass transfer coefficients.			
v	Texts/References	1. R.B.Bird, W.E. Stewart and E.N. Lightfoot, Transport Phenomena, 2nd ed., Wiley, 2006.		
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Introductory Chemical Lab. (DIL)	Course Code	CL 211
ii	Credit structure	L T P C 0 0.5 3 4		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content	Will be provided by the Lab Instructor		
v	Texts/References	As given by Lab Instructor		
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Environmental Studies	Course Code	ES 202
ii	Credit structure	L T P C (Half semester course) 2 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Multidisciplinary nature of environmental studies, Ecosystems, Biodiversity and its conservation, Indicators of environmental pollution, Environment and human health Consumption of natural resources and environmental degradation (forests, water, coal, minerals, energy, and land), Sustainable development, Environmental policy and legislation, Environmental impact assessment. Pollution of lakes, rivers, ground water, coasts, and oceans, Science and technology for drinking water and wastewater treatment and issues in management of systems, Solid and hazardous waste management (causes, effects and control measures) Air and noise pollution (science and engineering of pollution control), Global Issues including climate change, global warming, acid rain, ozone layer depletion, nuclear hazards, Disaster management (industrial accidents, floods, earthquakes, cyclones and landslides),			
v	Texts/References Cunningham W.P. and Cunningham M.A. (2002), Principles of Environmental Science, Tata McGraw-Hill Publishing Company, New Delhi. Nathanson, J.A. (2002), Basic Environmental Technology, Prentice Hall of India, New Delhi. Arceivala, S.J. and Asolekar, S.R. (2006), Wastewater Treatment for Pollution Control and Reuse, 3rd Edition, Tata McGraw Publishing Co. Ltd., New Delhi. Asolekar, S.R. and Gopichandran, R. (2005), Preventive Environmental Management – An Indian Perspective, Foundation Books Pvt. Ltd., New Delhi, 2005. Some selected book-chapters, monographs and journal papers			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All departments		

i	Title of the Course	Environmental Studies	Course Code	HS 202
ii	Credit structure	L T P C (Half semester course) 2 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Social Issues and the environment, Public awareness and Human rights, Indicators of sustainability, Governance of Natural Resources - Common pool resources: issues and management. Environmental ethics, Religion and environment, Wilderness and Developing Trends, Environmental movements and Activism, Social Ecology and Bioregionalism, Environmental justice. Environmental economics, Trade and environment, Economics of environmental regulation, Natural resource accounting, Green GDP. Environment and development, Resettlement and rehabilitation of people, Impacts of climate change on economy and society, Vulnerability and adaptation to climate change.			
v	Texts/References Agar, N., 2001. *Life's Intrinsic Value*, New York: Columbia University Press. Dasgupta, P. and Maler, G. (eds.), (1997), The Environment and Emerging Development Issues, Vol. I, OUP. Guha, Ramachandra (2006): "Mahatama Gandhi and Environmental Movement," *Debating on Gandhi*, in A. Raghuramaraju (ed.), New Delhi: Oxford University Press. Guha, Ramachandra and Madhav Gadgil (1995): Ecology and Equity: The Use and Abuse of Nature in Contemporary India, New Delhi: Penguin. Hanley, Nick, Jason F. Shogren and Ben White (2004): Environmental Economics in Theory and Practice, New Delhi: MacMillan. Naess, A. and G. Sessions (1984): "Basic Principles of Deep Ecology," *Ecophilosophy*, Vol.6. Redclift, M. and Woodgate, G. (eds.), (1997), International Handbook of Environmental Sociology, Edward Edgar.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All Departments		

i	Title of the Course	Fundamentals of Heat and Mass Transfer	Course Code	CL 202
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Review of conduction, resistance concept, extended surfaces, lumped capacitance; Introduction to Convection, boundary layer theory, natural and forced convection, correlations; Radiation; Heat exchangers: LMTD, epsilon-NTU method; In- terphase mass transfer, mass transfer coefficient, theories for interphase mass transfer, overall mass transfer coefficient, correlations, mass transfer with chemical reaction, simultaneous heat and mass transfer, analogy between momentum, heat and mass transfer; Crystallization.			
v	Texts/References 1. F.P. Incropera and D.P. Dewitt, Introduction to Heat Transfer, 5th ed., Wiley, 2006. 2. E.L. Cussler, Diffusion: Mass Transfer in Fluid Systems, 2nd ed., CUP, 1997. 3. R.B. Bird, W.E. Stewart and E.N. Lightfoot, Transport Phenomena, 2nd ed., Wiley, 2006.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Process Fluid Mechanics	Course Code	CL 204
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)			
iv	Course Content Basic Fluid Concepts: Dimensions and Units, Velocity and Stress Fields, Viscosity and surface tension, Nonnewtonian viscosity, Dimensional Analysis (Buckingham PI theorem), Types of flows, Methods of Analysis, Fluid Statics; Differen- tial Analysis: Review of NSE, Potential flows, Velocity potential, Boundary Layer Theory (Laminar), Viscous flows (past sphere), Integral Analysis: Mass, Energy (Bernouli), Momentum (Impinging jet, pitot tube, Orifice meter, rotameter, pipe flow: f vs Re charts); Chem Engg Equipment: Piping systems (K factors, networks), Flow past immersed objects (Packed beds, Fluidised beds, sedimentation, Centrifugal separation, filtration), Pumps, Agitation and Mixing, (Power consump- tion, mixing times, scale up), Particulate solids, characterisation, Other topics: Introduction to Turbulent Flows (Reynolds equations), Compressible flows, Compressors.			
v	Texts/References 1. 1. R.W. Fox, A.T. MacDonald and P.J. Pritchard, Introduction to Fluid Mechanics Wiley, 2008. 2. J.O. Wilkes, Fluid Mechanics for chemical engineers with microfluidics and CFD, 2nd ed., Prentice Hall, 1998. 3. M.Denn, Process Fluid Mechanics, Prentice Hall, 1979. 4. 4. V.Gupta and S.K. Gupta, Fluid Mechanics and its applications, Wiley, 1984. 5. R.B. Bird, W.E. Stewart and E.N. Lightfoot, Transport Phenomena, 2nd ed., Wiley, 2006.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Introduction to Numerical Analysis	Course Code	CL 206
ii	Credit structure	L T P C 3 1 0 8		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Interpolation by polynomials, divided differences, error of the interpolating polynomial, piecewise linear and cubic spline interpolation. Numerical integration, composite rules, error formulae. Solution of a system of linear equations, implemen- tation of Gaussian elimination and Gauss-Seidel methods, partial pivoting, row echelon form, LU factorization Cholesky's method, ill-conditioning, norms. Solution of a nonlinear equation, bisection and secant methods. Newton's method, rate of convergence, solution of a system of nonlinear equations, numerical solution of ordinary differential equations, Euler and Runge-Kutta methods, multi-step methods, predictor-corrector methods, order of convergence, finite difference methods, numerical solutions of elliptic, parabolic, and hyperbolic partial differential equations. Eigenvalue problem, power method, QR method, Gershgorin's theorem. Exposure to software packages like IMSL subroutines, MATLAB.			
v	Texts/References 1. S.D. Conte and C. de Boor, Elementary Numerical Analysis- An Algorithmic Approach, 3rd ed., McGraw-Hill, 1980. 2. C.E. Froberg, Introduction to Numerical Analysis, 2nd ed., Addison-Wesley, 1981. 3. E. Kreyszig, Advanced engineering mathematics, 8th ed., John Wiley (1999).			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Chemical Engineering Lab I	Course Code	CL 212
ii	Credit structure	L T P C 0.5 0 2 3		
iii	Prerequisite, if any(for the students)			
iv	Course Content	(Focus: Fluid Mechanics, Thermodynamics) Experiments on the flow through piping networks, Nature of flow, Venturi / Orifice meter, Stokes Law, pumps in series / parallel, determination of partial molar enthalpies, vapour pressures, infinite di- lution activity coefficient,vapour-liquid equilibrium, adiabatic calorimetry, size reduction (ball mill), porosity measurement		
v	Texts/References	As provided by Lab Instructor		
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Introduction to Electrical and Electronic Circuits	Course Code	EE 102
ii	Credit structure	L T P C 3 1 0 8		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Introduction, basic physical laws, circuit elements, KVL, KCL, and a few important circuit theorems, simple circuits, Transients in R-L, R-C, L-C Sinusoidal Steady State, Real/Reactive Power, three phases. Working Principles of Transformers / AC / DC machines. Functional Characteristics of Diode, BJT, OP-AMP, Analog circuit Examples: rectifiers, amplifiers, oscillators etc. Digital Circuits: AND/OR grates, Flip Flops, DAC /ADC etc.			
v	Texts/References 1. Vincent Del Toro, Electrical Engineering Fundamental, Printice Hall, 1989 2. K.A.Krishnamurthy and M.R.Raghuveer, Electrical and Electronics Engineering for Scientists, Wiley Eastern Ltd., 1993			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Molecular Cell Biology	Course Code	BT 301
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Biology and Bioprocess, Relevance to society. Procaryotes and eucaryotes. Classification of microorganisms and important cell types. Structures of the bacterial cell. Organization of plant and animal cells, organelles, structure, chemical composition, function, Biomolecules : properties of water amino acids, proteins, carbohydrates, lipids and nucleic acids. Cellular processes : carbon and nitrogen cycle in nature, metabolic grid, glycolysis. TCA cycle and forms of energy in biology. Single transduction, receptor concept, nature of ligand-receptor interactions. Information transfer in cells: Central dogma, DNA replication, RNA transcription, genetic code and translation. Genetics and inheritance: chromosomes, Mendel's laws, phenotype and genotype, genetic diseases in humans. Special topics : Genetic engineering, Cell culture and immune system			
v	Texts/References 1. B.Alberts, D.Bray, J.Lewis, M.Raff,K.Roberts and J.D.Watson, Molecular Biology of the Cell. Garland Publishing, Inc 2nd edition, 1989. 2. E.J.Gardner, M.J.Simons and D.P.Snustad, Principles of Genetics, John Wiley and Sons, 8th edition, 1991 3. D.Voet and J.G.Voet, Biochemistry, John Wiley and Sons, 10990 4. L.Stryer, Biochemistry W.H.Freeman and Company, 1965.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Psychology / Sociology / Literature / Philosophy	Course Code	HS 3xx
ii	Credit structure	L T P C 3 0 0 6		
iii	Prerequisite, if any(for the students)			
iv	Course Content	Will be provided by the course instructor		
v	Texts/References	Will be provided by the instructor		
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Mass Transfer operations	Course Code	CL 301
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Distillation: batch distillation, continuous fractionation, calculations with multiple feeds and withdrawals; Special dis- tillation techniques (azeotropic, extractive, etc.) steam and molecular distillation; Tray hydrodynamics and efficiencies; Liquid-Liquid extraction: Calculations with and without reflux for immiscible and partially miscible system; Gas absorp- tion: packed tower design, effect of reaction; Simultaneous heat and mass transfer: Drying; Design of cooling towers; Adsorption: Types and nature of adsorption; Freundlich isotherm; Membrane processes: Gas separation processes; reverse osmosis processes.			
v	Texts/References 1. J.D. Seader and E.J. Henley, Separation Process Principles, 2nd ed., Wiley, 2005. 2. E.L. Cussler, Diffusion: Mass Transfer in Fluid Systems, 2nd ed., Cambridge series, 1997. 3. P.C. Wankat, Separation Process Engineering, 2nd ed., Prentice Hall, 2006.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Chemical Engineering Lab II	Course Code	CL 311
ii	Credit structure	L T P C 0.5 0 2 3		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content	(Focus: Heat and Mass Transfer) Experiments on hydrodynamics of a packed column, Differential distillation, Heat transfer in laminar and turbulent flow, boiling and condensation, Plate heat exchanger, Fluidization with heat transfer, heat transfer through a submerged helical coil, heat transfer in an agitated vessel, finned tube heat exchanger		
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Basic Electric Circuits Lab.	Course Code	CL 313
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)			
iv	Course Content	Will be provided by the lab instructor		
v	Texts/References	Will be provided by the lab instructor		
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Chemical Reaction Engineering	Course Code	CL 302
ii	Credit structure	L T P C 3 1 0 8		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Kinetics Reaction rate, order, rate constant; Batch reactors Design + basics; Kinetic constants from batch reactor data; Ideal flow reactors Mass and Energy balances; Isothermal, adiabatic and non-isothermal operation; Catalysts, Catalytic rates, Reaction mechanisms; Internal/External transport in catalysts; Non-catalytic solid-gas reactions; Reactor design for ideal flow reactors; Yield and Selectivity; Concept of RTD; Segregation and Maximum Mixedness model			
v	Texts/References 1. H.S.Fogler, Elements of Chemical Reaction Engineering, 2nd ed., Prentice Hall, New Jersey, 1992. 2. O.Levenspiel, Chemical Reaction Engineering, 2nd ed., Wiley Eastern, 1972. 3. J.M.Smith, Chemical Engineering Kinetics, 3rd ed., McGraw Hill, 1980.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Material Science	Course Code	CL 304
ii	Credit structure	L T P C 3 0 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content	Atomic Bonding, Crystal Structure and Defects, Mechanical and Thermal Behaviour: Failure Analysis and prevention, Phase Diagrams; Metals and alloys, Polymers (Plastics), Semiconductors, Ceramics & Glasses, Corrosion and its preven- tion, Environmental Effects, Nanotechnology, Biomaterials.		
v	Texts/References	1. J.F. Shackelford, Introduction to Material Science for Engineers, 6th ed., Prentice Hall, 2004.		
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Chemical Engineering Lab III	Course Code	CL 312
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content	(Focus: Reaction Engineering and Unit Operations) Experiments on esterification kinetics, Batch reactive distillation, mi- cellar catalysis, homogeneous reaction, metal recovery from dilute solutions, reaction in CSTR, reaction in PFR, Gas chromatography, Cooling tower, gas liquid absorption		
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Process Equipment Design and Economics	Course Code	CL 401
ii	Credit structure	L T P C 3 0 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Mechanical design of process equipment: pressure vessels, tall columns, etc., process piping design; Materials and Fabri- cation Selection; Design Strategy and Optimum Equipment Design: Economic Design criteria; Cost and Asset Accounting; Cost Estimation; Interest and Investment Costs; Taxes and Insurance; Depreciation; Profitability, Alternative Investments and Replacement; Illustrative Case Study in Process Equipment Design and Costing of Equipment in each of the following categories: Material Transfer, Handling and Treatment Equipment Heat Transfer Equipment: Shell and tube heat exchangers (Kern and Bell-Delaware design methods), Plate heat exchangers, Evaporators Mass Transfer Equipment: Absorption/ Stripping columns (packed/tray), Multicomponent distallation colum (Fenske- Underwood-Gilliland correlations) Reactors: Choices of reactors, non-isothermal reactors, reactor configuration, interstage heating/cooling, multi-tubular reac- tors, catalyst deactivation.			
v	Texts/References 1. 1. M.S. Peters and K.D. Timmerhaus, Plant Design and Economics for Chemical Engineers, McGraw Hill, 1991. 2. 2. D.F. Rudd and C.C. Watson, Strategy of Process Engineering, John Wiley, 1969. 3. 3. F.C. Jelen and J.H. Black, Cost and Optimization Engineering, McGraw Hill, 3rd ed., 1992. 4. 4. S. Walas, Chemical Process Equipment Selection and Design, Butterworth, 1988 5. 5. M.V. Joshi, Process Equipment Design, McMillan India, New Delhi, 1976. 6. 6. R.K. Sinnot, An Introduction to Chemical Engineering Design, Pergamon Press, Oxford, 1989. 7. Relevant Design Codes BS,IS and ASME. 8. R. Smith, Chemical Process Design, McGraw Hill, 1995			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Process Control	Course Code	CL 403
ii	Credit structure	L T P C 3 1 0 8		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content First Principles model development; Process dynamics for first, second and higher order systems: linearisation, transfer function models, effect of poles, zeros and time delays on system response; Empirical models from data; control system instrumentation; introduction to feedback control: objectives, PID control; analysis of closed loop systems: stability, root locus, frequency response using Bode and Nyquist plots; control design techniques: design criteria, time and frequency domain techniques, model based design, tuning; advanced control strategies: cascade and feed forward, introduction to multivariable control; controller implementation through discretisation.			
v	Texts/References 1. 1. D.E. Seborg, T.F. Edgar, D. A. Mellichamp, Process Dynamics and Control, John Wiley and Sons, 2nd ed., 2004. 2. 2. B.W. Bequette, Process Control: Modeling, Design and Simulation, Prentice Hall, New Delhi, 2003. 3. 3. W.L. Luyben. Process Modeling Simulation and Control for Chemical Engineers, 2nd ed., McGraw Hill, 1990. 4. 4. G. Stephanopoulos, Chemical Process Control: An Introduction to Theory and Practice, Prentice Hall, New Delhi, 1984.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Chemical Engineering Lab - IV	Course Code	CL 411
ii	Credit structure	L T P C 0 0 6 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content	(Focus: Process Control, Unit Operations) Experiments on Residence time distribution, continuous distillation, Dynamic process modeling, identification of transfer functions, P /PI control, Temperature measurement and signal conversion, Con- trol valve characteristics, Fixed bed reactor, drying		
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Chemical Processes	Course Code	CL 402
ii	Credit structure	L T P C 3 0 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Introduction to fuels, Properties of fuels, Solid fuels and uses, liquid fuels and uses, Gaseous fuel and uses, Combustion and furnace calculations. Chemical processes based on agricultural and sylvicultural raw materials: Sugar, starch, alcohol, cel- lulose, paper, glyceride, oils, soaps, detergents; Petroleum refining Operations: Principles and details of Crude Distillation, Vacuum Distillation, coking, cracking, hydrotreating, isomerization and alkylation; Petrochemicals: Raw materials and principles involved in the production of olefins and aromatics. Acetylene, Butadiene and typical intermediates from olefins and aromatics such as ethylene glycol, ethyl benzene, phenol, cumene and DMT/PTA; dyes and pharmaceuticals, coal chemicals. Inorganic heavy chemicals: Processes for manufacture of acids, alkalis, salts and fertilizers. Typical products such as sulphuric, nitric, and phosphoric acids, soda ash, ammonia, superphosphates. Renewable resources, Biorefineries. Biopharmaceuticals. Fine chemicals and Biotransformations.			
v	Texts/References 1. J.A. Moulijn, M. Makkee and A.V Diepen, 1st ed., Wiley, 2001 2. C.E. Dryden, Outlines of Chemical Technology, Edited and revised by M.Gopala Rao and Marshall Sitting, 2nd ed., Affiliated East-West Press, New Delhi, 1973 3. G.T. Austin, R.N. Shreve, Chemical Process Industries, 5th ed., McGraw Hill, 1984. 4. P.H. Groggins , Unit processes in organic synthesis, 5th ed., McGraw Hill, 1958. 5. Kirk-Othmer D.F., Encyclopedia of Chemical Technology, 4th ed. Interscience, New York, 1991. 6. J.H. Gary and G.E. Handwerk, Petroleum Refining: Technology and Economics, Marcel Dekker, New York, 2001 7. S. Sarkar, Fuels and Combustion, 2nd ed., Orient Longmans, Bombay, 1990.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Chemical Process Design	Course Code	CL 404
ii	Credit structure	L T P C 3 0 0 6		
iii	Prerequisite, if any(for the students)	CL 354		
iv	Course Content Process Design and Development: General Design Considerations; The Hierarchy of Chemical Process Design; The Nature of Process Synthesis and Analysis; Reactor networks in process flowsheets: Attainable region Separation systems in process flowsheets: multicomponent distillation for ideal and non-ideal systems, distillation column sequences, heat integration in distillation columns Heat exchange networks synthesis and utilities: Energy targets Introduction to optimization approaches to optimal design, role of simulations in process design, Design under uncertainty and failure tolerance, Engineering around variations, Introduction to process integration			
v	Texts/References 1. J. Douglas, Conceptual Design of Chemical Processes, McGraw Hill, 1989. 2. R. Smith, Chemical Process Design, McGraw Hill, New York, 1995. 3. D.F. Rudd and C.C. Watson, Strategy of Process Engineering, John Wiley, 1969. 4. R.K. Sinnot, An Introduction to Chemical Engineering Design, Pergamon Press, Oxford, 1989. 5. L.T. Biegler, E.I. Grossmann, and A.W. Westerberg, Systematic Methods of Chemical Process Design, Prentice Hall International Inc. Series in the Physical and Chemical Engg. Sciences, 1997. 6. W.D. Seider and J.D. Seader, Product and Process Design Principles: Synthesis, Analysis and Evaluation, 2nd ed., John Wiley, 2004			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Design Lab. I	Course Code	CL 411
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content	Steady-state simulation of flow sheets; Optimization and costing in flow sheets; Design and analysis of control systems; Simulations using commercial simulators (eg. ASPEN, HYSYS), Computational Fluid Dynamics, Molecular modeling.		
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Design Lab. II	Course Code	CL 413
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content	Process and Mechanical design calculations for process equipment; Numerical studies in reactor design; Design and analysis of separation equipment.		
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

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Course Curriculum for B.Tech. Programme: Electrical Engineering Department

Semester I					
Course code	Course Name	Credit structure			
		L	T	P	C
CH 101	Chemistry	2	1	0	6
CS 101	Computer Programming & Utilization	2	0	2	6
HS 101 HS 103	English Language Course * Introduction to Philosophy	3	0	0	6
MA 101	Calculus	3	1	0	8
PH 101	Electricity and Magnetism	2	1	0	6
PH 111	Physics Lab.	0	0	3	3
ME 101	Engineering Graphics & Drawing	0	1	3	5
NC 101#	National Cadet Corps (NCC)	0	0	0	P/NP
NO 101#	National Sports Organization (NSO)	0	0	0	P/NP
NS 101#	National Service Scheme (NSS)	0	0	0	P/NP
					40

* For students deficient in English Language

Semester II					
Course Code	Course Name	Credit Structure			
		L	T	P	C
PH 102	Modern Physics	3	1	0	8
HS 102	Economics	3	0	0	6
CL 102 EE 102	Introduction to Chemical Engg (**for CL**) Intro. to Electrical and Electronic Circuits* **(for EE and ME)**	3	0	0	6
MA 102 MA 104	Linear Algebra Ordinary Differential Equation - I	3 3	1 1	0 0	4 4
ME 102	Workshop Practice	0	1	3	5
CH 112	Chemistry Lab	0	0	3	3
NC 102#	National Cadet Corps (NCC)	0	0	0	P/NP
NO 102#	National Sports Organization (NSO)	0	0	0	P/NP
NS 102#	National Service Scheme (NSS)	0	0	0	P/NP
					36

Any one of these courses to be taken

Semester III					
Course code	Course Name	Credit structure			
		L	T	P	C
MA 201	Complex Analysis	3	1	0	4
MA 203	Differential Equations-II	3	1	0	4
EE 201	Network Theory	2	1	0	6
EE 203	Electronics Devices	2	1	0	6
EE 205	Introduction to Electrical Systems	3	0	0	6
EE 211	Electronics Devices Lab	0	0	3	3
EE 213	Electrical and Electronics lab.	0	0.5	3	4
					33

Semester IV					
Course code	Course Name	Credit structure			
		L	T	P	C
EE 202	Signals and Systems	2	1	0	6
EE 204	Analog Circuits	2	1	0	6
EE 206	Electrical Machines and Power Electronics	2	1	0	6
EE 208	Digital Systems	2	1	0	6
EE 212	Analog Lab.	0	0	3	3
EE 214	Digital Circuits Lab.	0	0	3	3
EE 216	Machine Lab.	0	0	4	4
					34
HONOURS					
EE xxx	Honours Elective	3	0	0	**6**

Semester V					
Course code	Course Name	Credit structure			
		L	T	P	C
EE 301	Microprocessors	2	0	2	6
EE 303	Communication Systems	2	1	0	6
EE 305	EM Waves	2	1	0	6
EE 307	Probability and Random Processes	2	1	0	6
HS 3xx	HSS elective	3	0	0	6
					30
HONOURS					
EE xxx	Honors Elective	3	0	0	**6**

Semester VI					
Course code	Course Name	Credit structure			
		L	T	P	C
EE 302	Control Systems	2	1	0	6
EE 304	Digital Signal Processing	2	1	0	6
EE 306	Digital Communications	2	1	0	6
EE 308	Power Systems	3	1	0	6
EE 312	Communications Lab	0	0	3	3
EE 314	Control Systems Lab	0	0	3	3
					30
HONOURS					
EE xxx	Honors Elective	3	0	0	**6**

Semester VII					
Course code	Course Name	Credit structure			
		L	T	P	C
ES 202	Environmental Studies (half semester)	2	1	0	3
HS 202	Environmental Studies (half semester)	2	1	0	3
XX xxx	Institute Elective – I	2	1	0	6
EE xxx	Department Elective – I	3	0	0	6
EE xxx	Department Elective – II	3	0	0	6
EE 451	B.Tech. Project – I	0	0	6	6
					30
HONOURS					
EE xxx	Honors Elective	2	1	0	**6**

Semester VIII					
Course code	Course Name	Credit structure			
		L	T	P	C
XX xxx	Institute Elective – II	2	1	0	6
EExxx / XX xxx	Department / Open Elective -III	3	0	0	6
EExxx/XXxxx	Department / Open Elective – IV	3	0	0	6
EExxx	Department Elective – V &	3	0	0	6
EExxx	Department Elective – VI or	3	0	0	6
EE 452	B.Tech. Project – II	0	0	12	12
					30
HONOURS					
EE xxx	Honors Elective	2	1	0	**6**

Elective List For B.Tech . Electrical Engineering

1. Discrete Data and Digital Control
2. Advanced Network Analysis
3. Information Theory and Coding
4. VLSI Technology
5. Electronic Design Laboratory (6 CREDITS, 0 0 6 6)
6. B. Tech Project – II (12 CREDITS)
7. Error Correcting Codes
8. Fiber Optic Communication
9. Radiating Systems
10. Physics of Transistors
11. Optimal Control Systems
12. Simulation of Circuits and Devices
13. Finite Fields and their Applications
14. Electric Drives I
15. A First Course in Optimization
16. Application of Power Electronics to Power Systems
17. Physical Electronics
18. High Power Semiconductor Devices
19. Speech Processing
20. Introduction to MEMS
21. Circuit Simulation in Power Electronics
22. Behavioral Theory of Systems
23. Restructured Power Systems
24. Nanoelectronics
25. Computational Electromagnetics

i	Title of the Course	Chemistry	Course Code	CH 101
ii	Credit structure	L T P C 1 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Schrodinger equation (origin of quantization), Born interpretation of wave function, Hydrogen atom: solution to Φ-part, MO theory: atomic and molecular orbitals, Structure, bonding and energy levels of diatomic molecules. Examples N2, O2, CO and HF, Configuration, molecular chirality and isomerism, Conformation of alkanes and cycloalkanes, Reactivity of carbonyl group (addition reactions, reactions due to acidic proton, addition-elimination reactions and reactivity of acid halide, ester and amide), Functional group interconversions involving oxidation and reduction, Periodic properties: trends in size, electron affinity, ionization potential and electronegativity, Use of Ellingham diagram and thermodynamics in the extraction of elements, Transition metal chemistry: inorganic complexes, bonding theories, magnetism, bonding aspects and structural distortion, Bioinorganic chemistry: storage and transport proteins, Catalysis: hydrogenation, hydroformylation and olefin metathesis			
v	Texts/References P.W.Atkins, Physical Chemistry, Oxford University Press, 7th Edition, 2006. G.M.Barrow, Physical Chemistry, 5th Edition, Tata McGraw-Hill, New Delhi, 1992. D.A.McQuarrie and J.D. Simon, Physical Chemistry - a molecular approach, Viva Books Pvt. Ltd. (1998). R.T.Morrison and R.N. Boyd, Organic Chemistry, Prentice Hall of India Pvt. Ltd., 5th Ed, 1990 L. G. Wade, Organic Chemistry, Pearson Education 6th Ed, 2006. G. Solomons and C. Fryhle, Organic Chemistry, John Wiley & Sons (Asia) Pte Ltd. M.J.Sienko and R.A.Plane, Chemical Principles and Applications, McGraw Hill, 1980. J.D.Lee, Concise Inorganic Chemistry, 4th Edition, ELBS, 1991. D.D.Ebbing, General Chemistry, Houghton Miffin Co., 1984.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All departments		

i	Title of the Course	Computer Programming and Utilization	Course code	CS 101
ii	Credit structure	L T P C 2 0 2 6		
iii	Prerequisite, if any(for the students)	High School Mathematics		
iv	Course Content <u>Description:</u> This course provides provides an introduction to problem solving with computers using a modern language such as Java or C/C++. Topics covered will include: A. Utilization: Developer fundamentals such as editor, integratedprogramming environment, Unix shell, modules,libraries. B. Programming features: Machine representation, primitive types, arrays and records, objects, expressions, control statements, iteration, procedures, functions, and basic i/o. C. Sample problems in engineering, science, text processing, and numerical methods.			
	Texts/References 1. G. Dromey, How to Solve It by Computer, Prentice-Hall, Inc., Upper Saddle River, NJ, 1982 2. Polya, G., How to Solve It (2nd ed.), Doubleday and co. (1957). 3. C++ Program Design: An introduction to Programming and Object-Oriented Design. Tata McGraw Hill. Coohoon and Davidson. 3rd edition. 2003. 4. Let`s C. Yashwant Kanetkar. Allied Publishers, 1998. 5. The Java Tutorial, Sun Microsystems. Addison-Wesley, 1999.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All Department		

i	Title of the Course	Economics	Course Code	HS 102
ii	Credit structure	L T P C 3 0 0 6		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Basic economic problems. Resource constraints and Welfare maximizations. Nature of Economics: Positive and normative economics; Micro and macroeconomics, Basic concepts in economics. The role of the State in economic activity; market and government failures; New Economic Policy in India. Theory of utility and consumer"s choice. Theories of demand, supply and market equilibrium. Theories of firm, production and costs. Market structures. Perfect and imperfect competition, oligopoly, monopoly. An overview of macroeconomics, measurement and determination of national income. Consumption, savings, and investments. Commercial and central banking. Relationship between money, output and prices. Inflation - causes, consequences and remedies. International trade, foreign exchange and balace payments, stabilization policies : Monetary, Fiscal and Exchange rate policies.			
v	Texts/References • P. A. Samuelson & W. D. nordhaus, Economics, McGraw Hill, NY, 1995. • A. Koutsoyiannis, Modern Microeconomics, Macmillan, 1975. R. Pindyck and D. L. Rubinfeld, Microeconomics, Macmillan publishing company, NY, 1989. • R. J. Gordon, Macroeconomics 4th edition, Little Brown and Co., Boston, 1987. William F. Shughart II, • The Organization of Industry, Richard D. Irwin, Illinois, 1990.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All Departments		

i	Title of the Course	Calculus	Course code	MA 101
ii	Credit structure	L T P C 3 1 0 8		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Review of Limits, continuity, differentiability. Mean value theorem, Taylors Theorem, Maxima and Minima. Riemann integrals, Fundamental theorem of Calculus, Improper integrals, applications to area, volume Convergence of sequences and series, power series. Partial Derivatives, gradient and directional direvatives, chain rule, maxima and minima, Lagrange multipliers. Double and Triple integration, Jacobians and change of variables formula. Parametrization of curves and surfaces, vector Fields, Line and surface integrals. Divergence and curl, Theorems of Green, Gauss, and Stokes.			
v	Texts/References 1. Hughes-Hallett et al, *Calculus – Single and Multivariable* (3rd Edition), John-Wiley and Sons (2003) 2. James Stewart, *Calculus* (5th Edition), Thomson (2003) 3. T.M. Apostol, *Calculus*, Volumes 1 and 2 (2nd Edition), Wiley Eastern 1980 4. G.B.Thomas and R.L.Finney, *Calculus and Analytic Geometry* (9th Edition), ISE Reprint, Addison-Wesley, 1998.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All Departments		

i	Title of the Course	Electricity and Magnetism	Course code	PH 101
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Electrostatics: Coulomb's law, Gauss theorem, electric potential, Laplace's equation, Poisson's equation, electrostatics with conductors, capacitors, dielectrics. Magnetostatics: Biot Savart's law, Ampere's law, Lorentz force. Magnetic Induction: Faraday's law, Lenz's law, self and mutual inductance, energy in a magnetic field, LCR circuit, resonance. Maxwell's equations: displacement current, electromagnetic waves, plane wave solutions of Maxwell's equations, Poynting vector, wave propagation through a boundary, reflection, refraction, absorption and skin depth.			
v	Texts/References A.S. Mahajan and A. Rangawala, Electricity and Magnetism, Tata McGraw Hill, 1989. D. Griffiths, Introduction to Electrodynamics, 2nd ed., Prentice Hall, 1989.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All departments		

i	Title of the Course	Chemistry Lab	Course code	CH 112
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content	Experiments illustrating the concepts of 1) galvanic cells, (2) thermochemistry, (3) chemical kinetics, (4) equilibrium constant, (5) analysis by oxidation reduction titration.		
v	Texts/References	--		
vi	Instructor(s)name	--		
vii	Name of other departments to whom the course is relevant	All departments		

i	Title of the Course	Engineering Graphics and Drawing	Course code	ME 101
ii	Credit structure	L T P C 0 1 3 5		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content	Introduction to engineering drawing and orthographic projections; Projection of points and straight line; Projection of planes and solids; Projection of simple machine elements; Development of surfaces, Intersection of surfaces; Construction of isometric views from orthographic projections. v		
v	Texts/References	Bhatt N. D. and Panchal V. M., Engineering Drawing, Charotar Publishers, Anand, 2007. Luzadder Warren J. and Duff Jon M., Fundamentals of Engineering Drawing, Prentice Hall of India, 2001. French Thomas E. and Vierck Charles J., Engineering Drawing and Graphic Technology, McGraw Hill, 1993. Jolhe Dhananjay A., Engineering Drawing, Tata McGraw Hill, 2007. Shah M. B. and Rana B. C., Engineering Drawing, Dorling Kindersley (India) Pvt. Ltd, Pearson Education,		
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Modern Physics	Course Code	PH 102
ii	Credit structure	L T P C 3 1 0 8		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Special theory of relativity: Galilean and Lorentz transformation, space time viewpoints, Minkowski space and four vectors, energy momentum conservation. Review of quantum concepts, Black body radiation, particle nature of light, photoelectric effect, Compton effect, matter waves, wave packets, phase and group velocity, Davisson Germer experiment, Franck-Hertz experiment, Heisenberg uncertainty principle. Schrödinger equation, probabilistic interpretation of wave function. One dimensional problems-particle in a box, potential well, potential barrier and tunneling, harmonic oscillator. Hydrogen atom. Elements of statistical Physics: Maxwellian distribution, Bose-Einstein and Fermi-Dirac distributions.			
v	Texts/References 1. H.S. Mani and G.K. Mehta, Introduction to Modern Physics. 2. S.H. Patil, Elements of Modern Physics. 3. K.S. Kane, Modern Physics 4. Beiser, Concepts of Modern Physics			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All Departments		

i	Title of the Course	**Introduction to Philosophy**	Course Code	HS 103
ii	Credit structure	L T P C 3 0 0 6		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content The course will acquaint the students of science and engineering with some issues on the nature and methods of science and mathematics, and the ethical issues arising out of the application of science and technology. The objective is to develop a critical, reflective and historical awareness on the issues relating to the following topics: Philosophy and History of Science: Growth of scientific knowledge: factors leading to the emergence of modern science. Conceptual evolution: internal and external history. Methodology of science: induction, falsificationism, confirmation and probability. Nature of scientific laws and theories: realism, instrumentalism and underdetermination. Relationship between scientific observation, experiment and scientific theory. Nature of scientific explanation: teleological explanations and the covering law model. Selected case studies on scientific theories.Logic and the nature of mathematical reasoning: Inductive and deductive forms of reasoning. Nature of axioms: formal axiomatic systems. Concept of consistency, independence and completeness. Nature of rules of inference and proof. Selected examples of axiomatic systems and proof procedures. Cognition: Current approaches to the understanding of mind and mental processes: empiricist, rationalist, behaviourist and cognitivist. Ethics: Impact of science and technology on man and society: elements of environmental and professional ethics.			
v	Texts/References A.C. Grayling (Ed.) Philosophy; A Guide through the subject, Oxford University Press, Londown, 1995.Marx W. Wartofsky, Conceptual Foundations of Scientific Thought: An Introduction to the Philosophy of Science, Macmillan, London 1968.I.B. Cohen, The Birth of a New Physics, Penguin Books, 1985.H. Eves and C.V. Newsom, Foundations and Fundamental Concepts of Mathematics, Boston, PWS-Kart Pub. Co., 1990.K.E. Goodpaster and K.M. Sayre (Eds.) Ethics and Problems of 21st Century, Univ. of Notre Dame Press, London, 1979.S.D. Agashe, A.Gupta and K. Valicha (Eds.) Scientific Method, Science, Technology and Society: A Book of Readings, Univ. of Bombay Press 1980.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All Departments		

i	Title of the Course	Introduction to Electrical and Electronic Circuits	Course code	EE 102
ii	Credit structure	L T P C 3 0 0 6		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Introduction, basic physical laws, circuit elements, KVL, KCL, and a few important circuit theorems, simple circuits, Transients in R-L, R-C, R-L-C, Sinusoidal Steady State, Real/Reactive Power, Three Phase Working Principles of Transformers/AC/DC machines Functional Characteristics of Diode, BJT, OP-AMP Analog circuit Examples: rectifiers, amplifiers, oscillators etc. Digital Circuits: AND/OR gates, Flip Flops, DAC/ADC etc.			
v	Texts/References	1. Vincent Del Toro, `Electrical Engineering Fundamental, Prentice Hall, 1989 2. K.A.Krishnamurthy and M.R.Raghuveer, `Electrical and Electronics Engineering for Scientists', Wiley Eastern Ltd., 1993.		
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Linear Algebra	Course Code	MA 102
ii	Credit structure	L T P C 3 1 0 4		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Vectors in R^n, notion of linear independence and dependence, linear span of a set of vectors, vector subspaces of R^n, basis of a vector subspace. Systems of Linear equations, matrices and Gauss elimination, row space, null space, and column space, rank of a matrix. Determinants and rank of a matrix in terms of determinants. Abstract vector spaces, linear transformations, matrix of a linear transformation, change of basis and similarity, rank-nullity theorem. Inner product spaces, Gram-Schmidt process, orthonormal bases, projections and least squares approximation. Eigenvalues and eigenvectors, characteristic polynomials, eigenvalues of special matrices (orthogonal, unitary, hermitian, symmetric, skew-symmetric, normal). Algebraic and geometric multiplicity, diagonalization by similarity transformations, spectral theorem for real symmetric matrices, applications to quadratic forms.			
v	Texts/References • H.Anton, *Elementary linear algebra with applications* (8^{th} ed.), John Wiley (1995) • G.Strang, *Linear algebra and its applications* (4rh Ed.), Thomson (2006) • S.Kumaresan, *Linear algebra – A Geometric approach*, Prentice Hall of India (2000) • E.Kreyszig, *Advanced Engineering Mathematics* (8^{th} Ed.), John Wiley (1999)			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

<table>
<tr><td>i</td><td>Title of the Course</td><td>Ordinary Differential Equations - I</td><td>Course code</td><td>MA 104</td></tr>
<tr><td>ii</td><td>Credit structure</td><td colspan="3">L T P C
3 1 0 4</td></tr>
<tr><td>iii</td><td>Prerequisite, if any(for the students)</td><td colspan="3">None</td></tr>
<tr><td>iv</td><td colspan="4">Course Content
• Exact equations, integrating factors and Bernoulli equations.
• Orghogonal trajectories.
• Lipschitz condition, Picard’s theorem, examples on nonuniqueness.
• Linear differential equations generalities.
• Linear dependence and Wornskians.
• Diamensionality of space of solutions, abel-Liouville formula.
• Linear ODE’s with constant coefficients, the characteristic equations.
• Cauchy-Euler equations.
• Method of undetermined coefficients
• Method of variation of parameters.
• Laplace transform generalities.
• Shifting theorems
• Convolution theorem.</td></tr>
<tr><td>v</td><td colspan="4">Texts/References
1. E.Kreyszig, Advanced engineering mathematics (8th Ed.), John Wiley (1999)
2. W.E.Boyce and R. DiPrima, Elementary Differential Equations (8th Ed.) John Wiley (2005)
3. T.M.Apostol, Calculus, Volume 2 (2nd Ed.), Wiley Eastern, 1980.</td></tr>
<tr><td>vi</td><td>Instructor(s)name</td><td colspan="3"></td></tr>
<tr><td>vii</td><td>Name of other departments to whom the course is relevant</td><td colspan="3"></td></tr>
</table>

i	Title of the Course	Workshop Practice	Course Code	ME 102
ii	Credit structure	L T P C 0 1 3 5		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Introduction to wood work: hand tools & various operations. Introduction to pattern making: types of patterns, allowances, colour coding. etc. Introduction to bench work & fitting: tools & operations. Introduction to metal cutting and machine tools: Safety measures, principles of operation of basic machine tools like lathe, shaping, & drilling. Important operations on these machines. Cutting tools and their usage, selection of cutting speeds, feeds, etc. Introduction to welding. Assignments: Simple assignments in wood working, fitting, electric arc welding, lathe and shaping machine work.			
v	Texts/References 1) Elements of Workshop Technology, Vol. I by S. K. Hajrachoudhury & Others, Media Promoters and Publishers, Mumbai. 14th Edition, 2007. 2) Elements of Workshop Technology, Vol. II by S. K. Hajrachoudhury & Others, Media Promoters and Publishers, Mumbai. 12th Edition, 2007. 3) Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All Departments		

i	Title of the Course	Physics Lab.	Course code	PH 111
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)			
iv	Course Content Error analysis and accuracy of measurement. Selected experiments from the following: current and voltage sensitivities of a moving coil galvanometer, measurement of self inductance using Anderson's bridge, resistivity of a thermistor, Helmholtz coil. Fresnel biprism, Newton's rings. Young's modulus using Koenig's method, physical pendulum, Kundt's Tube, Laser Diffraction, Grating Spectrometer, G.M. Counter.			
v	Texts/References 1. B.L. Worsnop and H.T. Flint, Advanced Practical Physics for students, Asia Publishing House, 1971. 2. G.L. Squires, University Press, Cambridge, 1999.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Complex Analysis	Course Code	MA 201
ii	Credit structure	L T P C 3 1 0 4		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content • Definition and properties of analytic functions. • Cauchy-Riemann equations, harmonic functions. • Power series and their properties. • Elementary functions • Cauchy's theorem and its applications. • Taylor series and Laurent expansions. • Evaluation of improper integrals. • Conformal mappings. • Inversion of Laplace transforms.			
v	Texts/References 1. R.V.Churchill and J.W.Brown, Complex variables and applications (7^{th} Edition), McGraw-Hill (2003) 2. J.M.Howie, Complex analysis, Springer-Verlag (2004) 3. M.J.Ablowitz and A.S.Fokas, Complex Variables – Introduction and Applications, Cambridge University Press, 1998 (Indian Edition) 4. E.Kreyszig, Advanced engineering mathematics (8^{th} Edition), John Wiley (1999)			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Differential Equations – II	Course Code	MA 203
ii	Credit structure	L T P C 3 1 0 4		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content 1. Review of power series and series solutions of ODE's. 2. Legendre's equation and Legendre polynomials. 3. Regular and irregular singular points, method of Frobenius. 4. Bessel's equation and Bessel's functions 5. Strum-Liouville problems 6. Fourier series 7. D'Alembert solution to the Wave equation 8. Classification of linear second order PDE in two variables. 9. Laplace, Wave and Heat equations using separetion of variables. 10. Vibration of a circular membrane 11. Heat equation in the half space.			
v	Texts/References 1. E.Kreyszig, Advanced engineering mathematics (8^{th} Edition), John Wiley (1999) 2. W.E.Boyce and R.DiPrima, Elementary Differencial Equations (8^{th} Edition), John Wiley (2005) 3. R.V.Churchill and J.W.Brown, Furier series and boundary value problems (7^{th} Edition), McGraw Hill (2006)			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Network Theory	Course Code	EE 201
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Graphs of networks; current and voltage spaces of graphs and their representations: incidence, cutset and circuit matrices; Tellegen's Theorem. Formal study of methods of analysis such as nodal, modified nodal, cutset, loop analysis for linear networks. Multiport representation for networks with particular emphasis on 2-ports. Time domain analysis of R, L, M, C, controlled sources, networks using state space methods. Introduction to s-domain methods.			
v	Texts/References 1. N Balabanian and T.A. Bickart, Linear Network Theory: Analysis, Properties, Design and Synthesis, Matrix Publishers, Inc. 1981. 2. L.O. Chua, C.A. Desoer, E.S. Kuh, Linear and Nonlinear Circuits, McGraw - Hill International Edition 1987.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Electronic Devices	Course Code	EE 203
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Modeling devices: Static characteristics of ideal two terminal and three terminal devices; Small signal models of non-linear devices. Introduction to semiconductor equations and carrier statistics: poisson's and continuity equations, Fermi-Dirac statistics and Boltzmann approximation to the Fermi-Dirac statistics. Semiconductor Diodes: Barrier formation in metal-semiconductor junctions, PN homo- and hetero- junctions; CV characteristics and dopant profiling; IV characteristics; Small signal models of diodes; Some Applications of diodes. Field Effect Devices : JFET/HFET, MIS structures and MOSFET operation; JFET characteristics and small signal models; MOS capacitor CV and concept of accumulation, depletion and inversion; MOSFET characteristics and small signal models. Bipolar transistors : IV characteristics and elers-Moll model; small signal models; Charge storage and transient response. Discrete transistor amplifiers: Common emitter and common source amplifiers; Emitter and source followers.			
v	Texts/References 1. D. A. Neamen, Semiconductor Physics and Devices (IRWIN), Times Mirror High Education Group, Chicago) 1997. 2. E.S. Yang, Microelectronic Devices, McGraw Hill, Singapore, 1988. 3. B.G. Streetman, Solid State Electronic Devices, Prentice Hall of India, New Delhi, 1995. 4. J. Millman and A. Grabel, Microelectronics, McGraw Hill, International, 1987. 5. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, 1991. 6. R.T. Howe and C.G. Sodini, Microelectronics: An integrated Approach, Prentice Hall International, 1997.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Introduction to Electrical Systems	Course Code	EE 205
ii	Credit structure	L T P C 3 0 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Passive elements, Sources, Review of Kirchhoff's Laws: KCL, KVL, ; Mesh and Nodal analysis; Steady state ac circuit analysis, phasors; Single phase, Power, Reactive power, Power factor improvement, 3 phase circuits; Magnetic circuits and Mutual inductance ; Transformers, DC machines, Induction machines (1 and 3 phase), Synchronous machines, Stepper motor; Introduction to Power Engineering			
v	Texts/References 1. Vincent Del Toro, `Electrical Engineering Fundamental, Prentice Hall, 1989 2. P.C.Sen, `Principles of Electrical Machines and Power Electronics', John Wiley and Sons 1989 3. I.J.Nagrath, `Basic Electrical Engineering', Tata McGraw Hill, India. 1988			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Electronics Devices Lab.	Course Code	EE 211
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content	(To supplement **EE112** and Electronic **Devices** Course)		
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Basic Electric Laboratory	Course Code	EE 213
ii	Credit structure	L T P C 0 0.5 3 4		
iii	Prerequisite, if any(for the students)			
iv	Course Content	Will be provided by the lab instructor		
v	Texts/References	Will be provided by the lab instructor		
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Signals and Systems	Course Code	EE 202
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Continuous-time signals and systems: signal characteristics; common signals; properties of continuous-time systems. Continuous linear time-invariant systems: impulse response; convolution; linear constant-coefficient differential equations. Fourier series, Fourier transform Laplace transform: system analysis; frequency response; analog filters. State-space analysis for continuous-time systems Discrete-time signals and systems Discrete-time LTI systems: convolution; difference equations. Sampling			
v	Texts/References 1. R.F. Ziemer, W.H. Tranter and D.R. Fannin, Signals and Systems - Continuous and Discrete, 4th Edn. Prentice Hall, 1998. 2. A.V. Oppenheim, A.S. Willsky and I.T. Young, Signals and Systems, Prentice Hall, 1983. 3. B.P. Lathi, Signal Processing and Linear Systems, Oxford University Press, 1998.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Analog Circuits	Course Code	EE 204
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Introduction to operational amplifiers: The difference amplifier and the ideal operational amplifier models, concept of negative feedback and virtual short; Analysis of simple operational amplifier circuits; Frequency response of amplifiers, Bode plots. Feedback: Feedback topologies and analysis for discrete transistor amplifiers; stability of feedback circuits using Barkhausen criteria. Linear applications of operational amplifiers: Instrumentation and Isolation amplifiers; Current and voltage sources; Active filters. Non-linear applications of operational amplifiers: Comparators, clippers and clampers; Linearization amplifiers; Precision rectifiers; Logarithmic amplifiers, multifunction circuits and true rms converters. Waveform Generation: sinusoidal feedback oscillators; Relaxation oscillators, square-triangle oscillators Real operational amplifiers: Current sources and active loads, difference, intermediate and output stages including Miller capacitors for frequency computation; Operational amplifier parameters; Effects of real operational amplifier parameters on circuit performance. Analog and Digital interface circuits: A/D, D/A Converters, S/H circuits and multiplexers.			
v	Texts/References 1. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, 2nd edition, McGraw Hill, New York, 1992. 2. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, 3. Cambridge University Press, 1989. 4. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, Edition IV 5. Paul R.Gray \& Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, Wiley, 3 rd Edition			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Electrical Machines and Power Electronics	Course Code	EE 206
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Review of principles of operation of dc, induction and synchronous machines Operating Characteristics of dc and ac machines, Speed control of dc and induction motors. Operating characteristics of power semi-conductor devices, principle of operation of single and three phase ac-dc line commutated converters, introduction to unity power factor converters. Principle of operation dc-dc (buck, boost, buck-boost, cuk, fly-back and forward) converters. Principle of operation single phase and three phase dc-ac converters, PWM techniques.			
v	Texts/References 1. P.C. Sen, "Principles of Electric Machines and Power Electronics," Second Edition, John Wiley & Sons-1996 2. M.H. Rashid, "Power Electronics Circuits, Devices and Applications," Third Edition, Prentice-Hall of India Private Limited, New Delhi-2004.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Digital Systems	Course Code	EE 208
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	none		
iv	Course Content • Review of basic combinational and sequential logic, Review of digital electronics, • Digital Logic Families: TTL, CMOS etc., • Number systems and basic digital arithmetic, • Finite State Machine Design, Analysis and Synthesis, • Introduction to Hardware Description Language, • Array based logic elements (Memory, PLA, FPGA), • Special Topics (such as processor design, testing and verification, special digital systems, asynchronous state machines etc.)			
v	Texts/References 1. J.F.Wakerly: Digital Design, Principles and Practices, 4th Edition, Pearson Education, 2005 2. Charles H Roth: Digital Systems Design using VHDL, Thomson Learning, 1998 3. Taub and D. Schilling, Digital Integrated Electronics, McGraw Hill, 1977. 4. D.A. Hodges and H.G. Jackson, Analysis and Design of Digital Integrated Circuits, International Student Edition, McGraw Hill, 1983. 5. F.J. Hill and G.L. Peterson, Switching Theory and Logic Design, John Wiley, 1981. 6. Kohavi, Switching and Finite Automata Theory, McGraw Hill, 1970.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Analog Lab.	Course Code	EE 212
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)			
iv	Course Content	(To supplement **Analog Circuits** Course)		
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Digital Circuits Lab.	Course Code	EE 214
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)			
iv	Course Content	(To supplement **Introduction to Electronics** and **Digital Systems** Course)		
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	**Machines Laboratory**	Course Code	EE 216
ii	Credit structure	L T P C 0 0 4 4		
iii	Prerequisite, if any(for the students)			
iv	Course Content	(To supplement **Introduction to Electrical Systems** and **Electrical Machines and Power Electronics** Courses)		
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Microprocessors	Course Code	EE 301
ii	Credit structure	L T P C 2 0 2 6		
iii	Prerequisite, if any(for the students)	**Digital Systems** Course		
iv	Course Content Theory: A block diagram view of a general purpose processor; elements of hardware and software architectures; introductory data and control paths concepts, registers and memory organization. Instruction set basics and assembly language programming: Instruction structure and addressing modes, instruction encoding, detailed study of 8085A instruction set and interfacing basics: memory interfacing, principles of I/O interfacing, polled and interrupts I/O handshaking principles. Examples of I/O devices: parallel port, serial port, keypad, display, etc. Introductory micro controllers. Laboratory: Supplements the theory 8085-microprocessor kit based experiments: Software experiments demonstrate the use of the instruction set and assembly language programming. Hardware experiments for memory interfacing, parallel port, serial ports, interrupt driven I/O Simple micro controllers based experiments.			
v	Texts/References 1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996 2. D. A .Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface. Morgan Kaufman Publishers. 3. Douglas Hall, Microprocessors Interfacing, Tata McGraw Hill, 1991. 4. Kenneth J. Ayala, the 8051 Microcontroller, Penram International Publishing, 1996.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Communication Systems	Course Code	EE 303
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	**Signals and System**s Course		
iv	Course Content Review of signals and systems, Frequency domain of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation., Representation of FM and PM signals. Spectral characteristics of angle modulated signals. Review of probability and random process. Gaussian and white noise characteristics. Noise in amplitude modulation systems. Noise in Frequency modulation systems. Preemphasis and Deemphasis. Threshold effect in angle modulation. Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM). Differential pulse code modulation. Delta modulation. Noise considerations in PCM. Time Division multiplrxing. Digital Multiplexers.			
v	Texts/References • Haykin S., "Communications Systems", John Wiley and Sons, 2001. • Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002. • Taub H. and Schilling D.L., "Prnciples of Communication Systems", Tata McGraw Hill, 2001.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	E M Waves	Course Code	EE 305
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)			
iv	Course Content Review of Maxwell's equations, TEM modes in a linear homogenous isotropic medium, polarization, Pointing vector and power flow, TEM waves incident on a boundary - Snell's laws, wave propagation inside a conductor - skin depth, weakly dispersive TEM modes - phase and group velocity. Field analysis of guided TEM modes (transmission lines), characteristic impedance, voltage and current relationships, impedance discontinuities and standing waves, impedance matching, Smith chart, pulse propagation in transmission lines, lossy lines. Field analysis of guided non-TEM modes (rectangular and cylindrical waveguides), quantization of modes by boundary conditions, mode cut-off frequencies, dispersion relation, field patterns, power flow, orthogonality of modes, excitation of waveguide modes by coaxial cables, non-TEM modes in coaxial cables. Electromagnetic radiation - inhomogeneous wave equation, solution by potentials (Lienard-Wiechert formula), retarded potentials, radiation from a Hertzian dipole, formulation of the antenna problem as an integral equation, antenna gain, radiation resistance, radiation pattern, antenna feed structures, study of some standard antennas - dipole, array, aperture, horn, and optical.			
v	Texts/References 1. Ramo, S., Whinnery J.R., and van Duzer, T: Fields and Waves in Communication Electronics, 3rd ed., Wiley Eastern (1997). 2. R.E. Collin, Foundations for Microwave Engineering, 2nd ed., McGraw-Hill, 1993. 3. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

<table>
<tr><td>i</td><td>Title of the Course</td><td>Probability and Random Processes</td><td>Course Code</td><td>EE 307</td></tr>
<tr><td>ii</td><td>Credit structure</td><td colspan="3">L T P C
2 1 0 6</td></tr>
<tr><td>iii</td><td>Prerequisite, if any(for the students)</td><td colspan="3"></td></tr>
<tr><td>iv</td><td colspan="4">Course Content

Sets and set operations; Probability space; Conditional probability and Bayes theorem; Combinatorial probability and sampling models; Discrete random variables, probability mass function, probability distribution function, example random variables and distributions; Continuous random variables, probability density function, probability distribution function, example distributions; Joint distributions, functions of one and two random variables, moments of random variables; Conditional distribution, densities and moments; Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds; Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem.
Random process. Stationary processes. Mean and covariance functions.
Ergodicity. Transmission of random process through LTI. Power spectral density.</td></tr>
<tr><td>v</td><td colspan="4">Texts/References

1. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing,'' Third Edition, Pearson Education. (Indian Edition is available).<br>2. Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes,'' Fourth Edition, McGraw Hill. (Indian Edition is available).
3. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International Student Edition. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers
4. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers
5. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.</td></tr>
<tr><td>vi</td><td>Instructor(s)name</td><td colspan="3"></td></tr>
<tr><td>vii</td><td>Name of other departments to whom the course is relevant</td><td colspan="3"></td></tr>
</table>

i	Title of the Course	HSS elective	Course Code	HS xxx
ii	Credit structure	L T P C 3 0 0 6		
iii	Prerequisite, if any(for the students)			
iv	Course Content	Will be provided by course instructor		
v	Texts/References	Will be provided by course instructor		
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Control Systems	Course Code	EE 302
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	**Signals and Systems** Course		
iv	Course Content Basic concepts: Notion of feedback; open- and closed-loop systems. Modeling and representations of control systems: Ordinary differential equations; Transfer functions; Block diagrams; Signal flow graphs; State-space representations, Performance and stability: Time-domain analysis; Second-order systems; Characteristic-equation and roots; Routh-Hurwitz criteria, Frequency-domain techniques: Root-locus methods; Frequency responses; Bode-plots; Gain-margin and phase-margin; Nyquist plots; Compensator design: Proportional, PI and PID controllers; Lead-lag compensators. State-space concepts: Controlability; Observability; pole placement result; Minimal representations.			
v	Texts/References 1. Norman S. Nise, Control Systems Engineering, 4th edition, New York, John Wiley, 2003. (Indian edition) 2. Franklin, J.D. Powell and A. Emami-Naeini, Feedback Control of Dynamic Systems, Addison Wesley, 1986. 3. I.J. Nagrath and M. Gopal, Control System Engineering, 2nd Edn. Wiley Eastern, New Delhi, 1982. 4. J.C. Doyle, B.A. Francis and A.R. Tannenbaum, Feedback Control Theory, Maxwell Macmilan International Edn. 1992. 5. C.L. Phillips and R.D. Harbour, Feedback Control Systems, Prentice Hall, 1985 6. B.C. Kuo, Automatic Control Systems, 4th Edn. Prentice Hall of India, New Delhi, 1985.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Digital Signal Processing	Course Code	EE 304
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	**Signals and System**s Course		
iv	Course Content Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals; Discrete systems: attributes, Z-Transform, Analysis of LSI systems, Frequency analysis, Inverse Systems, Discrete Fourier Transform (DFT), Fast Fourier Transform algorithm, Implementation of Discrete Time Systems. Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Lowpass, Bandpass, Bandstop and High pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multirate signal processing. Application of DSP to Speech and Radar signal processing.			
v	Texts/References 1. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989. 2. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997. 3. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992. 4. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992. 5. D. J. DeFatta, J. G. Lucas and W. S. Hodgkiss, Digital Signal Processing, J Wiley and Sons, Singapore, 1988.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Digital Communications	Course Code	EE 206
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	**Probability and Random Processes** and **Communication Systems** Course		
iv	Course Content Review of Random Processes and Spectral analysis. Elements of Detection Theory. Optimum detection of signals in noise. Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Tranmission- Intersymbol Interference and Nyquist criterion. Passband Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continous Phase Modulation and Minimum Shift Keying. Digital Modulation tradeoffs. Optimum demodulation of digital signals over bandlimited channels- Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation.			
v	Texts/References 1. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering'', John Wiley, 1965. 2. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication'', Kluwer Academic Publishers, 2004. 3. Proakis J.G., ``Digital Communications'', 4th Edition, McGraw Hill, 2000.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Power Systems	Course Code	EE 308
ii	Credit structure	L T P C 3 1 0 6		
iii	Prerequisite, if any(for the students)	**Electrical Machines and Power Electronics** Course		
iv	**Course Content** Evolution of Power Systems, Energy Sources Structure of Bulk Power Systems Basic three phase system concepts Power System Components: Generators, Loads, Transformers, Transmission Lines etc. Modeling, Performance and Constraints of these components Formulation/Solution of steady state equations for interconnected systems: Balanced and Unbalanced systems. Positive Sequence Network, Per Unit System, Ybus formation Simple example of a load flow solution Introduction to generator swing equations and stability issues, Simple Example of Loss of synchronism Interconnected System Operation and Control: Operational Objectives, Frequency Control, Voltage Control and Power Flow Control: introduction to HVDC transmission and FACTS Economic Issues in Power Systems. Analysis of Faulted Power Systems and Protection: Unbalanced System Analysis using Sequence Components, Equipment Protection Schemes: Overcurrent, Differential and Distance Protection, Relay coordination Preventive Control and Emergency Control (System Protection Schemes) Blackouts and Restoration			
v	Texts/References 1. O.I Elgerd, Electric energy systems theory-An Introduction, 2nd edition, Tata McGraw Hill, 1982 2. A.R.Bergen and V. Vittal, Power Systems Analysis, Pearson Education Asia, New Delhi, 2002 3. P.Kundur, Power System Stability and Control, MGraw Hill, 1993			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Communications Laboratory	Course Code	EE 312
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content	(To supplement **Electromagnetic Waves, Communications Systems and Digital Signal Processing** Courses)		
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Control Systems Laboratory	Course Code	EE 314
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content	(To supplement **Control Systems** Course)		
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Environmental Studies	Course Code	ES 202
ii	Credit structure	L T P C 2 1 0 3	(Half semester course)	
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Multidisciplinary nature of environmental studies, Ecosystems, Biodiversity and its conservation, Indicators of environmental pollution, Environment and human health Consumption of natural resources and environmental degradation (forests, water, coal, minerals, energy, and land), Sustainable development, Environmental policy and legislation, Environmental impact assessment. Pollution of lakes, rivers, ground water, coasts, and oceans, Science and technology for drinking water and wastewater treatment and issues in management of systems, Solid and hazardous waste management (causes, effects and control measures) Air and noise pollution (science and engineering of pollution control), Global Issues including climate change, global warming, acid rain, ozone layer depletion, nuclear hazards, Disaster management (industrial accidents, floods, earthquakes, cyclones and landslides),			
v	Texts/References Cunningham W.P. and Cunningham M.A. (2002), Principles of Environmental Science, Tata McGraw-Hill Publishing Company, New Delhi. Nathanson, J.A. (2002), Basic Environmental Technology, Prentice Hall of India, New Delhi. Arceivala, S.J. and Asolekar, S.R. (2006), Wastewater Treatment for Pollution Control and Reuse, 3rd Edition, Tata McGraw Publishing Co. Ltd., New Delhi. Asolekar, S.R. and Gopichandran, R. (2005), Preventive Environmental Management – An Indian Perspective, Foundation Books Pvt. Ltd., New Delhi, 2005. Some selected book-chapters, monographs and journal papers			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Environmental Studies	Course Code	HS 202
ii	Credit structure	L T P C (Half semester course) 2 1 0 3		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Social Issues and the environment, Public awareness and Human rights, Indicators of sustainability, Governance of Natural Resources - Common pool resources: issues and management. Environmental ethics, Religion and environment, Wilderness and Developing Trends, Environmental movements and Activism, Social Ecology and Bioregionalism, Environmental justice. Environmental economics, Trade and environment, Economics of environmental regulation, Natural resource accounting, Green GDP. Environment and development, Resettlement and rehabilitation of people, Impacts of climate change on economy and society, Vulnerability and adaptation to climate change.			
v	Texts/References Agar, N., 2001. *Life's Intrinsic Value*, New York: Columbia University Press. Dasgupta, P. and Maler, G. (eds.), (1997), The Environment and Emerging Development Issues, Vol. I, OUP. Guha, Ramachandra (2006): "Mahatama Gandhi and Environmental Movement," *Debating on Gandhi*, in A. Raghuramaraju (ed.), New Delhi: Oxford University Press. Guha, Ramachandra and Madhav Gadgil (1995): Ecology and Equity: The Use and Abuse of Nature in Contemporary India, New Delhi: Penguin. Hanley, Nick, Jason F. Shogren and Ben White (2004): Environmental Economics in Theory and Practice, New Delhi: MacMillan. Naess, A. and G. Sessions (1984): "Basic Principles of Deep Ecology," *Ecophilosophy*, Vol.6. Redclift, M. and Woodgate, G. (eds.), (1997), International Handbook of Environmental Sociology, Edward Edgar.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	B.Tech. Project – I	Course Code	EE 451
ii	Credit structure	L T P C 0 0 6 6		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content	As assigned by the Project guide /co-ordinator		
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	B.Tech. project – II	Course Code	EE 452
ii	Credit structure	L T P C 0 0 12 12		
iii	Prerequisite, if any(for the students)			
iv	Course Content	As assigned by the project guide / co-ordinator.		
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

Course Curriculum for B.Tech. Programme: Mechanical Engineering Department

Semester I					
Course code	Course Name	Credit structure			
		L	T	P	C
CH 101	Chemistry	2	1	0	6
CS 101	Computer Programming & Utilization	2	0	2	6
HS 101 HS 103	English Language Course * Introduction to Philosophy	3	0	0	6
MA 101	Calculus	3	1	0	8
PH 101	Electricity and Magnetism	2	1	0	6
PH 111	Physics Lab.	0	0	3	3
ME 101	Engineering Graphics & Drawing	0	1	3	5
NC 101#	National Cadet Corps (NCC)	0	0	0	P/NP
NO 101#	National Sports Organization (NSO)	0	0	0	P/NP
NS 101#	National Service Scheme (NSS)	0	0	0	P/NP
					40

* For students deficient in English Language

Semester II					
Course Code	Course Name	Credit Structure			
		L	T	P	C
PH 102	Modern Physics	3	1	0	8
HS 102	Economics	3	0	0	6
CL 102 EE 102	Introduction to Chemical Engg (**for CL**) Intro. to Electrical and Electronic Circuits* **(for EE and ME)**	3	0	0	6
MA 102 MA 104	Linear Algebra Ordinary Differential Equation - I	3 3	1 1	0 0	4 4
ME 102	Workshop Practice	0	1	3	5
CH 112	Chemistry Lab	0	0	3	3
NC 102#	National Cadet Corps (NCC)	0	0	0	P/NP
NO 102#	National Sports Organization (NSO)	0	0	0	P/NP
NS 102#	National Service Scheme (NSS)	0	0	0	P/NP
					36

Any one of these courses to be taken

Semester III					
Course code	Course Name	Credit structure			
		L	T	P	C
ME 201	Solid Mechanics	2	1	0	6
ME 203	Thermodynamics	2	1	0	6
EE 207	Electric Circuits	3	1	0	8
MM 201	Engineering Metallurgy	2	1	0	6
EE 213	Electrical and Electronics lab.	0	0.5	3	4
					30

Semester IV					
Course code	Course Name	Credit structure			
		L	T	P	C
ME 202	Strength of Materials	2	1	0	6
ME 204	Fluid Mechanics	2	1	0	6
ME 206	Manufacturing Processes – I	2	1	0	6
MA 204	Numerical Analysis	3	1	0	8
ME 212	Solid Mechanics Lab	0	0	3	3
ME 214	Manufacturing Practice Lab	0	1	3	5
					34

Semester V					
Course code	Course Name	Credit structure			
		L	T	P	C
ME 301	Heat Transfer	2	1	0	6
ME 303	Industrial Engineering and Operations Research	2	1	0	6
ME 305	Manufacturing Processes – II	2	1	0	6
HS xxx	HSS core	3	0	0	6
ME 311	Manufacturing Process Lab	0	0	3	3
ME 313	Fluid Mechanics Lab	0	0	3	3
					30

Semester VI					
Course code	Course Name	Credit structure			
		L	T	P	C
ME 302	Applied Thermodynamics	2	1	0	6
ME 304	Kinematics and Dynamics of Machines	2	1	0	6
ME xxx	Departmental Elective	3	0	0	6
ES 202	Environmental Studies (Half semester)	3	0	0	3
HS 202	Environmental Studies (Half semester)	3	0	0	3
ME 312	Kinematics and Dynamics of Machines Lab	0	0	3	3
ME 314	Heat Transfer and Metrology Lab	0	0	3	3
					30
HONORS					
ME xxx	Honors Course – 1	3	0	0	**6**

Semester VII					
Course code	Course Name	Credit structure			
		L	T	P	C
ME 401	Machine Design	2	1	2	8
ME 403	Microprocessors and Automatic Control	2	1	0	6
ME xxx	Department Elective – II	3	0	0	6
XX xxx	Institute Elective – I	3	0	0	6
ME 411	Applied Thermodynamics Lab	0	0	3	3
ME 413	Microprocessors and Automatic Control Lab	0	0	3	3
					32
HONORS					
ME xxx	Honors Course – 2	3	0	0	**6**
ME xxx	Honors Project (stage – I)	0	0	0	**6**

Semester VIII					
Course code	Course Name	Credit structure			
		L	T	P	C
ME xxx	Department Elective – III	3	0	0	6
ME xxx	Department Elective – IV	3	0	0	6
ME xxx	Department Elective - V	3	0	0	6
ME xxx	Department Elective – VI	3	0	0	6
XX xxx	Institute Elective – II	3	0	0	6
					30
HONORS					
ME xxx	Honors Project (Stage – II)	0	0	0	**12**

Important Instructions and List of Electives for B.Tech.

(i) B.Tech. Program consists of 262 credits including 30 credits for Departmental elective and 12 credits of Institute elective courses. (6+2 electives)

(ii) Each student must select any 6 courses from the departmental elective list I to IV given below.

(iii) Honors can be earned by completing 2 electives (12 credits) and an 18-credit project. The project, guide and the electives must be decided by the end of semester V. The project should be taken up in the semesters VII and VIII. 2 electives must be slanted towards the project and decided in consultation with the project guide from the list of department electives I to VI given below.

Department Electives I to VI

ME 3xx Analytical Methods in Engineering
ME 3xx Computer Aided Solution
ME 3xx Refrigeration and Air-Conditioning
ME 3xx Mechanization
ME 3xx Power Plant Engineering
ME 3xx Experimental Stress Analysis
ME 4xx Internal Combustion Engines
ME 4xx Steam and Gas Turbines
ME 4xx Industrial Engineering and Operations Research II
ME 4xx Microfluidics
ME 4xx Computational Fluid Dynamics and Heat Transfer
ME 4xx Design for Fatigue and Fracture
ME 4xx Industrial Tribology
ME 4xx Fuels and Combustion
ME 4xx Vibration and Noise Control
ME 4xx Automobile Engineering (Transmission)
ME 4xx Non Linear Dynamics and Chaos
ME 4xx Introduction to Optimization
ME 6xx Stress Analysis
ME 6xx Fatigue, Fracture and Failure Analysis *
ME 6xx Kinematics and Dynamics of Machinery
ME 6xx Robotics
ME 6xx Computer Aided Design of Machines

ME 6xx Machine Design
ME 6xx Applied Tribology
ME 6xx Finite and Boundary Element Methods
ME 6xx Fracture Mechanics *
ME 6xx Rapid Product Development
ME 6xx Pressure Vessel Design
ME 6xx Mathematical Methods for Applied Mechanics
ME 6xx Cryogenics II
ME 6xx Linear Systems Theory
ME 6xx MEMS: Design, Fabrication and Charaterization
ME 6xx Advanced Finite and Boundary Element Methods
ME 6xx Convective Heat and Mass Transfer
ME 6xx Advanced Heat Transfer
ME 6xx Conduction and Radiation Heat Transfer
ME 6xx Industrial Noise Control
ME 6xx Design for Manufacturing
ME 6xx Collaborative Engineering
ME 6xx Fundamentals of Gas Dynamics
ME 6xx Thermal Environment Engineering
ME 6xx Cryogenic I
ME 6xx Air-Conditioning System Design
ME 7xx Computational Methods in Thermal and Fluids Engineering
ME 7xx Computer Integrated Manufacturing
ME 7xx Essential of Turbulence
ME 7xx Ultra Precision Machining
ME 7xx Selected Application of AI & OR in Manufacturing Systems
ME 7xx Vibro-Acoustics
ME 7xx Sheet Metal Engineering
ME 7xx Textile Machinery and Automation
ME 7xx Numerical Modeling of Manufacturing Processes
ME 7xx Casting Design and Simulation
ME 7xx Science and Technology of Welding
ME 7xx Analysis of Metal Forming Processes
ME 7xx Advances in Material Removal Processes
EN 6xx Non-Conventional Energy Sources
EN 6xx Fuel Cells

EN 6xx Nuclear Reactor Theory
EN 6xx Wind Energy Conversion Systems
EN 6xx Direct Energy Conversion
EN 6xx Energy Systems Modeling & Analysis
EN 6xx Solar Energy for Industrial Process Heat
EN 6xx Utilization of Solar Energy
EN 6xx Nuclear Reactor Thermal Hydraulics and Safety
EN 6xx Solar Photovoltaic: Fundamentals, Technologies and Applications
EN 6xx Power Generation and Systems Planning
IE 6xx Deterministic Models of Optimization and Operations Research
IE 6xx Discrete Event System Simulation
IE 6xx Introduction to Stochastic Models
IE 6xx Introduction to Financial Engineering
IE 6xx Engineering Economic Analysis
IE 6xx Industrial Scheduling
IE 6xx Quality Engineering and Management Systems
IE 6xx Applied Integer Programming
IE 6xx Inventory Control and Management Systems
IE 6xx System Dynamics Modeling and Analysis
IE 7xx Neural Networks, Fuzzy Systems and Applications
IE 7xx Introduction to Knowledge Based Systems and Applications
IE 7xx Selected Applications of AI in Operations Research
IE 7xx Quantitative Methods in Project Management
IE 7xx Pricing and Revenue Management
IE 7xx Multi-Player Decision Making Models
IE 7xx Markov Decision Processes
IE 7xx O.R. Applications in Infrastructure & Service Sectors
IE 7xx Selected Applications of Stochastic Models
IE 7xx Quantitative Models for Supply Chain Management

i	Title of the Course	Chemistry	Course Code	CH 101
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Schrodinger equation (origin of quantization), Born interpretation of wave function, Hydrogen atom: solution to Φ-part, MO theory: atomic and molecular orbitals, Structure, bonding and energy levels of diatomic molecules. Examples N2, O2, CO and HF, Configuration, molecular chirality and isomerism, Conformation of alkanes and cycloalkanes, Reactivity of carbonyl group (addition reactions, reactions due to acidic proton, addition-elimination reactions and reactivity of acid halide, ester and amide), Functional group interconversions involving oxidation and reduction, Periodic properties: trends in size, electron affinity, ionization potential and electronegativity, Use of Ellingham diagram and thermodynamics in the extraction of elements, Transition metal chemistry: inorganic complexes, bonding theories, magnetism, bonding aspects and structural distortion, Bioinorganic chemistry: storage and transport proteins, Catalysis: hydrogenation, hydroformylation and olefin metathesis			
v	Texts/References P.W.Atkins, Physical Chemistry, Oxford University Press, 7th Edition, 2006. G.M.Barrow, Physical Chemistry, 5th Edition, Tata McGraw-Hill, New Delhi, 1992. D.A.McQuarrie and J.D. Simon, Physical Chemistry - a molecular approach, Viva Books Pvt. Ltd. (1998). R.T.Morrison and R.N. Boyd, Organic Chemistry, Prentice Hall of India Pvt. Ltd., 5th Ed, 1990 L. G. Wade, Organic Chemistry, Pearson Education 6th Ed, 2006. G. Solomons and C. Fryhle, Organic Chemistry, John Wiley & Sons (Asia) Pte Ltd. M.J.Sienko and R.A.Plane, Chemical Principles and Applications, McGraw Hill, 1980. J.D.Lee, Concise Inorganic Chemistry, 4th Edition, ELBS, 1991. D.D.Ebbing, General Chemistry, Houghton Miffin Co., 1984.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All departments		

<table>
<tr><td>i</td><td>Title of the Course</td><td>Computer Programming and Utilization</td><td>Course code</td><td>CS 101</td></tr>
<tr><td>ii</td><td>Credit structure</td><td colspan="3">L T P C
2 0 2 6</td></tr>
<tr><td>iii</td><td>Prerequisite, if any(for the students)</td><td colspan="3">High School Mathematics</td></tr>
<tr><td>iv</td><td colspan="4">Course Content
<u>Description:</u> This course provides an introduction to problem solving with computers using a modern language such as Java or C/C++. Topics covered will include:

A. Utilization: Developer fundamentals such as editor, integrated programming environment, Unix shell, modules, libraries.
B. Programming features: Machine representation, primitive types, arrays and records, objects, expressions, control statements, iteration, procedures, functions, and basic i/o.
C. Sample problems in engineering, science, text processing, and numerical methods.

<u>Prerequisites:</u> High School Mathematics</td></tr>
<tr><td>v</td><td colspan="4">Texts/References
1. G. Dromey, How to Solve It by Computer, Prentice-Hall, Inc., Upper Saddle River, NJ, 1982
2. Polya, G., How to Solve _It (2nd ed.), Doubleday and co. (1957).
3. C++ Program Design: An introduction to Programming and Object-Oriented Design. Tata McGraw Hill. Coohoon and Davidson. 3rd Edition. 2003.
4. Let`s C. Yashwant Kanetkar. Allied Publishers, 1998.
5. The Java Tutorial, Sun Microsystems. Addison-Wesley, 1999.</td></tr>
<tr><td>vi</td><td>Instructor(s)name</td><td colspan="3"></td></tr>
<tr><td>vii</td><td>Name of other departments to whom the course is relevant</td><td colspan="3">All Department</td></tr>
</table>

i	Title of the Course	Economics	Course Code	HS 102
ii	Credit structure	L T P C 3 0 0 6		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Basic economic problems. Resource constraints and Welfare maximizations. Nature of Economics: Positive and normative economics; Micro and macroeconomics, Basic concepts in economics. The role of the State in economic activity; market and government failures; New Economic Policy in India. Theory of utility and consumer's choice. Theories of demand, supply and market equilibrium. Theories of firm, production and costs. Market structures. Perfect and imperfect competition, oligopoly, monopoly. An overview of macroeconomics, measurement and determination of national income. Consumption, savings, and investments. Commercial and central banking. Relationship between money, output and prices. Inflation - causes, consequences and remedies. International trade, foreign exchange and balace payments, stabilization policies: Monetary, Fiscal and Exchange rate policies.			
v	Texts/References 1. P. A. Samuelson & W. D. nordhaus, Economics, McGraw Hill, NY, 1995. 2. Koutsoyiannis, Modern Microeconomics, Macmillan, 1975. R. Pindyck and D. L. Rubinfeld, Microeconomics, Macmillan publishing company, NY, 1989. 3. R. J. Gordon, Macroeconomics 4th edition, Little Brown and Co., Boston, 1987. William F. Shughart II, 4. The Organization of Industry, Richard D. Irwin, Illinois, 1990.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All Departments		

i	Title of the Course	Calculus	Course code	MA 101
ii	Credit structure	L T P C 3 1 0 8		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Review of Limits, continuity, differentiability. Mean value theorem, Taylors Theorem, Maxima and Minima. Riemann integrals, Fundamental theorem of Calculus, Improper integrals, applications to area, volume Convergence of sequences and series, power series. Partial Derivatives, gradient and directional direvatives, chain rule, maxima and minima, Lagrange multipliers. Double and Triple integration, Jacobians and change of variables formula. Parametrization of curves and surfaces, vector Fields, Line and surface integrals. Divergence and curl, Theorems of Green, Gauss, and Stokes.			
v	Texts/References 1. Hughes-Hallett et al, *Calculus – Single and Multivariable* (3rd Edition), 2. John-Wiley and Sons (2003) 3. James Stewart, *Calculus* (5th Edition), Thomson (2003) 4. T.M. Apostol, *Calculus*, Volumes 1 and 2 (2nd Edition), Wiley Eastern 1980 5. G.B.Thomas and R.L.Finney, *Calculus and Analytic Geometry* 6. (9th Edition), ISE Reprint, Addison-Wesley, 1998.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All Departments		

i	Title of the Course	Electricity and Magnetism	Course code	PH 101
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Electrostatics: Coulomb's law, Gauss theorem, electric potential, Laplace's equation, Poisson's equation, electrostatics with conductors, capacitors, dielectrics. Magnetostatics : Biot Savart's law, Ampere's law, Lorentz force. Magnetic Induction: Faraday's law, Lenz's law, self and mutual inductance, energy in a magnetic field, LCR circuit, resonance. Maxwell's equations: displacement current, electromagnetic waves, plane wave solutions of Maxwell's equations, Poynting vector, wave propagation through a boundary, reflection, refraction, absorption and skin depth.			
v	Texts/References 1. A.S. Mahajan and A. Rangawala, Electricity and Magnetism, Tata McGraw Hill, 1989. 2. D. Griffiths, Introduction to Electrodynamics, 2nd ed., Prentice Hall, 1989.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All departments		

i	Title of the Course	Chemistry Lab	Course code	CH 112
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Experiments illustrating the concepts of (1) Galvanic cells, (2) Thermo chemistry (3) Chemical kinetics (4) Equilibrium constant (5) Analysis by oxidation reduction titration.			
v	Texts/References	--		
vi	Instructor(s)name	--		
vii	Name of other departments to whom the course is relevant	All departments		

i	Title of the Course	Engineering Graphics and Drawing	Course code	ME 101
ii	Credit structure	L T P C 0 1 3 5		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Introduction to engineering drawing and orthographic projections; Projection of points and straight line; Projection of planes and solids; Projection of simple machine elements; Development of surfaces, Intersection of surfaces; Construction of isometric views from orthographic projections. v			
v	Texts/References 1. Bhatt N. D. and Panchal V. M., Engineering Drawing, Charotar Publishers, Anand, 2007. 2. Luzadder Warren J. and Duff Jon M., Fundamentals of Engineering Drawing, Prentice Hall of India, 2001. 3. French Thomas E. and Vierck Charles J., Engineering Drawing and Graphic Technology, McGraw Hill, 1993. 4. Jolhe Dhananjay A., Engineering Drawing, Tata McGraw Hill, 2007. Shah M. B. and Rana B. C., Engineering Drawing, Dorling Kindersley (India) Pvt. Ltd, Pearson Education,			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Modern Physics	Course Code	PH 102
ii	Credit structure	L T P C 3 1 0 8		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Special theory of relativity: Galilean and Lorentz transformation, space time viewpoints, Minkowski space and four vectors, energy momentum conservation. Review of quantum concepts, Black body radiation, particle nature of light, photoelectric effect, Compton effect, matter waves, wave packets, phase and group velocity, Davisson Germer experiment, Franck-Hertz experiment, Heisenberg uncertainty principle. Schrödinger equation, probabilistic interpretation of wave function. One dimensional problems-particle in a box, potential well, potential barrier and tunneling, harmonic oscillator. Hydrogen atom. Elements of statistical Physics: Maxwellian distribution, Bose-Einstein and Fermi-Dirac distributions.			
v	Texts/References 1. H.S. Mani and G.K. Mehta, Introduction to Modern Physics. 2. S.H. Patil, Elements of Modern Physics. 3. K.S. Kane, Modern Physics 4. Beiser, Concepts of Modern Physics			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All Departments		

i	Title of the Course	**Introduction to Philosophy**	Course Code	HS 103
ii	Credit structure	L T P C 3 0 0 6		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content The course will acquaint the students of science and engineering with some issues on the nature and methods of science and mathematics, and the ethical issues arising out of the application of science and technology. The objective is to develop a critical, reflective and historical awareness on the issues relating to the following topics: Philosophy and History of Science: Growth of scientific knowledge: factors leading to the emergence of modern science. Conceptual evolution: internal and external history. Methodology of science: induction, falsificationism, confirmation and probability. Nature of scientific laws and theories: realism, instrumentalism and underdetermination. Relationship between scientific observation, experiment and scientific theory. Nature of scientific explanation: teleological explanations and the covering law model. Selected case studies on scientific theories. Logic and the nature of mathematical reasoning: Inductive and deductive forms of reasoning. Nature of axioms: formal axiomatic systems. Concept of consistency, independence and completeness. Nature of rules of inference and proof. Selected examples of axiomatic systems and proof procedures. Cognition: Current approaches to the understanding of mind and mental processes: empiricist, rationalist, behaviourist and cognitivist. Ethics: Impact of science and technology on man and society: elements of environmental and professional ethics.			
v	Texts/References 1. A.C. Grayling (Ed.) Philosophy; A Guide through the subject, Oxford University Press, Londown, 1995. 2. Marx W. Wartofsky, Conceptual Foundations of Scientific Thought: An Introduction to the Philosophy of Science, Macmillan, London 1968. 3. I.B. Cohen, The Birth of a New Physics, Penguin Books, 1985. 4. H. Eves and C.V. Newsom, Foundations and Fundamental Concepts of Mathematics, Boston, PWS-Kart Pub. Co., 1990. 5. K.E. Goodpaster and K.M. Sayre (Eds.) Ethics and Problems of 21st Century, Univ. of Notre Dame Press, London, 1979. 6. S.D. Agashe, A.Gupta and K. Valicha (Eds.) Scientific Method, Science, Technology and Society: A Book of Readings, Univ. of Bombay Press 1980.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All Departments		

i	Title of the Course	Introduction to Electrical and Electronic Circuits	Course code	EE 102
ii	Credit structure	L T P C 3 0 0 6		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Introduction, basic physical laws, circuit elements, KVL, KCL, and a few important circuit theorems, simple circuits, Transients in R-L, R-C, R-L-C, Sinusoidal Steady State, Real/Reactive Power, Three Phase Working Principles of Transformers/AC/DC machines Functional Characteristics of Diode, BJT, OP-AMP Analog circuit Examples: rectifiers, amplifiers, oscillators etc. Digital Circuits: AND/OR gates, Flip Flops, DAC/ADC etc.			
v	Texts/References	1. Vincent Del Toro, `Electrical Engineering Fundamental, Prentice Hall, 1989  2. K.A.Krishnamurthy and M.R.Raghuveer, `Electrical and Electronics Engineering for Scientists', Wiley Eastern Ltd., 1993.		
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Linear Algebra	Course Code	MA 102
ii	Credit structure	L T P C 3 1 0 4		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Vectors in R^n, notion of linear independence and dependence, linear span of a set of vectors, vector subspaces of R^n, basis of a vector subspace. Systems of Linear equations, matrices and Gauss elimination, row space, null space, and column space, rank of a matrix. Determinants and rank of a matrix in terms of determinants. Abstract vector spaces, linear transformations, matrix of a linear transformation, change of basis and similarity, rank-nullity theorem. Inner product spaces, Gram-Schmidt process, orthonormal bases, projections and least squares approximation. Eigenvalues and eigenvectors, characteristic polynomials, eigenvalues of special matrices (orthogonal, unitary, hermitian, symmetric, skew-symmetric, normal). Algebraic and geometric multiplicity, diagonalization by similarity transformations, spectral theorem for real symmetric matrices, applications to quadratic forms.			
v	Texts/References 1. H.Anton, *Elementary linear algebra with applications* (8^{th} ed.), John Wiley (1995) 2. G.Strang, *Linear algebra and its applications* (4rh Ed.), Thomson (2006) 3. S.Kumaresan, *Linear algebra – A Geometric approach*, Prentice Hall of India (2000) 4. E.Kreyszig, *Advanced Engineering Mathematics* (8^{th} Ed.), John Wiley (1999)			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Ordinary Differential Equations - I	Course code	MA 104
ii	Credit structure	L T P C 3 1 0 4		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content • Exact equations, integrating factors and Bernoulli equations. • Orghogonal trajectories. • Lipschitz condition, Picard's theorem, examples on nonuniqueness. • Linear differential equations generalities. • Linear dependence and Wornskians. • Diamensionality of space of solutions, abel-Liouville formula. • Linear ODE's with constant coefficients, the characteristic equations. • Cauchy-Euler equations. • Method of undetermined coefficients • Method of variation of parameters. • Laplace transform generalities. • Shifting theorems • Convolution theorem.			
v	Texts/References 1. E.Kreyszig, *Advanced engineering mathematics* (8^{th} Ed.), John Wiley (1999) 2. W.E.Boyce and R. DiPrima, *Elementary Differential Equations* (8^{th} Ed.) John Wiley (2005) 3. T.M.Apostol, *Calculus, Volume* 2 (2^{nd} Ed.), Wiley Eastern, 1980.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Workshop Practice	Course Code	ME 102
ii	Credit structure	L T P C 0 1 3 5		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Introduction to wood work: hand tools & various operations. Introduction to pattern making: types of patterns, allowances, colour coding. etc. Introduction to bench work & fitting: tools & operations. Introduction to metal cutting and machine tools: Safety measures, principles of operation of basic machine tools like lathe, shaping, & drilling. Important operations on these machines. Cutting tools and their usage, selection of cutting speeds, feeds, etc. Introduction to welding. Assignments: Simple assignments in wood working, fitting, electric arc welding, lathe and shaping machine work.			
v	Texts/References 1) Elements of Workshop Technology, Vol. I by S. K. Hajrachoudhury & Others, Media Promoters and Publishers, Mumbai. 14th Edition, 2007. 2) Elements of Workshop Technology, Vol. II by S. K. Hajrachoudhury & Others, Media Promoters and Publishers, Mumbai. 12th Edition, 2007. 3) Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All Departments		

i	Title of the Course	Physics Lab.	Course code	PH 111
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	None		
Iv	Course Content	Error analysis and accuracy of measurement. Selected experiments from the following: current and voltage sensitivities of a moving coil galvanometer, measurement of self inductance using Anderson's bridge, resistivity of a thermistor, Helmholtz coil. Fresnel biprism, Newton's rings. Young's modulus using Koenig's method, physical pendulum, Kundt's Tube, Laser Diffraction, Grating Spectrometer, G.M. Counter.		
v	Texts/References	1. B.L. Worsnop and H.T. Flint, Advanced Practical Physics for students, Asia Publishing House, 1971. 2. G.L. Squires, University Press, Cambridge, 1999.		
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i.	Title of the Course	Solid Mechanics	Course Code	ME 201
ii.	Credit Structure	L T P C 2 1 0 6		
iii.	Prerequisite, if any (for the students)	None		
iv.	Course Content (separate sheet may be used, if necessary) Introduction. Analysis of Axially Loaded Components – Statically Determinate and Indeterminate Problems; Castigliano's Theorem. Analysis of Shear Loaded Components. Beams; Shear Force and Bending Moment Diagrams. Stress and Strain Tensors. Mohr Circle. Stress-strain Relations; Stress-strain-temperature Relations. Basic Equations of Elasticity. Material Testing - Properties under tension, impact, fatigue and creep. Strain Rosettes. Stresses in Beams. Torsion of Circular Shaft. Introduction to Elastic-plastic Bending of Beams and Torsion of Circular Shaft. Thick Cylinder; Interference Fit; Rotating Disc.			
v.	Texts/References (separate sheet may be used, if necessary) 1. Crandall S. H., Dahl N.C. and Lardner T. J., An Introduction to Mechanics of Solids, McGraw Hill, 1978. 2. Popov E. P., Introduction to Mechanics of Solids, Prentice Hall of India, 1993. 3. Case J. and Chilver A. H., Strength of Materials and Structures, Edward Arnold, 1980. 4. Srinath L. S., Desayi P., Murthy N.S. and Anantha S. Murthy, Strength of Materials, Macmillan India, 1997. 5. Srinath L. S., Advanced Mechanics of Solids, 2nd Ed., Tata McGraw Hill, 2003.			
vi.	Instructor (s)			
vii.	Name of other departments to whom the course is relevant			

i	Title of the Course	Thermodynamics	Course Code	ME 206
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Introduction to thermodynamics. System, surroundings, boundaries, classification of systems. Units and dimensions. Conversion factors. Properties of systems. Equilibrium, processes, interactions. The work interaction. Thermodynamic definition of work. Characteristics of the work interaction. Evaluation of work. Adiabatic boundary. Adiabatic systems and processes. Adiabatic work. The First Law. Basic form. Energy of a system. The heat interaction. Sign convention. Diathermic boundary. Zeroth law. Isothermal states. Empirical temperature. Principles of thermometry. Scales of temperature. Gas thermometer. The ideal gas. Ideal gas temperature scale. The state principle. Equations of state. Properties of gases. Properties of steam. Introduction to steam tables. Other equations of state. Van-der-Waals gas. Critical state. Reduced equation of state. First law for open systems. Derivation of the general form. Special cases. Steady-flow energy equation. The Second Law. Kelvin-Planck and Clausius statements. Equivalence of statements. Carnot theorem. Thermodynamic temperature. Kelvin scale. Carnot engine. Equivalence of thermodynamic Kelvin scale and ideal gas Kelvin scale. Clausius inequality. Definition of entropy. Evaluation of entropy. Principle of increase of entropy. Formulation of second law for closed and open systems. Auxiliary functions. Property relations. Maxwell's equations. Applications to equations of state. Combined first and second laws. Availability and exergy. Lost work.			
v	Texts/References 1. Achuthan M, Engineering Thermodynamics, Prentice-Hall of India, New Delhi, 2002. 2. Sears F. W. and Salinger G. L., Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Addison-Wesley/Narosa, New Delhi, 1975. 3. Moran M. J. and H. N. Shapiro., Fundamentals of engineering Thermodynamics, Third Edition, Wiley, New York, 1995. 4. Zemansky M. W., Heat and Thermodynamics, Fourth Edition, McGraw-Hill Kogakusha, New York/Tokyo, 1957. 5. Mathur M. L. and Mehta F. S., Steam and Other Tables (with Mollier Chart), Revised Edition, Jain Brothers, New Delhi, 2005.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Electric Circuits	Course Code	EE 207
ii	Credit structure	L T P C 3 1 0 8		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content Introduction, basic physical laws, circuit elements, KVL, KCL, and a few important circuit theorems, simple circuits, Transients in R-L, R-C, R-L-C, Sinusoidal Steady State, Real/Reactive Power, Three Phase Working Principles of Transformers/AC/DC machines Functional Characteristics of Diode, BJT, OP-AMP Analog circuit Examples: rectifiers, amplifiers, oscillators etc. Digital Circuits: AND/OR gates, Flip Flops, DAC/ADC etc			
v	Texts/References 1. Vincent Del Toro, `Electrical Engineering Fundamental, Prentice Hall, 1989 2. K.A.Krishnamurthy and M.R.Raghuveer, `Electrical and Electronics Engineering for Scientists', Wiley Eastern Ltd., 1993.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Engineering Metallurgy	Course Code	MM 201
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Introduction and classification of Engineering Materials. Structure of Metals and Alloys. Iron-carbon Phase Diagrams. Classification and Properties of Steels. Principles of Heat Treatment of Steels and alloys. Case-Hardening of steels. Properties and Industrial applications of alloys steels, tool steels, stainless steels and cast irons. Properties and uses of non-ferrous materials – Brasses and bronzes, aluminium and its alloys, zinc, tin alloys, nickel and titanium alloys. Mechanical behavior of metals. Cold and hot working of metals. Fracture, fatigue and creep behavior of metals. Corrosion and its prevention.			
v	Texts/References 1. R.E. Reed-Hill: Physical Metallurgy Principles, 4th Edition 2. Cengage Learning, 2003 3. F.C. Compbell 'Elements of Metallurgy and Engineering Alloys", ASM International, Ohio, 2008 4. R.E. Smallman, A.H.W. Nagan, "Physical Metallurgy and Advanced Materials", Seventh Edn, Elsevier, 2007 5. William D Callister, Jr., "Materials Science and Engineering", Wiley India (P) Ltd., 2007 6. D.A. Porter and K.E. Easterling, Phase Transformations in Metals and Alloys, second edition, Chapman and Hall, London 1992			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Experimental Engineering Lab	Course Code	ME 211
ii	Credit structure	L T P C 0 0.5 3 4		
iii	Prerequisite, if any(for the students)	--		
iv	Course Content	Principles of experimental investigation, planning and designing of experiments, error estimation. Experiments in fluid machinery and strength of materials.		
v	Texts/References	--		
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Strength of Materials	Course Code	ME 202
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	Solid Mechanics		
iv	Course Content Introduction. Bending of Curved Bars. Unsymmetrical Bending. Torsion of Thin Box Sections. Deflection of Beams - Methods based on integration, Singularity function, Energy Principles (virtual work, minimum potential energy, reciprocal theorem, etc.), Superposition Principle, etc. Statically Indeterminate Problems. Continuous Beams. Buckling - Euler Load, Secant and Rankine-Gordon Formulae. Theories of Failure. Introduction to Griffith Theory. Introduction to Bending of Thin Plates and Shells. Thermal Stress Analysis for Rectangular and Circular Plates. Photoelasticity.			
v	Texts/References 1. Crandall S. H., Dahl N.C. and Lardner T. J., An Introduction to Mechanics of Solids, McGraw Hill, 1978. 2. Popov E. P., Introduction to Mechanics of Solids, Prentice Hall of India, 1993. 3. Case J. and Chilver A. H., Strength of Materials and Structures, Edward Arnold, 1980. 4. Srinath L. S., Advanced Mechanics of Solids, 2nd Edition, Tata McGraw Hill, 2003. 5. Timoshenko S. P. and Goodier J. N., Theory of Elasticity, International Students Edition, McGraw Hill, 1982.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Fluid Mechanics	Course Code	ME 204
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	NIL		
iv	**Course Content** Domain of Fluid mechanics, Concept of Continuum, Mean free path, Knudsen number, applicability of continuum, chain rule, Differential-Integral analysis, dimensionality of the problem, Scalar, Vector, Tensor, Stream line, Streak line, path line and time line, thermodynamic properties, equation of state, viscosity, Newtonian and Non-Newtonian, kinematic viscosity, surface tension and contact angle. Pascal's law, Hydrostatic equation, Force on planar surfaces, Force on a curved surface, Manometry, Buoyancy, Stability of floating objects, pressure distribution in solid body translation and rotation. Reynolds transport theorem, Conservation of mass, linear momentum, for fixed, moving and accelerating control volumes. Conservation of angular momentum and energy for fixed control volumes. Acceleration of a particle, Substantial derivative, Derivation of mass balance for incompressible flow, Concept of linear deformation and physical interpretation of mass balance, Angular deformation, vorticity and irrotational flow, Momentum equations for Cartesian coordinates, generalization to vector forms, Generalized Newtonian Stress-Strain relation (just statement), Navier-Stokes Equations, Concept of stream function, Bernoulli's equation, stagnation pressure, Pitot tube, Energy grade lines. Buckigham π theorem, Non-dimensionalization of governing equation, Modelling and similitude. Fully developed flow between parallel plates and pipe flows, Concept of friction factor (Fanning and Darcy), Introduction to turbulent flow and the problem of closure, empirical treatments of turbulent flow (law of wall, Moody's plot), minor losses in fittings, pipes in series and parallel, concept of hydraulic diameter for non-circular pipe, flow measurement using orifice plates, flow nozzles and venturis. Derivation of isentropic law, Pulse propagation speed in ideal gas, Mach cone, Compressible frictionless flow in a variable area system. Flow in a C-D Nozzle, Choking, Normal shocks. Concept of a boundary layer, Displacement and momentum thickness definitions, Momentum integral equation for flat plates and its solution to estimate drag coefficient, similarity transformation and its application for flat plate, empirical equations for turbulent flow. Introduction to separation, vortex shedding, drag in cylinders, sphere, lift and drag in aerofoils (purely qualitative treatment with just final relations for solving some typical problems). Introduction to pumps and turbines (classification and types), General characteristics, Homologous curves, Throttle and bypass governing.			
v	Texts/References 1. Fox R.W. and McDonald A.T., Fluid Mechanics, John Wiley International, 2005. 2. White F. M., Fluid Mechanics, Tata McGraw Hill, 2008. 3. Gupta V. and Gupta S.K., Fluid Mechanics, Narosa, 2005.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Manufacturing Processes – I	Course Code	ME 206
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Casting processes: dispensable and permanent mould processes; analysis of melting, pouring and solidification phenomena; design of pattern, core, feeder and gating system; casting defects and inspection. Joining processes: fusion and solid-state welding; brazing and soldering; weld joint design, cooling rate, and joint properties; welding defects and inspection. Bulk and Sheet Forming processes: rolling, forging, extrusion and drawing; sheet metal working; forming limit diagram; loads, friction and lubrication; forming defects and inspection. Powder processing: Powder manufacture, characterization, compaction and sintering; metal injection moulding; hot and cold isostatic pressing. Polymers and Composites: Thermoplastics, thermosets, elastomers and composites; related processes; injection mould design; moulding defects and inspection. Advanced processes: Free form fabrication (rapid prototyping), and net shape manufacturing processes.			
v	Texts/References 1. Ghosh A. and Mallick A. K., Manufacturing Science, Affiliated East West Press, 2001. 2. Rao P. N., Manufacturing Technology- Foundry, Forming and Welding, Tata McGraw Hill, 1987. 3. Schey J., Introduction to Manufacturing Processes, Tata McGraw Hill, 2000. 4. DeGarmo E. P., Black J. T. and Kohser R. A., Materials and Processes in Manufacturing, Prentice Hall India, 1997. 5. Pye R. G. W., Injection Mold Design, Longman Scientific & Technical, Essex, 1989.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Numerical Analysis	Course Code	MA 204
ii	Credit structure	L T P C 3 1 0 8		
iii	Prerequisite, if any(for the students)			
iv	Course Content Interpolation by polynomials, divided differences, error of the interpolating polynomial, piecewise linear and cubic spline interpolation. Numerical integration, composite rules, error formulae. Solution of a system of linear equations, implementation of Caussian elimination and Gauss-seidel methods, partial pivoting, row echelon form, LU factorization Cholesky's method, ill-conditioning, norms. Solution of a nonlinear equation, bisection and secant methods. Newton's method, rate of convergence, solution of a system of nonlinear equations, numerical solution of ordinary differential equations, Euler and Runge-Kutta methods, multi-step methods, predictor-corrector methods, order of convergence, finite difference methods, numerical solutions of elliptic, parabolic and hyperbolic partial differential equations. Eigenvalue problem, power method, QR method, Gershgorin's theorem. Exposure to software packages like IMSL subroutines, MATLAB			
v	Texts/References 1. S.D.Conte and Carle de Boor, Elementary Numerical Analysis – An Algorithmic Approach (3rd Edition), McGraw-Hill, 1980 2. C.E. Forberg, Introduction to Numerical Analysis (2nd Edition), Addison-Wesley, 1981 3. E.Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley (1999)			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Solid Mechanics Lab	Course Code	ME 212
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	Solid Mechanics		
iv	Course Content Experiments associated with tensile testing, torsion testing, buckling, hardness testing, fatigue testing and impact testing. Experiments on beam bending, strain gaging and photoelasticity.			
v	Texts/References 1. Crandall S. H., Dahl N.C., and Lardner T. J., An Introduction to the Mechanics of Solids McGraw Hill, 1978. 2. Dally J. W. and Riley W. F., Experimental Stress Analysis, McGraw Hill, 1987. 3. Doebelin E. and Manik D. N., Measurement Systems, McGraw Hill Educations, 2007.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Manufacturing Practice Lab	Course Code	ME 214
ii	Credit structure	L T P C 0 1 3 5		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Study of sand casting process flow and equipment for molding, core-making, melting, pouring and fettling; Gas, Arc and Resistance welding equipment; Metal forming equipments; General purpose machine tools: lathe, milling, drilling, grinding, etc.; Semi-automatic and automatic machines. Manufacturing and fitting practice of a machine subassembly according to given specifications.			
v	Texts/References 1. DeGarmo E.P., Black J.T. and Kohser R.A., Materials and Processes in Manufacturing, Prentice Hall India, 1997. 2. HMT Production Technology, Tata McGraw Hill, 1980			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Heat Transfer	Course Code	ME 301
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	Fluid Mechanics, Thermodynamics		
iv	Course Content Introduction to conduction: Fourier law; Thermal conductivity and diffusivity; Isotropic and anisotropic materials; Boundary and initial conditions. ; Derivation of governing equation in Cartesian coordinate; Equations in cylindrical and spherical coordinates.; One-dimensional steady state conduction: Plane walls, thermal resistance, composite walls, radial systems, critical radius, heat generation.; Fins; Evaluation of fin performance; Thermal contact resistance.; Two-dimensional steady state conduction: separation of variables. ; Transient conduction: lumped capacitance, semi-infinite solid model. ; Introduction to convection: Prandtl and Nusselt numbers ; Derivation of differential energy equation. ; Momentum boundary layers; Similarity solution for flat plate. ; Thermal boundary layer; Pohlhausen similarity solution for flat plate. Integral energy equation. Momentum integral equation. Von Karman integral solution for flat plate; Analogy between heat and momentum transfer. ; Heat transfer in pipe flows; Thermal entry length; Correlations for some common configurations. ; Free convection from plate: Governing equations and non-dimensionalization. ; Similarity and integral solutions for vertical plate. ; Free convection for other cases; Mixed convection; Introduction to pool boiling; correlations. Radiation: Basic concepts; Planck, Wien and Stefan-Boltzmann laws. Irradiation; solid angle; radiation intensity. ; Heat exchange between two surfaces. Shape factor: Definition, common configurations. Radiation exchange between two diffuse-gray surfaces. ; Heat Exchangers. ; Applications and classification of heat xchangers; Fouling factor.; Design analysis using LMTD method.; Performance analysis using ϵ - NTU method.; Design considerations for heat exchangers.			
v	Texts/References 1. Ghoshdastidar P.S., Heat Transfer, Oxford University Press, New Delhi, 2004. 2. Sukhatme S. P., A Textbook of Heat Transfer, 4th Ed., Universities Press, Hyderabad, 2005. 3. Incropera F. P. and Dewitt D. P., Fundamentals of Heat and Mass Transfer, 5th Ed., Wiley and Sons, ew York, 2002.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Industrial Engineering and Operations Research	Course Code	ME 303
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	NIL		
iv	Course Content Introduction to Industrial Engineering, Work-time study and productivity. Capacity planning. Location and layout models for factories and warehouses. Manufacturing planning concepts based on forecasting, push and pull models of planning, and aggregate planning. Basic inventory models. Introduction to concepts of operations research and optimization. Linear Programming: problem formulation, simplex method, concept of primal-dual, duality and sensitivity analysis, Interior point methods Network flow model & methods including transportation and assignment models, min-cost flow, shortest path problem. Integer programming models, branch and bound method Introduction to applied probability models for decision making. Random variables and their distributions. Independence and conditional probabilities/expectations. Expectations, variances and probabilistic notions of performance.			
v	Texts/References • Taha H. A., Operations Research: An Introduction, 8th Ed., McGraw Hill, 2004. • Bazaraa M. S., Jarvis J. J. and Sherali H. D., Linear Programming & Network Flows, 2nd Ed., Wiley, 1990. • Hillier F. S. and Lieberman G. J., Introduction to Operations Research, 8th Ed., McGraw Hill, 2004. • Nahmias S., Production and Operations Analysis, McGraw Hill, 1997. • Lawrence J. A., Jr. and Pasternack B.A., Applied Management Science, 2nd Ed, Wiley, 2004. • Krajewski L. J. and Ritzman L. P., Operations Management: Strategy and Analysis, 6th Ed., Pearson Education, 2002. • Hopp Wallace J. and Spearman Mark L., Factory Physics, 2nd Ed., McGraw Hill, 2000.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Manufacturing Processes – II	Course Code	ME 205
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	NIL		
iv	Course Content Fundamentals of Material Removal Processes: Chip formation, tool geometry and materials, mechanics of machining, Tool temperature, Tool wear, Tool-life, Surface finish, Machinability, Economics of machining. Fundamentals of Machine Tools: General-purpose, semi-automatic and Automatic machine tools, Set-ups and operations on - Lathe, Drilling, Milling, Grinding, Broaching machines; Machining processes for production: Gear cutting (Hobbing and Shaping), Thread cutting, Centerless grinding; Finishing operations: Honing, Lapping, etc. Introduction to Jigs and Fixture Design: Principles of location and clamping. Non-conventional Machining Processes: Electric discharge Machining (EDM), Electrochemical Machining, LASER and Abrasive Flow Machining, etc. Dimensional Metrology: Limits, Fits and dimensional tolerances; Design of limit gages, Taylor's principle, Gage tolerancing; Geometrical tolerances of form, orientation, position, location, run-out; Basic definitions and measurement principles, MMC/RFS conditions. Comparators and Metrological Instruments: Principles of optical, pneumatic, electric/electronic instruments; Inspection of gears and screw threads; Surface finish and its measurement, Coordinate Dimensional metrology, CMM - construction and operation.			
v	Texts/References 1. Boothroyd G. and Knight W. A., Fundamentals of Machining and Machine Tools, Marcel Dekker, 1989. 2. Ghosh A. and Mallick A. K., Manufacturing Science, Affiliated EWP, 2001. 3. HMT Production Technology, Tata-McGraw Hill, 1980. 4. Gayler J. F. W. and Shotbolt C. R., Metrology for Engineers, ELBS, 1990. 5. Foster L. W., Geometrics II, the Application of Geometric Tolerancing Techniques, Addison-Wesley, 1986.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	H S S Core	Course Code	HS xxx
ii	Credit structure	L T P C 3 0 0 6		
iii	Prerequisite, if any(for the students)			
iv	Course Content	Will be provided by the course instructor		
v	Texts/References	Will be provided by the course instructor		
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Manufacturing Process Lab.	Course Code	ME 311
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	Manufacturing Processes I		
iv	Course Content	Experiments on casting, metal forming, welding and machining processes; Assessment of manufactured components; Machine capability study.		
v	Texts/References	1. Ghosh A. and Mallick A.K., Manufacturing Science, Affiliated East West Press, 1985. 2. Boothroyd G. and Knight W. A., Fundamentals of Machining and Machine Tools, Marcel Dekker, 1989.		
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Fluid Mechanics Lab	Course Code	ME 313
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	Fluid Mechanics		
iv	Course Content • Observation of flow regimes and pressure distribution measurement for flow over circular cylinder. • Measurement of laminar velocity profile and friction factor in pipe flow. • Friction factor measurement in turbulent flow in pipes for different Reynolds number. • Pressure and velocity distribution measurements in submerged jet. • Measurement of convergent-divergent nozzle characteristics. • Measurement of lift and drag on an airfoil (single and cascade). • Losses in pipe fittings. • Experiments on a hydraulic trainer and pressure distribution in curved diffusers. • Characteristics of labyrinth seals. • Measurement of force due to impact of jets.			
v	Texts/References 1. Fox R.W. and McDonald A.T., Fluid Mechanics, John Wiley International, 2005.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Applied Thermodynamics	Course Code	ME 302
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	Thermodynamics		
iv	Course Content Introduction to the Course, General Scheme of things, Energy Resources, Heat Engines.; Recap of I law for Closed and Open Systems. Classification of cycles as Open/Closed, Refrigeration/Power, Multi-component/ Single- component, Internal combustion/ external combustion, etc.; Performance parameters: Net work, thermal efficiency, heat rate, specific fuel consumption, work ratio, specific output, mean effective pressure, volumetric efficiency, COP, refrigeration effect. Carnot vs. other cycles. ; General stoichiometry and definition of terms (rich mixture, lean mixtures). ; Heat of formation, Heat of reaction, Calorific Value of fuel, Estimation methods for Calorific values, Exhaust Gas Analysis, Orsat Apparatus.; Otto Cycles, Diesel Cycles, Air-standard cycles and Actual cycles, Dual cycle, p-theta diagram. ; Combustion and knocking in SI engine.; Combustion and knocking in CI engine. ; Carburetion.; Brayton cycle with explanation of various terms Modifications of Brayton cycle. ; Rankine cycle. Modifications to Rankine cycle. Feed Water Heaters and analysis. Moisture separators/ application of Rankine to Nuclear power plants. ; Vapour Compression and Reverse Brayton Cycles Vapour Absorption Cycles. Psychrometry.; Reciprocating, rotary and centrifugal Compressors.			
v	Texts/References 1. Moran M. J. and H. N. Shapiro., Fundamentals of Engineering Thermodynamics, Third Edition, Wiley, New York, 1995. 2. Cengel Y. A. and Boles M. A., Thermodynamics: An Engineering Approach, McGraw Hill, 3rd Ed., 1998 3. Dossat R. J. and Horan T. J., Principles of Refrigeration, Pearson Education, 4th Indian Reprint, 2004. 4. Arora C. P., Refrigeration and Air-conditioning, Tata McGraw Hill, 2nd Ed., 2003.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Kinematics and Dynamics of Machines	Course Code	ME 304
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	NIL		
iv	Course Content Introduction to Mechanisms. Position, velocity and acceleration analysis. Design of Cam Follower Mechanisms. Gear tooth profiles, spur gears and helical gears. Epicyclic Gear Trains. Dynamic Analysis of Mechanisms. Balancing. Analysis and Applications of Discrete and Continuous System Vibration.			
v	Texts/References 1. Paul B., Kinematics and Dynamics of Planar Mechanisms, Prentice Hall, 1979. 2. Tse F. S., Morse I.E. and Hinkle R. T., Mechanical Vibrations, CBS Publishers and Distributors, 1983. 3. Rao J. S. and Gupta K., Introductory Course on Vibrations, Wiley Eastern, 1984. 4. Den Hartog J. P., Mechanical Vibrations, McGraw Hill, 1956. 5. Uicker J.J., Pennock G.R. and Shigley J.E., Theory of Machines and Mechanisms, 3rd Ed., Oxford University Press, New York, 2005. 6. Rattan S.S., Theory of Machines, 2nd Ed., Tata McGraw Hill, New Delhi, 2005. 7. Norton, R.L., Design of Machinery, Third Edition, Tata McGraw Hill, New Delhi, 2005.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Environmental Studies	Course Code	ES 202
ii	Credit structure	L T P C 2 1 0 3	(Half semester course)	
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Multidisciplinary nature of environmental studies, Ecosystems, Biodiversity and its conservation, Indicators of environmental pollution, Environment and human health Consumption of natural resources and environmental degradation (forests, water, coal, minerals, energy, and land), Sustainable development, Environmental policy and legislation, Environmental impact assessment. Pollution of lakes, rivers, ground water, coasts, and oceans, Science and technology for drinking water and wastewater treatment and issues in management of systems, Solid and hazardous waste management (causes, effects and control measures) Air and noise pollution (science and engineering of pollution control), Global Issues including climate change, global warming, acid rain, ozone layer depletion, nuclear hazards, Disaster management (industrial accidents, floods, earthquakes, cyclones and landslides),			
v	Texts/References Cunningham W.P. and Cunningham M.A. (2002), Principles of Environmental Science, Tata McGraw-Hill Publishing Company, New Delhi. Nathanson, J.A. (2002), Basic Environmental Technology, Prentice Hall of India, New Delhi. Arceivala, S.J. and Asolekar, S.R. (2006), Wastewater Treatment for Pollution Control and Reuse, 3rd Edition, Tata McGraw Publishing Co. Ltd., New Delhi. Asolekar, S.R. and Gopichandran, R. (2005), Preventive Environmental Management – An Indian Perspective, Foundation Books Pvt. Ltd., New Delhi, 2005. Some selected book-chapters, monographs and journal papers			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Environmental Studies	Course Code	HS 202
ii	Credit structure	L T P C (Half semester course) 2 1 0 3		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Social Issues and the environment, Public awareness and Human rights, Indicators of sustainability, Governance of Natural Resources - Common pool resources: issues and management. Environmental ethics, Religion and environment, Wilderness and Developing Trends, Environmental movements and Activism, Social Ecology and Bioregionalism, Environmental justice. Environmental economics, Trade and environment, Economics of environmental regulation, Natural resource accounting, Green GDP. Environment and development, Resettlement and rehabilitation of people, Impacts of climate change on economy and society, Vulnerability and adaptation to climate change.			
v	Texts/References Agar, N., 2001. *Life's Intrinsic Value*, New York: Columbia University Press. Dasgupta, P. and Maler, G. (eds.), (1997), The Environment and Emerging Development Issues, Vol. I, OUP. Guha, Ramachandra (2006): "Mahatama Gandhi and Environmental Movement," *Debating on Gandhi*, in A. Raghuramaraju (ed.), New Delhi: Oxford University Press. Guha, Ramachandra and Madhav Gadgil (1995): Ecology and Equity: The Use and Abuse of Nature in Contemporary India, New Delhi: Penguin. Hanley, Nick, Jason F. Shogren and Ben White (2004): Environmental Economics in Theory and Practice, New Delhi: MacMillan. Naess, A. and G. Sessions (1984): "Basic Principles of Deep Ecology," *Ecophilosophy*, Vol.6. Redclift, M. and Woodgate, G. (eds.), (1997), International Handbook of Environmental Sociology, Edward Edgar.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Kinematics and Dynamics of Machines Lab.	Course Code	ME 312
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Experiments on velocity, static force and acceleration analysis of mechanisms; friction; belt drives and cam-follower; balancing; bearings; gyroscopes; vibrations.			
v	Texts/References 1. Uicker J.J., Pennock G.R. and Shigley J.E., Theory of Machines and Mechanisms, 3rd Ed., Oxford University Press, New York, 2005. 2. Rattan S.S., Theory of Machines, 2nd Ed., Tata McGraw Hill, New Delhi, 2005.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Heat Transfer and Metrology Lab.	Course Code	ME 314
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	Heat Transfer, Manufacturing Processes II		
iv	Course Content Part A: Heat Transfer Determination of the thermal conductivity of a material in granular form. Determination of the total hemispherical emissivity of a surface by two methods. Study the natural convection heat transfer from a vertical tube. Study the performance of a pin fin under natural and forced convection conditions. Heat transfer through circular tube with uniform heat flow. Measurement of the forced convection heat transfer coefficient in cross-flow over a circular tube. Study the performance of a double-pipe heat exchanger under parallel and counter flow conditions. Part B: Metrology Measurements of lengths, angles, flatness, squareness, parallelism, alignment, surface finish and errors in gears and screw threads.			
v	Texts/References 1. Incropera F. P. and Dewitt D. P., Fundamentals of Heat and Mass Transfer, 5th Ed., Wiley and Sons, New York, 2002. 2. Gayler J. F. W. and C. R Shotbolt, Metrology for Engineers, ELBS, 1990.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Machine Design	Course Code	ME 401
ii	Credit structure	L T P C 2 1 2 8		
iii	Prerequisite, if any(for the students)	Solid Mechanics		
iv	Course Content Introduction: design for function, economy, stresses, operation, maintenance, manufacture and assembly, transport, materials. Physical properties of materials (ferrous and non-ferrous), static, dynamic and impact strengths; factor of safety; permissible stresses; standard materials and sections and the meaning of material properties in terms of manufacturability Fastening techniques and properties; welds, screw and bolted connections. Bearings and friction: Bush and rolling element bearings, design selection; heat generation; properties of lubricants and selection; wear and associated failures. Shafts, axles and design of bearing mountings – stress concentration and thermal expansion. Design for fatigue. Introduction to machine drawing. Small design exercises - Cotter joints and rigid/flexible coupling ; Design of a simple gear box involving keyway design, stress concentration, mounting, gear profile selection, gear/shaft failure, etc. Complete design exercise on one of the following - hot-air stirling engine, reciprocating pump, robot arm with linear actuators, etc.			
v	Texts/References 1. Spotts M. F., Design of Machine Elements, Allen and Unwin, 1968. 2. Shigley J. E. and Mischke C. R., Mechanical Engineering Design, Tata McGraw Hill, 2007. 3. Nieman F. and Winter H., Machine Elements, Springer, 1989. 4. Hamrock B.J., Fundamentals of Machine Elements, McGraw Hill, 1999. 5. Bhatt N. D. and Panchal, V. M., Machine Drawing, Charotar Publishing House, Anand, India, 2006. 6. Narayana K. L., Kannaiah, P. and Venkata Reddy K., Machine Drawing, New Age International, Mumbai, 1999.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Microprocessors and Automatic Control	Course Code	ME 403
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Introduction, Review of combinational logic circuits. Intro to Sequential circuits, prelim design of sequential circuits, flip-flops. Registers, counters, tri-state logic, Register-register data transfer. Timing and control circuitry. Sequential circuit design examples design considerations for arriving at appropriate data/control paths. Functional architecture of microprocessors, terminology. Intro to Microcontroller Programming. Interfacing – A/D, D/A, Timer. Introduction to feedback, dynamic system behaviour. Math review: Fourier series, transforms, LTI systems, notion of stability. Non-linear system behaviour, linearization. Linear feedback controller design – frequency response based methods. PID control. Sampling theorem, Digital implementation of controllers			
v	Texts/References 1. Benjamin C. Kuo, Automatic Control Systems, 7th Ed., Prentice Hall, 1995. 2. Randy H. Katz, Contemporary Logic Design, Benjamin/Cummings, 1994.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Applied Thermodynamics Lab.	Course Code	ME 411
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	Applied Thermodynamics		
iv	Course Content The following experiments will be conducted. Measurement of characteristics of centrifugal pump and gear pump, Pelton turbine, Francis turbine, vapour compression refrigeration cycle, and triple fluid vapour absorption refrigeration cycle. Performance test / load test of a multi cylinder petrol engine and automotive diesel engine. Measurement of the flame velocity of a pre-mixed mixture and study of flame stability. Measurement of thickness of aluminum foil using □-ray back scattering technique and level of column of water using nuclear technique.			
v	Texts/References 1. Cengel Y. A. and Boles M. A., Thermodynamics: An Engineering Approach, McGraw Hill, 3rd Ed., 1998			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Microprocessor and Automatic Control Lab.	Course Code	ME 413
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content The course will expose students to electronic prototyping equipment, micro-controllers, power amplifiers, DC and stepper motors and various sensors. Students will perform experiments leading upto the realization of a mechatronic system that works with closed-loop control.			
v	Texts/References 1. Horowitz P. and Hill W., Art of Electronics, 2nd Ed., Cambridge University Press, 1989.			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

INDIAN INSTITUTE OF TECHNOLOGY GANDHINAGAR

FORMAT FOR INTRODUCTION OF NEW COURSE PROPOSAL

(Faculty members willing to introduce new courses shall use this format for making a proposal for consideration of the UGPC / Academic Council)

i	Title of the Course			
ii	Credit structure	**L T P C** ☐ ☐ ☐ ☐		
iii	Core course / Elective (Institute/Departmental)			
iv	Prerequisite, if any(for the students) Existing course No.			
v	Course Content			
vi	Texts / References			
vii	Name of the Instructor/(s) For core course please specify no. of instructors / faculty who can teach the course			
viii	Name of other department (s) to whom the course is relevant			
ix	Justification for introduction of the new course			
x	Statement whether similar course(s) is/ are running in the Institute elsewhere		Course code	

Signature of the course proposer

Signature of the Convener DUGC/DPGC